State of Hawaii
AGRIBUSINESS DEVELOPMENT CORPORATION

Wendy L. Gady
Executive Director

CONTRACT SPECIFICATIONS AND PLANS

Job No. 100002
Waiahole Water System Improvements – Well Site
Kunia, Oahu, Hawaii

Civil Engineer:	R. M. Towill Corporation
Geotechnical Engineer:	Geolabs, Inc.
Structural Engineer:	KAI Hawaii, Inc.
Mechanical Engineer:	Tom Nance Water Resource Engineering
Electrical Engineer:	Ronald N. S. Ho & Associates, Inc.
Land Surveyor:	R. M. Towill Corporation

May 2024

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AGRIBUSINESS DEVELOPMENT CORPORATION

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Approved: _____
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May 2024

DETAILED SPECIFICATIONS

TABLE OF CONTENTS

NOTICE TO BIDDERS
(Chapter 103D, HRS)

COMPETITIVE BIDS for Job No. 100002, Waiahole Water System Improvements – Well Site, Kunia, Hawaii, shall be submitted to the Agribusiness Development Corporation (ADC) on the specified date and time through the Hawaii State e-Procurement (HIePRO). HIePRO is accessible through the State Procurement Office website at www.spo.hawaii.gov.

The Department of Land and Natural Resources Interim General Condition, dated October 1994, as amended, and the General Conditions –AG008, latest revision shall be made part of the specifications.

The project is located at the Agribusiness Development Corporation (ADC) Waiahole Water System, Kunia, Hawaii.

The work shall generally consist of the installation of: new water supply well to be used a backup to the Waiahole Ditch as a source for irrigation water; new buried irrigation waterlines to interconnect the new well Waiahole Ditch with an existing reservoir; new pipe system within Waiahole Ditch at a hairpin turn which will replace an existing pipe system; and incidental and related improvements.

Due to the nature of work contemplated, bidders must possess a valid State Contractor's license, classification "A".

A voluntary pre-bid conference and State-conducted site visit will be held on May 10, 2024 at 9:00 a.m. The pre-bid conference and site visit will begin at the entrance to the Waiahole Water System located off of Kunia Road in Kunia, Hawaii. Interested parties shall contact Ken Nakamoto at (808) 586-0087 or Ken.T.Nakamoto@hawaii.gov to coordinate details.

The estimated cost of construction is $5 million.

The award of the contract, if it be awarded, will be subject to the availability of funds.

This project is subject to preference to Hawaii Products established by Section 103D, Hawaii Revised Statutes. The Hawaii Product List may be examined at the State Procurement Office website.

Since the estimated cost of construction is $250,000 or more, the apprenticeship agreement preference pursuant to Hawaii Revised Statutes §103-55.6 (ACT 17, SLH 2009) shall apply.

Should there be any questions, please refer to the HIePRO solicitation.

INFORMATION AND INSTRUCTIONS TO BIDDERS

CONTENTS

INFORMATION AND INSTRUCTIONS TO BIDDERS

A. PROJECT LOCATION AND SCOPE OF WORK: The project location and scope of work shall be as generally described in the Notice to Bidders.

B. PROPOSALS**:** Bidders shall submit their bid, including the completed proposal form, bid bond, and any other documents required by the solicitation as part of their bid through the State of Hawaii e-Procurement System (HIePRO). See Item D, PROPOSAL FORM.

C. GENERAL CONDITIONS: The Department of Land and Natural Resources Interim General Conditions dated October 1994, as amended, shall be made a part of these contract specifications and are referred to hereafter as the General Conditions.

D. PROPOSAL FORM: **The Bidders shall fill out and upload the electronic copy of the proposal form to the HIePRO website when submitting the bid. Bid Proposals shall not be mailed, faxed or delivered to the State, unless requested to do so after the designated closing date. The successful Bidder shall fill out and print a hard copy of the proposal form, sign and submit the form with the contract award package.**

E. OMISSIONS OR ERASURES: Any proposal which contains any omission or erasure or alteration not properly initialed, or conditional bid, or other irregularity may be rejected by the Board of Agriculture (Board).

F. NOTICE OF INTENT TO BID AND QUESTIONNAIRE:
A Notice of Intent to Bid is not required for this project. In compliance with HRS Section 103D-310, the lowest responsive and responsible bidder may be required to complete a questionnaire. When requested by the State, the completed questionnaire shall be submitted to the Chief Engineer for evaluation. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

G. BID SECURITY: A bid security will be furnished by each bidder as provided in sub-section 2.7 of the General Conditions. The successful bidder's bid security will be retained until Contract execution and furnished a performance and payment bond in an amount equal to one hundred percent (100%) of the total Contract price, including an amount estimated to be required for extra work, is furnished.

The Board reserves the right to hold the bid securities of the four lowest bidders until the successful bidder has entered into a contract and has furnished the required performance bond. All bid securities will be returned in accordance with sub-section 3.5 of the General Conditions.

Should the successful bidder fail to enter into a contract and furnish a satisfactory performance bond within the time stated in the proposal, the bid security shall be forfeited as required by law.

H. CONTRACTOR'S LICENSE REQUIRED: The Board will reject all bids received from contractors who have not been licensed by the State Contractors License Board in accordance

with Chapter 444, HRS; Title 16, Chapter 77, Hawaii Administrative Rules; and statutes amendatory thereto.

I. IRREGULAR BIDS: No irregular bids or propositions for doing the work will be considered by the Board.

J. WITHDRAWAL OF BIDS: No bidder may withdraw his bid between the time of the opening thereof and the award of contract.

K. SUCCESSFUL BIDDER TO FILE PERFORMANCE AND PAYMENT BONDS: The successful bidder will be required to file performance and payment bonds each; in the amount equal to the total contract price, including amounts estimated to be required for extra work, as provided in sub-section 3.6 of the General Conditions.

L. NUMBER OF EXECUTED ORIGINAL COUNTERPARTS OF CONTRACT DOCUMENTS: If requested by the Board, six copies of the Contract, performance and payment bonds shall be executed.

M. CHANGE ORDERS: No work of any kind in connection with the work covered by the plans and specifications shall be considered as change order work, or entitle the Contractor to extra compensation, except when the work has been ordered in writing by the Chief Engineer (Engineer) and in accordance with sub-section 4.2 of the General Conditions.

The Contractor shall clearly identify and inform the Engineer in writing of any deviations from the contract documents at the time of submission and shall obtain the Engineer's written approval to the specified deviation prior to proceeding with any work.

N. WAGES AND HOURS: In accordance with sub-sections 7.3 to 7.9 of the General Conditions relative to hours of labor, minimum wages and overtime pay, the current minimum wage rates promulgated by the Department of Labor and Industrial Relations (DLIR) shall be paid to the various classes of laborers and mechanics engaged in the performance of this contract on the job site. The minimum wages shall be increased during the performance of the contract in an amount equal to the increase in the prevailing wages for those kinds of work as periodically determined by the DLIR.

The Department of Agriculture will not recognize any claim for additional compensation because of the payment by the Contractor of any wage rate in excess of the said minimum wage rates. The possibility of wage increase is one of the elements to be considered by the Contractor in determining his bid, and will not, under any circumstances, be considered as the basis of a claim against the Department under this Contract.

No work shall be done on Saturdays, Sundays, legal State holidays, and/or in excess of eight (8) hours each day without the written consent of the Engineer. Should permission be granted to work at such times, the Contractor shall pay for all inspection administrative costs thereof. No work shall be done at night unless authorized by the Engineer.

O. PERMITS: The State will process permit applications whenever possible, and the Contractor shall procure the pre-processed permits and pay the required fees. If permit applications are not processed by the State, the Contractor shall process the permit applications, permits and

licenses, and pay all charges and fees. In all cases, the Contractor shall give all notices necessary and incident to the due and lawful prosecution of the work.

P. PROPERTY DAMAGE: It shall be the responsibility of the contractor to respect State property and to prevent damage to existing improvements. The Contractor will be responsible for damages resulting from construction operations. Immediately upon discovery, the Contractor shall repair such damage to the satisfaction of the Engineer.

All trees and shrubbery outside the excavation, embankment or construction limits shall be fully protected from injury.

Q. TIME: The time of completion is specified in the Proposal. It is the Board's intention to insist the Contractor diligently prosecute the work to completion within the specified time.

Prospective bidders are reminded that the State has the option to proceed with or abandon a project depending on whether the project can be completed for occupancy in the specified time.

It is the bidder's responsibility to check the availability of all materials before bidding. The bidder shall select sub-contractors and suppliers who can warrant availability and delivery of all specified or qualified materials to assure project completion within the specified time.

The successful bidder must assume all risks for completing the project by the specified date. There shall be no extension of time for any reason except for delays caused by acts of God, labor disputes involving unions, or actions of the State. If for any reason the project falls behind schedule, the Contractor shall at its own cost, take necessary remedial measures to get the project back on schedule, i.e., working overtime, air freighting all materials, etc. In addition, if the Contractor fails to fully complete the project by the completion date, Contractor will be required to make the facility usable at its own cost.

R. BIDDER'S RESPONSIBILITY TO PROVIDE PROPER SUPERINTENDENCE: The successful low bidder shall designate in writing to the Engineer the name of its authorized superintendent (Superintendent), who will be present at the job site whenever any work is in progress. The Superintendent shall be responsible for all work, receiving and implementing instructions from the Engineer in a timely manner. The cost for superintendence shall be considered incidental to the project.

If the Superintendent is not present at the site of work, the Engineer shall have the right to suspend the work as described under sub-section 5.5 c. and 7.20 - Suspension of Work of the General Conditions.

S. LIQUIDATED DAMAGES: Liquidated damages in the amount specified in the Proposal will be assessed for each and every calendar day from and after the expiration of the time period stated in the Contract for the completion of the project.

T. HIRING OF HAWAII RESIDENTS: The Contractor shall comply with Act 68, SLH 2010, in the performance and for the duration of this contract. The Contractor shall ensure that Hawaii residents compose not less than eighty percent of the workforce employed to perform the contract work on the project. The eighty percent requirement shall be determined by

dividing the total number of hours worked on the contract by Hawaii residents, by the total number of hours worked on the contract by all employees of the Contractor in the performance of the contract. The hours worked by any Subcontractor of the Contractor shall count towards the calculation for this section. The hours worked by employees with shortage trades, as determined by the Department of Labor and Industrial Relations (DLIR), shall not be included in the calculation for this section.

The requirements shall apply to any subcontract of $50,000 or more in connection with the Contractor, that is, such Subcontractors must also ensure that Hawaii residents compose not less than eighty percent of the Subcontractor's workforce used to perform the subcontract.

U. WATER AND ELECTRICITY: The Contractor shall make all necessary arrangements and pay all expenses for water and electricity used in the construction of this project.

V. PUBLIC CONVENIENCE AND SAFETY: The Contractor shall conduct construction operations with due regard to the convenience and safety of the public at all times. No materials or equipment shall be stored where it will interfere with the safe passage of public traffic. The Contractor shall provide, install, and maintain in satisfactory condition, all necessary signs, flares and other protective facilities and shall take all necessary precautions for the protection of the work and the convenience and safety of the public. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the General Conditions.

W. WORK TO BE DONE WITHOUT DIRECT PAYMENT: Whenever the contract that the Contractor is to perform work or furnish materials of any kind for which no price is fixed in the contract, it shall be understood that the Contractor shall perform such work or furnish said materials without extra charge or allowance or direct payment of any sort. The cost of performing such work or furnishing said material is to be included by the Contractor in a unit price for the appropriate item unless it is expressly specified that such work or material is to be paid for as extra work.

X. AS-BUILT DRAWINGS: As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required. All authorizations given by the Engineer to deviate from the plans shall be drawn on the job site plans. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded on the as-built drawings. Final as-built drawings shall be submitted to the Engineer for review and approval. After the Engineer approves the as-built drawings, the contractor shall submit an electronic copy in Adobe PDF format on CD ROM.

Y. ASBESTOS CONTAINING MATERIALS: The use of asbestos containing materials or equipment is prohibited. The Contractor shall insure that all materials and equipment incorporated in the project are asbestos-free

Z WORKER SAFETY: The Contractor shall provide, install and maintain in satisfactory condition all necessary protective facilities and shall take all necessary precautions for the protection and safety of its workers in accordance with the Occupational Safety and Health Standards for the State of Hawaii. The Engineer shall have the right to suspend the performance of the work in accordance with sub-section 7.20 - Suspension of Work of the

General Conditions.

AA. TOILET FACILITIES: All toilet facilities constructed at the project site shall be in accordance with the Public Health Regulations of the State Department of Health (DOH). All necessary precautions shall be observed at the project site. The use of sanitary facilities shall be strictly enforced and workers violating these provisions shall be promptly discharged.

BB. SIGNS: Whenever the project involves closing or obstructing any public thoroughfare, the Contractor shall provide traffic signs conforming to the applicable provisions of the current edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways", published by the Federal Highway Administration as directed by the Engineer for the purpose of diverting or warning traffic prior to the construction area. All traffic signs shall bear proper wording stating thereon the necessary information as to diverting or warning traffic.

When indicated in the Proposal, the Contractor shall provide a project sign, size 4'-0" x 7'-0" to be placed as directed by the Engineer. The sign shall be constructed in accordance with direction provided by the Engineer. All wording, type and size of lettering and color selection shall be as specified in these specifications or as approved by the Engineer.

All signs shall be kept neat and clean, and properly erected at all times.

CC. FIELD OFFICE AREA FOR DEPARTMENT: When indicated in the Proposal, the Contractor shall provide a housed working area of at least 100 square feet adjacent to the Contractor's office for the Department's use. This area will be used by the Engineer to perform tests and to store equipment. As a minimum, the field office shall include the following: standard sized office desk and chair, lighting, ventilation, window-type air conditioning rated at 5,000 BTU, door and window with locking hardware, electrical outlets, and working communications facilities (a cellular telephone is acceptable). The Department will pay for all long distance toll charges made by the Engineer.

DD. QUANTITIES: All bids will be compared on the basis of quantities of work to be done as shown in the Proposal; the quantities shown in the Unit Price items are estimated, being given as a basis for comparison of bids. The Board reserves the right to increase or decrease the quantities given under the items or delete items entirely as may be required during the progress of the work.

EE. OTHER HEALTH MEASURES: Forms of work site exposure or conditions which may be detrimental to the health or welfare of workers or of the general public shall be eliminated or reduced to safe levels as required by the DOH codes, standards, and regulations. Suitable first aid kits and a person qualified to render first aid, as specified in the DOH regulations, shall be provided at all times when work is scheduled.

FF. HAWAII BUSINESS OR COMPLIANT NON-HAWAII BUSINESS REQUIREMENT: Bidders (Contractors) shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR.

GG. COMPLIANCE WITH §3-122-112 HAR:

As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

A. TAX CLEARANCE REQUIREMENTS (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.

B. Department of Labor (DLIR) "**Certificate of Compliance**". (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers' Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) "**Certificate of Good Standing**". Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawaii Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at http://vendors.ehawaii.gov to acquire a "Certificate of Vendor Compliance" indicating the bidder's status is compliant with the requirements of §103D-310(c), HRS, and shall be accepted for contracting and final payment purposes. Bidders that elect to use the new HCE services will be required to pay an annual fee of $12.00 to the Hawaii Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

P R O P O S A L

FOR

AGRIBUSINESS DEVELOPMENT CORPORATION
State of Hawaii

Job No. 100002
Waiahole Water System Improvements – Well Site
Kunia, Oahu, Hawaii

_____, 2024

Executive Director
Agribusiness Development Corporation
State of Hawaii

Dear Sir:

The undersigned, having carefully examined the local conditions and all available records and information covering conditions which may affect the cost of the work to be performed, and having carefully examined the Plans and Specifications, and other contract documents, hereby proposes to furnish and pay for all materials, tools, equipment, labor and other incidental work necessary to construct improvements to the Agribusiness Development Corporation (ADC) Waiahole Water System, and related work as required or called for in this Proposal, all according to the true intent and meaning of the Notice to Bidders, Information and Instructions to Bidders, Proposal, Detailed Specifications, Interim General Conditions, Plans, and any and all addenda for:

Job No. 100002
Waiahole Water System Improvements – Well Site
Kunia, Oahu, Hawaii

on file in the office of the Agribusiness Development Corporation for the TOTAL BASE BID (Items 1 to 42) of:

_____

_____Dollars ($_____)
and will fully complete all work under this contract within 730 consecutive calendar days from the date of written notice to proceed, including date of said order, said total sum being itemized on the following pages.

PROPOSAL

Waiahole Water System Improvements – Well Site

BASE BID

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
General					
1.	LS	LS	Mobilization/Demobilization	LS	$_____
2.	LS	LS	Temporary Erosion and Sediment Control (inclusive, but not limited to, related permit requirements, filter socks, roadway cleaning, stabilized construction ingress/egress, grassing and BMPs/maintenance for the duration of construction work).	LS	$_____
3.	1	EA	Project Sign.	$_____	$_____
Civil Work					
A. Irrigation Waterlines					
4.	862	LF	Irrigation Line A-1, 12” ductile iron or polyvinyl chloride irrigation water pipe, including trenching, pipe cushion, backfill, and other incidentals, in place, complete.	$_____	$_____
5.	976	LF	Irrigation Line C, 12” ductile iron or polyvinyl chloride irrigation water pipe, including trenching, pipe cushion, backfill, and other incidentals, in place, complete.	$_____	$_____
6.	2	EA	12” gate valve, in place, complete.	$_____	$_____
7.	2	EA	Valve boxes, in place, complete.	$_____	$_____
8.	1	EA	Air Release Valve with valve box, in place, complete.	$_____	$_____
9.	20	CY	Class "B" concrete for reaction blocks, in place, complete.	$_____	$_____

BASE BID (CONTINUED)

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
B. Closed Conduit at Hairpin Turn in System					
10.	LS	LS	Remove and dispose of existing 2-20" pipes in hairpin turn of Waiahole Ditch, including existing inlet and outlet boxes.	LS	$_____
11.	592	LF	36" HDPE pipe, including pipe supports and CLSM over pipe to top of ditch, in-place, complete.	$_____	$_____
12.	LS	LS	Inlet and outlet boxes, in-place, complete.	LS	$_____
13.	54	CY	CLSM backfill over HDPE pipe, in place complete.	$_____	$_____
C. Well Site					
14.	0.5	Acres	Clearing and grubbing, in place, complete.	$_____	$_____
15.	57	CY	Excavation, in place, complete.	$_____	$_____
16.	505	CY	Embankment, in place, complete.	$_____	$_____
17.	180	SY	Access road, in place, complete.	$_____	$_____
18.	LS	LS	Concrete work for deep well pump pad, including all reinforcing bars, foundation preparation, cushion material, base course material, and all other incidental and appurtenant work, in place, complete.	LS	$_____
19.	LS	LS	CMU wall for mounting of electrical equipment, in place, complete.	LS	$_____
20.	LS	LS	Concrete work for portable generator pad, including all reinforcing bars, foundation preparation, cushion material, base course material, and all other incidental and appurtenant work, in place, complete.	LS	$_____

BASE BID (CONTINUED)

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
21.	489	LF	6’-0”-high chain link fence, including three (3) strands of barbed wire, extension arms, rails, posts, concrete footings, and appurtenances, all galvanized steel, in-place, complete.	$_____	$_____
22.	1	EA	6’-0”-high, 18’-wide double swing chain link gate, including three strands of barbed wire, extension arms, rails, drop rods, concrete retainer, posts, concrete footings, and appurtenances, all galvanized steel, in-place, complete; and, one locking chains and one padlock, with two keys furnished to the Engineer.	$_____	$_____

BASE BID (CONTINUED)

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
Well Drilling					
23.	LS	LS	Mobilization (not to exceed $30,000)	LS	$_____
24.	LS	LS	Demobilization (not to exceed $15,000)	LS	$_____
25.	745	LF	Drilling the 12-inch (min.) diameter pilot borehole to the depth directed by the Engineer	$_____	$_____
26.	3	Ea.	Video log the entire length of the pilot borehole, reamed borehole, and completed well	$_____	$_____
27.	1	Ea.	Provide equipment and run a pump test in the pilot borehole at rates up to 500 GPM for up to 8 hours	$_____	$_____
28.	745	LF	Ream the pilot borehole to 24-inch (min.) diameter	$_____	$_____
29.	595	LF	Furnish and install 16-inch (ID), 3/8-inch wall thickness solid casing conforming to ASTM A606	$_____	$_____
30.	150	LF	Furnish and install 16-inch (ID), 5/16-inch wall thickness louvered casing with 1/4-inch openings providing at least 90 square inches of open area per foot and conforming to ASTM A606	$_____	$_____
31.	585	LF	Provide and install cement grout in the annular space	$_____	$_____
32.	LS	LS	Furnish, install, and subsequently remove a line shaft test pump capable of up to 1750 GPM	LS	$_____
33.	108	HR	Development and test pumping	$_____	$_____
34.	1	Ea.	Plumbness and alignment tests in the completed well	$_____	$_____

BASE BID (CONTINUED)

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
Mechanical Work					
35.	LS	LS	Furnish and install one vertical turbine oil lubricated line shaft deepwell pump assembly, electric motor, inclusive of pump column, oil enclosing tube, pump line shaft, discharge head assembly, sounding tubes, oil feed system and storage tank, per plans and specs.	LS	$_____
36.	LS	LS	Furnish and install one pump discharge unit, inclusive of pump discharge piping, valves, fittings, pump butterfly valve w/electric operator, well air and vacuum release valve, pump check valve, turbine flow meter with strainer, flow switch, Tideflex check valve, pressure switch, air relief valve assembly, and pressure gage assemblies, inclusive of painting and testing, fully operational per plans and specs.	LS	$_____
37.	LS	LS	Well pump unit operational testing per specification, including electrical power cost for testing.	LS	$_____
38.	1	EA	Wireless pressure transmitter and transducer installed in existing stilling well at reservoir, in place complete	$_____	$_____

BASE BID (CONTINUED)

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
Electrical Work					
39.	LS	LS	Furnish, install, and test all equipment and materials for the new HECO electrical service, including transformer pad, electrical service ducts and cables, electrical metering and service equipment, and all appurtenant electrical work, in place, complete.	LS	$_____
40.	LS	LS	Provide complete Well Pump Motor Control Center (MCC), including but not limited to foundation, electrical metering, soft starters, motor controls, and all incidental and appurtenant electrical work, in place, complete.	LS	$_____
41.	LS	LS	Provide complete SCADA system, including but not limited to SCADA cabinet, foundation, RTU, touchscreen, radio antenna, and all incidental and appurtenant electrical work, in place, complete.	LS	$_____
42.	1	EA	Provide complete portable generator connection cabinet. Circuit breaker, termination lugs, foundation, and all incidental and appurtenant electrical work, in place, complete.	$_____	$_____
				Total—BASE BID (Items 1 to 42)	$_____

ADDITIVE ALTERNATE 1

Item No.	Estimated Quantity	Unit	Description	Unit Price	Total
			Total—ADDITIVE ALTERNATE 1		$_____

RECAPITULATION

Total Base Bid (Items 1 to 42) $_____

Additive Alternate No. 1 $_____

TOTAL SUM BID (Items 1 to 42) $_____

HAWAII PRODUCTS PREFERENCE AND/OR USE OF HAWAII PRODUCTS

In accordance with Act 175, SLH 2009, the Hawaii products preference is applicable to this solicitation. Bidders offering a Hawaii product ("HP") shall identify the HP in the table below.

Persons desiring to qualify their product(s) not currently on the Hawaii Product List, shall complete Form SPO-38, *Certification for Hawaii Product Preference*, and submit the completed form no later than the deadline specified in the procurement notice and solicitation. The responsibility for certification and qualification shall rest upon the person requesting the preference. One form shall be completed and submitted for each product. Form SPO-38 is available at http://Hawaii.gov/spo/goods-services-construction/preferences-103d-pt-x/hi-products/hawaii-product-preferences

For the purpose of selecting the low bid when a solicitation contains both HP and non-HP, the price offered for a HP item shall be decreased by subtracting 10% for the class I or 15% for the class II HP item(s) offered. The lowest total offer, taking the preference into consideration, shall be awarded the contract, unless the offer provides for additional award criteria. The contract amount of any contract awarded, however, shall be the amount of the price offered, exclusive of the preferences.

In the event of any change that materially alters the bidder's ability to supply the Hawaii product(s), the bidder shall immediately notify the procurement officer in writing and the parties shall enter into discussions for the purpose of revising the contract or terminating the contract for convenience.

Item No.	Pre-Approved Hawaii Product Description & Manufacturer	Class (I or II)	Quantity	Unit Measure	Unit Price	Total Price
						$_____
						$_____
						$_____
						$_____

RECYCLED PRODUCTS PREFERENCE

This project allows a 10% price preference for recycled products in accordance with HRS 103D-1005. Please indicate your recycled or non-recycled product by indicating its cost FOB jobsite unloaded in the schedule below, including applicable General Excise & Use Taxes.

DESCRIPTION	RECYCLED PRODUCT COST	NONRECYCLED PRODUCT COST
_____	$_____	$_____
_____	$_____	$_____
_____	$_____	$_____
_____	$_____	$_____

The bidder requesting a recycled product preference shall also complete and submit the form "CERTIFICATION OF RECYCLED CONTENT" as shown in the Interim General Conditions and provide all supporting information with this proposal. Additional information may be requested to qualify a product.

The following definitions are applicable to the CERTIFICATION OF RECYCLED CONTENT form:

"Post-consumer recovered material" means any product used by a consumer, including a business that purchases the material, that has served its intended end use, and that has been separated or diverted from the solid waste stream for the purpose of use, reuse, or recycling.

"Product" includes materials, manufactures, supplies, merchandise, goods, wares, and foodstuffs.

"Recovered material" means waste material and by-products that have been separated, diverted, or removed from the solid waste stream after a manufacturing process for the purpose of use, reuse, or recycling. Recovered material does not include those materials and by-products that are generated and normally reused on-site or within original manufacturing processes (such as mill broke, in the case of paper products).

"Recycled content" means the percentage of a product composed of recovered material, or post-consumer recovered material, or both.

"Recycled product" means a product containing recovered material, or post-consumer recovered material, or both.

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

APPRENTICESHIP AGREEMENT PREFERENCE

1. If applicable to this project, any bidder seeking the preference must be a party to an apprenticeship agreement registered with the State Department of Labor and Industrial Relations (DLIR) at the time the bid is submitted for each apprenticeable trade the bidder will employ to construct the project. "Employ" means the employment of a person in an employer-employee relationship.

    a. The apprenticeship agreement shall be registered with the DLIR and confirm to the requirements of Hawaii Revised Statutes Chapter 372.

    b. Subcontractors do not have to be a party to an apprenticeship agreement for the bidder to obtain preference.

    c. The bidder is not required to have apprentices in its employ at the time the bid is submitted to qualify for the preference.

2. A bidder seeking the preference must state the apprenticeable trade the bidder will employ for each trade to be employed to perform the work by submitting a completed signed original *Certification Form 1* verifying participation in an apprenticeship program registered with DLIR. "Apprenticeable trade" shall have the same meaning as "apprenticeable occupation" pursuant to Hawaii Administrative Rules (HAR) § 12-30-5.

    a. The *Certification Form 1* shall be authorized by an apprenticeship sponsor listed on the DLIR list of registered apprenticeship programs. "Sponsor" means an operator of an apprenticeship program and in whose name the program is approved and registered with DLIR pursuance to HAR § 12-30-1.

    b. The authorization shall be an original signature by an authorized official of the apprenticeship sponsor.

    c. The completed signed original *Certification Form 1* for each trade must be submitted with the bid. Previous certifications shall not apply.

    d. When filling out the *Certification Form 1*, the name of Apprenticeable Trade and Apprenticeship Sponsor must be the same as recorded in the List of Construction Trades in Registered Apprenticeship Programs that is posted on the DLIR website. "Registered apprenticeship program" means a construction trade program approved by DLIR pursuant to HAR § 12-301 and § 12-30-4.

    e. The *Certification Form 1* and the List of Construction Trades in Registered Apprenticeship Programs is available on the DLIR website at: http://hawaii.gov/labor/wdd.

3. Upon receiving the *Certification Form 1*, the Procurement Officer will verify that the apprenticeship program is on the List of Construction Trades in Registered Apprenticeship Programs and that the form is signed by an authorized official of the Apprenticeship Program Sponsor. If the programs and signature are not confirmed by the DLIR, the bidder will not qualify for the preference.

4. If the bidder is certified to participate in an apprenticeship program for each trade which will be employed by the bidder for the project, a preference will be applied to decrease the bidder's bid amount by five percent (5%) for evaluation purposes.

5. Should the bidder qualify for other preferences (e.g. Hawaii Products), all applicable preference shall be applied to the bid price.

CONTRIBUTIONS BY STATE AND COUNTY CONTRACTORS PROHIBITED

Contractors are hereby notified of the applicability of Section 11-355, HRS, which states that campaign contributions are prohibited from specified State of county government contractors during the term of the contract if the contractors are paid with funds appropriated by a legislative body.

CONDITION OF AWARD

It is understood that the award of the contract will be made on the basis of the lowest responsible Total Base Bid (Items 1 to 42) selected by the Agribusiness Development Corporation (ADC). Write the total of bid items 1 to 42 on page P-1.

It is understood and agreed that the Agribusiness Development Corporation reserves the right to reject any and/or all bids and waive any defects when, in ADC's opinion, such rejection or waiver will be for the best interest of the State of Hawaii.

In the event all bids exceed available funds certified by the appropriate fiscal officer, the head of the purchasing agency responsible for the procurement in question is authorized in situations where time or economic considerations preclude resolicitation of work of a reduced scope to negotiate an adjustment of the bid price, including changes in the bid requirements, with the low responsible and responsive bidder, in order to bring the bid within the amount of available funds. It is understood and agreed upon that the head of the purchasing agency may delete a portion or all of any item(s) in the proposal at the stated unit or lump sum price as necessary to stay within the available funding. The bidder is responsible to make an earnest effort to represent the actual cost of each item, including all materials, labor, equipment, overhead and profit in their bid proposal to preclude claims of anticipated profit or loss of profit because of an unbalanced bid proposal.

It is also understood that if a mutually agreeable cost for the reduced scope of work necessitated by a lack of available funds cannot be agreed upon between the bidder and the head of the purchasing agency within 14 calendar days after the bid opening, then the bid may be rejected in the best interest of the purchasing agency, and the head of the purchasing agency may negotiate in progressive order (lowest to highest) with the next lowest responsible and responsive bidder.

It is also understood and agreed that the award of the contract shall be conditioned upon funds being made available for this project and further upon the right of the Agribusiness Development Corporation to hold all bids received for a period of sixty (60) days from the date of the opening thereof, unless otherwise required by law, during which time no bid may be withdrawn.

It is also understood that Notice to Proceed may be delayed up to one (1) year after the bid opening date, and that no additional compensation will be provided for any claim for escalation or delay for issuance of Notice to Proceed on or before that date.

It is also understood and agreed that the quantities given herewith are approximate only and are subject to increase or decrease, and that the undersigned will perform all quantities of work as either increased or decreased, in accordance with the provisions of the Contract Specifications.

It is also understood and agreed that the estimated quantities shown for the items for which a UNIT PRICE is asked in this Proposal are only for the purpose of comparing on a uniform basis, bids offered for the work under this contract, and the undersigned agrees that he is satisfied with and will at no time, dispute said estimated quantities as a means of claims for anticipated profit or loss of profit, because of a difference between the quantities of the various classes of work done or the materials and equipment installed, and the said estimated quantities. On UNIT PRICE bids, payment will be made only for the actual number of units incorporated into the finished project at the contract UNIT PRICE.

After the proposals are opened and read, the figures will be extended and/or totaled in accordance with the bid prices of the acceptable proposals and the totals will be compared. In the comparison of bids, words written in the proposal shall govern over figures and unit prices will govern over totals. Until the award of the contract, however, the right will be reserved to reject any and all proposals and to waive any defects or technicalities as may be deemed best for the interest of the State.

It is also understood and agreed that liquidated damages in the amount of FIVE HUNDRED AND NO/100 ($500.00) for each and every calendar day in excess thereof prior to completion of the contract shall be withheld from payments due to the Contractor.

It is also understood and agreed that if this bid is accepted, the successful bidder must enter into and execute a contract with the Agribusiness Development Corporation and furnish a Performance and Payment Bond, as required by law. These bonds shall conform to provisions of Section 103D-324 and 325, Hawaii Revised Statutes and any law applicable hereto.

It is also understood and agreed that the successful bidder will provide all necessary labor, materials, tools, equipment, and other incidentals necessary to do all the work and furnish all the materials specified in the contract in the manner and time herein prescribed, and according to the requirements of the Engineer as therein set forth.

It is understood that by submitting this proposal, the undersigned is declaring that his firm has not been assisted or represented on this matter by an individual who has, in a State capacity, been involved in the subject matter of this contract in the past two years.

It is understood that by submitting this proposal in accordance with HAR 3-122-192, the undersigned is declaring that the price submitted is independently arrived without collusion.

It is also understood that by submitting this proposal, a Certification for Safety and Health Programs for bids in excess of $100,000 (in accordance with HRS 396-18), the undersigned certifies that his organization will have a written safety and health plan for this project that will be available and implemented by the Notice to Proceed date of this project. Details of the requirements of this plan may be obtained from the Department of Labor and Industrial Relations, Occupational, Safety and Health Division (HIOSH).

It is further understood and agreed that the successful bidder shall comply with paragraph 3.1.a "SUBCONTRACTING" of the General Provisions which requires that the contractor shall perform with his own organization and with the assistance of workmen under his immediate superintendence, work of a value not less than twenty percent (20%) of the value of all work embraced in the Contract, except that certain contract items of work, if specifically referred to in the special provisions, will be exempted from said twenty percent requirement.

Compliance with §103-310 HRS. As a condition of award all bidders shall comply with all laws governing entities doing business in the State, including Chapter 237 HRS (general excise tax); Chapter 383 HRS (employment security – unemployment insurance); Chapter 386 HRS (workers compensation); Chapter 392 HRS (temporary disability insurance); and Chapter 393 HRS (pre-paid health care), and shall produce all documents to the State (DLNR, Engineering Division) required to demonstrate compliance with these subsections. Any bidder making a false affirmation or certification under this subsection shall be suspended and may be debarred from further offerings or awards pursuant to §103D-702 HRS.

RECEIPT OF ADDENDA

The bidder also acknowledges receipt of any and all addenda issued by the Agribusiness Development Corporation, by recording the date of receipt of the respective addenda in the space provided below:

Addendum	Date Received	Addendum	Date Received
No. 1	_____	No. 5	_____
No. 2	_____	No. 6	_____
No. 3	_____	No. 7	_____
No. 4	_____	No. 8	_____

It is understood that failure to receive any such addendum shall not relieve the Contractor from any obligation under this Proposal as submitted.

It is also understood and agreed that if this Proposal is accepted and the undersigned should fail or neglect to contract as aforesaid, the State may determine that the bidder has abandoned the Contract, and thereupon, forfeiture of the security accompanying his proposal shall operate and the same shall become the property of the State.

JOINT CONTRACTORS OR SUBCONTRACTORS TO BE ENGAGED ON THIS PROJECT

The Bidder agrees that the following is a complete listing of all joint contractors or subcontractors covered under Chapter 444, Hawaii Revised Statutes (HRS), who will be engaged by the Bidder on this project to perform the required work indicated pursuant to Section 103D-302, HRS. It is the sole responsibility of the contractor to review the requirements of this Project and determine the appropriate licenses that are required to complete the Project. The Bidder certifies that the completed listing of joint contractors or subcontractors fulfills the requirements for the project and the Bidder, together with the listed subcontractors or joint contractors have all the specialty contractor's licenses to complete the work, except as provided for in HRS §103D-302(b). Failure of the Bidder to comply with this requirement may be just cause for rejection of the bid.

"A" General Engineering Contractors and "B" General Building Contractors are reminded that due to the Hawaii Supreme Court's January 28, 2002 decision in Okada Trucking Co., Ltd. v. Board of Water Supply, et al., 97 Haw. 450 (2002), they are prohibited from undertaking any work, solely or as part of a larger project, which would require the general contractor to act as a specialty contractor in any area in which the general contractor has no license. Although the "A" and "B" contractor may still bid on and act as the "prime" contractor on an "A" or "B" project (See, *HRS §*444-7 *for the definitions of an "A" and "B" project*.), respectively, the "A" and "B" contractor may only perform work in the areas in which they have the appropriate contractor's license (*An "A" or "B" contractor obtains "C" specialty contractor's licenses either on its own, or automatically under HAR § 16-77-32*). The remaining work must be performed by appropriately licensed entities.

General Engineering "A" Contractors automatically have these "C" specialty contractor's licenses: C-3, C-9, C-10, C-17, C-24, C-31a, C-32, C-35, C-37a, C-37b, C-38, C-43, C-49, C-56, C-57a, C-57b and C-61.

General Building "B" Contractors automatically have these "C" specialty contractor's licenses: C-5, C-6, C-10, C-12, C-24, C-25, C-31a, C-32a, C-42a and C-42b.

In completing the Joint Contractors or Subcontractors List, describe the specialty contractor's nature and scope of work to be performed for this project and provide the complete firm name of the joint

contractor or subcontractor in the respective columns. If the Bidder is a general contractor providing the work of a required specialty contractor, whose license is not automatically held pursuant to HAR 16-77-32, fill in the Bidder's (general contractor's) name and nature and scope of work to be performed on this project.

List only one joint contractor or subcontractor per required specialty contractor's classification, unless within the same specialty, the work of each joint contractor or subcontractor can be described so that there is no overlap in work descriptions.

If a contractor's license is required by law for the performance of the work which is called for in this bid, the bidder and all subcontractors must have the required license before the submission of the bidder's proposal in the case of a non-federal aid project, and for federal-aid projects, the bidder must have the required license prior to the award of the project and all subcontractors prior to the start of the subcontracted work.

COMPLETE FIRM NAME OF JOINT CONTRACTOR OR SUBCONTRACTOR	NATURE AND SCOPE OF WORK TO BE PERFORMED

Enclosed herewith is a:

1.	Surety Bond (*1)	)	
2.	Legal Tender (*2)	)	
3.	Cashier's Check (*3)	)	
4.	Certificate of Deposit (*3)	)	in the
5.	Certified Check (*3)	)	amount
6.	Official Check (*3)	)	of
7.	Share Certificate (*3)	)	
8.	Teller's Check (*3)	)	
9.	Treasurer's Check (*3)	)	

(Cross Out Those Not Applicable)

_____

_____Dollars ($_____)

as required by law.

Respectfully submitted,

_____
Name of Company, Joint Venture
or Partnership

_____
Contractor's License No.

By _____
Signature (*4)

Title _____
Print Name _____
Date _____
Address _____
_____
Telephone No. _____

E-Mail Address _____

NOTES:

1. Surety bond underwritten by a company licensed to issue bonds in this State;

2. Legal tender; or

3. A certificate of deposit; share certificate; or cashier's, treasurer's, teller's, or official check drawn by, or a certified check accepted by, and payable on demand to the State by a bank, a savings institution, or credit union insured by the Federal Deposit Insurance Corporation or the National Credit Union Administration.

   A. These instruments may be utilized only to a maximum of $100,000.

   B. If the required security or bond amount totals over $100,000, more than one instrument not exceeding $100,000 each and issued by different financial institutions shall be accepted.

4. Please attach to this page evidence of the authority of this officer to submit bids on behalf of the Company and also the names and residence addresses of all officers of the Company.

5. Fill in all blank spaces with information asked for or bid may be invalidated. PROPOSAL MUST BE INTACT, MISSING PAGES MAY INVALIDATE YOUR BID.

End of Proposal

SPECIAL PROVISIONS

Amend INTERIM GENERAL CONDITIONS, dated October 1994, as follows:

Section 2 – Proposal Requirements and Conditions

1. **AMEND** Section 2.1 Qualification of Bidder with the following:

Written Notice of Intent to Bid or Offer: A written Notice of Intent to Bid is not required for the Solicitation.

Standard Qualification Questionnaire: Bidders may be required to complete a standard qualifications questionnaire. When requested, the information shall be furnished within two working days or longer at the discretion of the Engineer. Failure to furnish the requested information within the time allowed may be grounds for a determination of non-responsibility, in accordance with HRS Section 103D-310 and HAR Section 3-122-108.

Hawaii Business or Compliant Non-Hawaii Business Requirement: Bidders shall be incorporated or organized under the laws of the State or be registered to do business in the State as a separate branch or division that is capable of fully performing under the contract, as stipulated in §3-122-112 HAR. A certified letter is not required prior to bid opening.

Compliance with §3-122-112 HAR: As a condition for award of the contract and as proof of compliance with the requirements of 103D-310(c) HRS, the apparent low bidder shall furnish the required documents to the Department. If the valid required certificates are not submitted on a timely basis for award of a contract, a bidder otherwise responsive and responsible may not receive the award. Bidder is responsible to apply for and submit the following documents to the Department.

A. Tax Clearance (HRS Chapter 237): Bidder shall obtain a tax clearance certificate from the Hawaii State Department of Taxation (DOTAX) and the Internal Revenue Service (IRS). The certificate is valid for six months from the most recently approved stamp date on the certificate; the certificate must be valid on the date received by the Department.

B. Department of Labor (DLIR) "Certificate of Compliance". (HRS Chapter 383 - Unemployment Insurance, Chapter 386 - Workers' Compensation, Chapter 392 - Temporary Disability Insurance, and 393 – Prepaid Health Care): Bidder shall obtain a certificate of compliance from the Hawaii State Department of Labor and Industrial relations (DLIR). The certificate is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

C. Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG) "Certificate of Good Standing". Bidder shall obtain a certificate of good standing issued by the Department of Commerce and Consumer Affairs (DCCA), Business Registration Division (BREG). The certificate of good standing is valid for six months from the date of issue; certificates must be valid on the date received by the Department.

Hawaii Compliance Express. Alternately, instead of separately applying for these certificates at the various state agencies, bidder may choose to use the Hawaii Compliance Express (HCE), which allows businesses to register online through a simple wizard interface at http://vendors.ehawaii.gov to acquire a "Certificate of Vendor compliance" indicating that bidder's status is compliant with requirements of §103D-310(c), HRS, shall be accepted for contracting and final payment purposes.
Bidders that elect to use the new HCE services will be required to pay an annual fee of $15.00 to the

Hawaii Information Consortium, LLC (HIC). Bidders choosing not to participate in the HCE program will be required to provide the paper certificates as instructed in the previous paragraphs.

2. **ADD** Section 2.4a, Pre-Bid Conferences

Required Pre-bid Conferences: For construction and design-build projects with an estimated value of $500,000 or more and solicited under the competitive sealed bid method (103D-302 HRS); and for construction and design-build projects with an estimated value of $100,000 or more and solicited under the competitive sealed proposal method (103D-303 HRS); a pre-bid conference is required.

Other Pre-Bid Conferences: The Department may require a pre-bid conference for construction or design-build projects that are below the dollar threshold listed in above or when projects have special or unusual requirements.

Other Conditions: The Department may require the prospective Bidders to make a physical inspection of the project site and make attendance at the pre-bid conference a condition for submitting an offer.

Nothing stated at the pre-bid conference shall change the solicitation unless a change is made by written addendum.

3. **DELETE** Section 2.5, Addenda and Interpretations, in its entirety and replace with the following:

"Discrepancies, omissions, or doubts as to the meaning of drawings and specifications should be communicated using the question and answer section on the HIePRO solicitation for interpretation and must be received in the time frame set in the HIePRO solicitation. Any interpretation, if made and any supplemental instructions will be in the form of written addenda to the plans and specifications and made available prior to the offer due date. It shall be the prospective bidder's sole responsibility to verify and obtain any said addenda. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents."

Section 3 – Award and Execution of Contract

1. **AMEND** Section 3.3, Award of Contract, by deleting "sixty (60)" and replacing with "ninety (90)" in the first paragraph.

2. **AMEND** Section 3.3, Award of Contract, by adding the following after the first paragraph:

"If the contract is not awarded within the ninety (90) days, the Department may request the successful Bidder to extend the time for the acceptance of its bid. The Bidder may reject such a request without penalty; and in such case, the Department may at its sole discretion make a similar offer to the next lowest responsive and responsible bidder and so on until a bid is duly accepted or until the Department elects to stop making such requests."

3. **AMEND** Section 3.9, Notice to Proceed, by deleting "180 days" and replacing with "one (1) year" in the last paragraph.

4. **ADD** Section 3.10, Protests:

"**3.10 PROTESTS**—Pursuant to Section 103D-701, Hawaii Revised Statutes, an actual or prospective offeror who is aggrieved in connection with the solicitation or award may submit a protest. Any protest

shall be submitting in writing to the Executive Director, Agribusiness Development Corporation, 235 South Beretania Street, Room 205, Honolulu, Hawaii 96813, or designee as specified in the solicitation.

A protest shall be submitted in writing within five (5) working days after the aggrieved person knows or should have known the facts giving rise thereto; provided that a protest based upon the content of the solicitation shall be submitted in writing prior to the date set for receipt of offers. Further provided that a protest of an award or proposed award shall be submitted within five (5) working days after the posting of the award of the contract.

Section 5 – Control of Work

AMEND Section 5.8 Value Engineering Incentive by deleting "$100,000" and replacing with "$250,000" in the first paragraph.

Section 6 – Substitution of Materials and Equipment

ADD the following to Section 6.3 Sub-paragraph b:

4. If the substitution meets all the requirements of the specifications and plans.

Section 7 – Prosecution and Progress

1. **DELETE** Section 7.2d in its entirety and replace with the following:

"d. Insurance Requirements

1. Obligation of Contractor

The Contractor shall not commence any work until it obtains, at its own expense, all required insurance. Such insurance must have the approval of the Department as to limit, form and amount and must be maintained with a company authorized by law to issue such insurance in the State of Hawaii.

All insurance described herein will be maintained by the Contractor for the full period of the contract and in no event will be terminated or otherwise allowed to lapse prior to written certification of final acceptance of the work by the Department.

Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. These certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty days written notice has been given to the Engineer by registered mail. The insurance policies shall name the State of Hawaii, its officers and employees as an additional insured and such coverage shall be noted on the Certificate. Should any policy be canceled before final acceptance of the work by the Department, and the Contractor fails to immediately procure replacement insurance as specified, the Department, in addition to all other remedies it may have for such breach, reserves the right to procure such insurance and deduct the cost thereof from any money due to the Contractor.

Nothing contained in these insurance requirements is to be construed as limiting the extent of Contractor's responsibility for payment of damages resulting from its operations under this contract, including the Contractor's obligation to pay liquidated damages, nor shall it affect the

Contractor's separate and independent duty to defend, indemnify and hold the Department harmless pursuant to other provisions of this contract. In no instance will the Department's exercise of an option to occupy and use completed portions of the work relieve the Contractor of its obligation to maintain the required insurance until the date of final acceptance of the work.

All insurance described herein shall cover the insured for all work to be performed under the contract, all work performed incidental thereto or directly or indirectly connected therewith, including traffic detour work or other work performed outside the work area, and all change order work.

The Contractor shall, from time to time, furnish the Engineer, when requested, satisfactory proof of coverage of each type of insurance required or a copy of the actual policies covering the work. Failure to comply with the Engineer's request may result in suspension of the work, and shall be sufficient grounds to withhold future payments due the Contractor and to terminate the contract for Contractor's default.

2. Types of Insurance

The Contractor shall purchase and maintain insurance described below which shall provide coverage against claims arising out of the Contractor's operations under the contract, whether such operations be by the Contractor itself or by the subcontractor or by anyone directly or indirectly employed by any of them or by anyone for whose acts any of them may be liable.

(a) Worker's Compensation. The Contractor and all subcontractors shall obtain full worker's compensation insurance coverage for all persons whom they employ or may employ in carrying out the work under this contact. This insurance shall be in strict conformity with the requirements of the most current and applicable State of Hawaii Worker's Compensation Insurance laws in effect on the date of the execution of this contract and as modified during the duration of the contract.

(b) Commercial General Liability Insurance and Automobile Insurance. Contractor's commercial general liability insurance and automobile liability insurance shall both be obtained in a combined, single limit of not less than $1,000,000 per occurrence that shall include coverage for bodily injury, sickness, disease or death of any person, arising directly or indirectly out of, or in connection with, the performance of work under this contract.

The Contractor's property damage liability insurance shall provide for a single combined limit of not less than $1,000,000 for all damages arising out of injury to or destruction of property of others including the Department's, arising directly or indirectly out of or in connection with the performance of the work under this contract including explosion or collapse.

The Contractor shall either:

i. Require each of its subcontractors to procure and to maintain during the life of its subcontract, subcontractors' comprehensive general liability, automobile liability and property damage liability insurance of the type and in the same amounts specified herein; or

ii. Insure the activities of its subcontractors in its own policy.

The Contractor will be permitted, in cooperation with insurers, to maintain a self insured retention for up to 25% of the per occurrence combined single limits of the commercial general liability and the automobile liability policies. The existence of the self insured retention must be noted on the certificate of insurance coverage submitted to the Department or else it will be understood that the insurer is providing first dollar coverage for all claims. For all claims within the self-insured retention amount, the rights, duties and obligations between the Contractor and the Department shall be identical to that between a liability insurer and the Department, as an additional insured, as if there was no self-insured retention.

(c) Builder's Risk Insurance. Unless included in the Specifications of this project, the Contractor shall not be required to provide builder's risk insurance. If required as noted in the Specifications, builder's risk insurance shall be provided during the progress of work and until final acceptance by the Department upon completion of the contract. It shall be "All Risk" (including but not limited to earthquake, windstorm and flood damage) completed value insurance coverage on all completed work and work in progress to the full replacement value thereof. Such insurance shall include the Department as additional name insured. The Contractor shall submit to the Engineer for its approval all items deemed to be uninsurable. The policy may provide for a deductible in an amount of up to 25% of the amount insured by the policy. With respect to all losses up to any deductible amount, the relationship between the Contractor and the Department shall be that of insurer and additional insured as if no deductible existed".

2. **DELETE** Section 7.16 in its entirety and replace with the following:

"RESPONSIBILITY FOR DAMAGE CLAIMS; INDEMNITY – The Contractor shall indemnify the State and the Department against all loss of or damage to the State's or the Department's existing property and facilities arising out of any act or omission committed in the performance of the work by the Contractor, any subcontractor or their employees and agents. Contractor shall defend, hold harmless and indemnify the Department and the State, their employees, officers and agents against all losses, claims, suits, liability and expense, including but not limited to attorneys' fees, arising out of injury to or death of persons (including employees of the State and the Department, the Contractor or any subcontractor) or damage to property resulting from or in connection with performance of the work and not caused solely by the negligence of the State or the Department, their agents, officers and employees. The State or the Department may participate in the defense of any claim or suit without relieving the Contractor of any obligation hereunder. The purchase of liability insurance shall not relieve the Contractor of the obligations described herein.

The Contractor agrees that it will not attempt to hold the State and its Departments and Agencies and their officers, representatives, employees or agents, liable or responsible for any losses or damages to third parties from the action of the elements, the nature of the work to be done under these specifications or from any unforeseen obstructions, acts of God, vandalism, fires or encumbrances which may be encountered in the prosecution of the work.

The Contractor shall pay all just claims for materials, supplies, tools, labor and other just claims against the Contractor or any subcontractor in connection with this contract and the surety bond will not be released by final acceptance and payment by the Department unless all such claims are paid or released. The Department may, but is not obligated to, withhold or retain as much of the monies due or to become due the Contractor under this contract considered necessary by the Engineer to cover such just claims

until satisfactory proof of payment or the establishment of a payment plan is presented.

The Contractor shall defend, indemnify and hold harmless the State and its Departments and Agencies and their officers, representatives, employees or agents from all suits, actions or claims of any character brought on account of any claims or amounts arising or recovered under the Worker's Compensation Laws or any other law, by-law, ordinance, order or decree.

Section 8 – Measurement and Payment

1. **DELETE** Section 8.7a in its entirety and replace with the following:

a. Tax Clearances from the State of Hawaii Department of Taxation and Internal Revenue Service, subject to section 103D-328, HRS, current within two months of issuance date indicating that all delinquent taxes levied or accrued under State Statutes against the contractor have been paid.

2. **ADD** Section 8.7d, Certificate of Compliance:

d. A Certification from the Contractor affirming that the Contractor has, as applicable, remained in compliance with all laws as required by Section 103D-310, HRS, and Section 3-122-112, HAR. A contractor making a false affirmation shall be suspended and may be debarred pursuant to section 103D-702, HRS.

    1. Certification of Compliance for Final Payment, State Procurement Office Form-22. Must be Signed Original.

3. **ADD** Section 8.7e, Hawaii Compliance Express:

e. In lieu of submitting the tax clearances from Taxation and IRS, and SPO Form -22, the Contractor may choose to use the Hawaii Compliance Express as described on page SP-1 of this Special Provisions.

SECTION 01 01 90 - GENERAL SPECIFICATIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Work shall consist of furnishing all labor, tools, materials and equipment necessary and required to construct in place complete all work as indicated on the drawings and as specified herein.

1.2 DESCRIPTION OF WORK

1.3 GENERAL

A. Examination of Premises: The Contractor shall contact the Engineer and obtain permission before visiting the site.

B. Right-of-Entry: Access to the site is located on private property. The Contractor shall be responsible for obtaining a right-of-entry agreement with the Waiahole Water System (WWS) and all other right-of-entry needed to access the project site. Provide a copy of the executed agreements to the Engineer at least three (3) working days before starting any work.

C. All lines and grades shall be established by a licensed surveyor, or licensed Civil Engineer, registered in the State of Hawaii. The Contractor shall submit evidence of current and valid registration.

D. Notices: The Contractor shall notify the Engineer and the WWS at least three (3) working days before starting any work.

E. Environmental Hazard: The Contractor shall comply with the requirements stated in the environmental hazard management plan.

F. Permits and Regulations: The Contractor shall obtain and pay for all permits and licenses, give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified.

G. Existing Utilities

The Contractor shall be responsible for the protection of existing surface and subsurface utilities and poles within and abutting the project site, trench excavations, borrow sites, and other work areas. Any utility that the Contractor encounters during the progress of the work, such as telephone poles, electric poles, water lines, sewer lines, electric lines, and drainage pipes, whether or not shown on the plans, shall not be disturbed or damaged unless otherwise instructed in the plans and specifications. The Contractor shall notify the Engineer and the affected utility company immediately of any damaged or disturbed utility.

In the event utilities which are not shown on the plans and specifications, not located and exposed on the job as it progressed or not pointed out to the Contractor in the field are damaged or disturbed by the Contractor, the Contractor shall not be held liable but shall notify the Engineer and the affected utility company.

H. Contractor's Operations

1. The Contractor must employ, insofar as possible, such methods and means of carrying out the work so as not to cause any interruption or interference to the facility's operations. Where the Contractor's operations would result in interruptions which would hamper the operations of the facilities, the Contractor shall rearrange the schedule of work accordingly.

2. The Contractor shall maintain a safe passageway to and from the facility for the user agency personnel and the public at all times.

I. Standard Specifications

1. The work embraced herein shall be done in accordance with:

   a. "DLNR INTERIM GENERAL CONDITIONS" October 1994

   b. "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION", City and County of Honolulu, 1986

   c. "2005 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Department of Transportation, Highways Division.

   d. "WATER SYSTEM STANDARDS", Board of Water Supply, City and County of Honolulu, 2002

2. The terms used hereinafter are as follows:

   a. "GENERAL CONDITIONS" shall refer to the "DLNR INTERIM GENERAL CONDITIONS, October 1994"

   b. "STANDARD SPECIFICATIONS" shall refer to the "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION" of the City and County of Honolulu, State of Hawaii, 1986.

   c. "2005 STANDARD SPECIFICATIONS" shall refer to the "2005 STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION."

   d. "BWS STANDARDS" shall refer to the "WATER SYSTEM STANDARDS", Board of Water Supply, City and County of Honolulu, 2002

3. These DETAILED SPECIFICATIONS supplement and modify the STANDARD SPECIFICATIONS.

J. Conditions at Site

1. EXISTING CONDITIONS: Every person bidding upon the work is expected to visit the site and examine the conditions of same and satisfy himself as to the character and amount of work to be performed as indicated on the plans and called

for by these specifications. No additional payment will be granted because of the lack of knowledge of such conditions.

2. WATER AND ELECTRICITY: The Contractor shall make all necessary arrangement and connections for temporary use of water and electricity for construction and shall pay all expenses.

K. Toilet Accommodations: The Contractor shall be responsible for providing and maintaining his own toilet facilities for his use.

L. Protection of Property: The Contractor shall continually maintain adequate protection of all its work from damage and shall protect all property, including but not limited to buildings, equipment, furniture, grounds, vegetation, material, utility systems located at and adjoining the job site. The Contractor shall repair, replace or pay the expense of repair of damages resulting from its operations.

M. Safety: The Contractor shall carefully read and strictly comply with the requirements of the Hawaii Occupational Safety and Health Law, Chapter 396, Hawaii Revised Statutes, as amended, is applicable and made a part of the Contract.

N. Clean Up Premises: The Contractor shall throughout the duration of the project keep all streets, sidewalks and driveways free from all debris produced from the project. The Contractor shall keep the project and surrounding area neat and free from dust nuisance. The Contractor shall clean up and remove from premises all debris accumulated from operations as necessary or as directed. See also Section 7.25 of the General Conditions.

O. Completion of Work: Upon completion of the work, the Contractor shall remove all equipment, signs and unused materials provided for the work and shall restore the project site to a neat and clean condition

P. Responsibility

1. The State will hold the Contractor liable for all the acts of Subcontractors and shall deal only with the prime Contractor in matters pertaining to other trades employed on the job. The Contractor shall be responsible for coordinating the work of all trades on the job.

2. Should the Contractor discover any discrepancy in the plans or specifications, the Contractor shall immediately notify the Engineer before proceeding any further with the work, otherwise, the Contractor will be held responsible for any cost involved in correction of work placed due to such discrepancy.

Q. Cooperation with Other Contractors: The State reserves the right at any time to contract for or otherwise perform other or additional work within the contract zone limits of this Contract. The Contractor of this project shall, to the extent ordered by the State, conduct its work so as not to interfere with or hinder the progress or completion of the work performed by other contractors.

R. Division of the Work: The Divisions and Sections into which these Specifications are divided shall not be considered an accurate or complete segregation of work by trades. This also applies to all work specified within each Section.

S. Drawings and Specifications

1. The Contractor shall not make alterations in the drawings and specifications. In the event the contractor discovers any errors or discrepancies, the Contractor shall immediately notify the Engineer in accordance with the General Conditions.

2. Where devices, or items, or parts thereof are referred to in the singular, it is intended that such reference shall apply to as many such devices, items or parts as are required to properly complete the work.

3. Specifications and drawings are prepared in abbreviated form and include incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a", "an", and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

END OF SECTION

SECTION 01 09 00 - STANDARD REFERENCES

PART 1 - GENERAL

Wherever used in the project, the following abbreviations will have the meanings listed:

Abbreviation	Company
AA	Aluminum Association Incorporated 818 Connecticut Avenue, N.W. Washington, D.C. 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 225 Washington, D.C. 20001
ACI	American Concrete Institute P.O. Box 19150 Detroit, MI
AEIC	Association of Edison Illuminating Companies 51 East 42nd Street New York, NY 10017
AFBMA	Anti-Friction Bearing Manufacturer's Association 60 East 42nd Street New York, NY 10017
AGA	American Gas Association 8501 East Pleasant Valley Road Cleveland, OH 44131
AGMA	American Gear Manufacturer's Association 1330 Massachusetts Avenue, N.W. Washington, D.C.
AISC	American Institute of Steel Construction 101 Park Avenue New York, NY 10017
AISI	American Iron and Steel Institute 1000 16th Street, N.W. Washington, D.C. 20036
AITC	American Institute of Timber Construction 333 West Hampden Avenue Englewood, CO 80110

Abbreviation	Company
AMCA	Air Moving and Conditioning Association, Inc. 30 West University Drive Arlington Heights, IL 60004
ANSI	American National Standards Institute, Inc. 1430 Broadway New York, NY 10018
APA	American Plywood Association 1119 A Street Tacoma, WA 98401
API	American Petroleum Institute 1801 K Street N.W. Washington, DC 20006
ARI	Air-Conditioning and Refrigeration Institute 1814 North Fort Myer Drive Arlington, VA 22209
ASCE	American Society of Civil Engineers 345 East 47th Street New York, NY 10017
ASCII	American Standard Code for Information Interchange United States of America Standards Institute 1430 Broadway New York, NY 10018
ASE Code	American Standard Safety Code for Elevators, Dumbwaiter and Escalators American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers United Engineering Center 345 East 47th Street New York, NY 10017
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103

Abbreviation	Company
AWPA	American Wood Preservers Association 1625 Eye Street Washington, DC 20006
AWS	American Welding Society 2501 N.W. 7th Street Miami, FL 33125
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
CBM	Certified Ballast Manufacturers 2120 Keith Building Cleveland, OH 44115
CMAA	Crane Manufacturers Association of America, Inc. (Formerly called: Overhead Electrical Crane Institute - OECI) 1326 Freeport Road Pittsburgh, PA 15238
CRSI	Concrete Reinforcing Steel Institute 180 North La Salle Street Chicago, IL 60601
CSA	Canadian Standards Association 178 Rexdale Boulevard Rexdale, Ontario, M9W IR3, Canada
DEMA	Diesel Engine Manufacturer's Association 122 East 42nd Street New York, NY 10017
DIS	Division of Industrial Safety California Department of Industrial Relations 2422 Arden Way Sacramento, CA 95825
EEI	Edison Electric Institute 90 Park Avenue New York, NY 10016
EIA	Electronic Industries Association 2001 Eye Street N.W. Washington, DC 20006

Abbreviation	Company
EJMA	Expansion Joint Manufacturer's Association 331 Madison Avenue New York, NY 10017
ESO	Electrical Safety Orders, California Administrative Code, Title 8, Chap. 4, Subarticle 5 Office of Procurement, Publications Section P.O. Box 20191 8141 Elder Creek Road Sacramento, CA 95820
FEDSPEC	Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch Washington Navy Yard, Bldg. 197 Washington, DC 20407
FEDSTDS	Federal Standards (see FEDSPECS)
FM	Factory Mutual Research 1151 Boston-Providence Turnpike Norwood, MA 02062
HEI	Heat Exchange Institute 122 East 42nd Street New York, NY 10017
HI	Hydraulic Institute 1230 Keith Building Cleveland, OH 44115
IAPMO	International Association of Plumbing and Mechanical Officials 5032 Alhambra Avenue Los Angeles, CA 90032
ICBO	International Conference of Building Officials 5360 South Workman Mill Road Whittier, CA 90601
ICEA	Insulated Cable Engineers Association P.O. Box P South Yarmouth, MA 02664
IEEE	Institute of Electrical and Electronics Engineers, Inc. 345 East 47th Street New York, NY 10017
IES	Illuminating Engineering Society

Abbreviation	Company
	C/O United Engineering Center 345 East 47th Street New York, NY 10017
ISA	Instrument Society of America 400 Stanwix Street Pittsburgh, PA 15222
JIC	Joint Industrial Council 7901 Westpark Drive McLean, VA 22101
MILSPEC	Military Specifications Naval Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. 127 Park Street, N.E. Vienna, VA 22180
NAAMM	National Association of Architectural Metal Manufacturers 100 South Marion Street Oak Park, IL 60302
NACE	National Association of Corrosion Engineers P.O. Box 986 Katy, TX 77450
NEC	National Electric Code National Fire Protection Association 470 Atlantic Avenue Boston, MA 02210
NEMA	National Electrical Manufacturer's Association 155 East 44th Street New York, NY 10017
NESC	National Electric Safety Code American National Standards Institute 1430 Broadway New York, NY 10018
NFPA	National Forest Products Association (Formerly called: National Lumber Manufacturer's Association) 1619 Massachusetts Avenue, N.W. Washington, DC 20036
OSHA	Occupational Safety and Health Act U.S. Department of Labor

Abbreviation	Company
	San Francisco Regional Office 450 Golden Gate Avenue, Box 36017 San Francisco, CA 94102
PPIC	The Plumbing & Piping Industry Council, Inc. Suite 402 510 Shatto Place Los Angeles, CA 90020
SAE	Society of Automotive Engineers 2 Pennsylvania Street New York, NY 10001
SAMA	Scientific Apparatus Makers Association One Thomas Circle Washington, DC 20005
SBCC	Southern Building Code Congress 1116 Brown-Marx Building Birmingham, AL 35203
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc. 8224 Old Courthouse Road Tysons Corner Vienna, VA 22180
SSPWC	Standard Specifications for Public Works Construction Building News, Inc. 3055 Overland Avenue Los Angeles, CA 90034
TEMA	Tubular Exchanger Manufacturer's Association 331 Madison Avenue New York, NY 10017
UBC	Uniform Building Code Published by ICBO
UL	Underwriters Laboratories Inc. 207 East Ohio Street Chicago, IL 60611
UMC	Uniform Mechanical Code Published by ICBO
UPC	Uniform Plumbing Code Published by IAPMO
USBR	Bureau of Reclamation U.S. Department of Interior Engineering and Research Center

Abbreviation	Company
	Denver Federal Center, Building 67 Denver, CO 80225
WWPA	Western Wood Products Association (Formerly called: West Coast Lumberman's Association - WCLA) Yeon Building Portland, CA 97204

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF WORK

The work of this Contract is located in Kunia, at the Agribusiness Development Corporation (ADC) Waiahole Water System in the central part of the island of O‘ahu.

1.2 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary and make modifications and improvements to the Waiahole Water System complete and ready for operation as shown on the Drawings and specified herein.

The Work includes, but is not necessarily limited to, the following major items:

1. Construction of new water supply well to be used a backup to the Waiahole Ditch as a source for irrigation water.

2. Construction of new buried irrigation waterlines to convey water from the new well to an existing reservoir.

3. Construction of new pipe system within Waiahole Ditch at a hairpin turn which will replace an existing pipe system.

1.3 WORK BY OTHERS

The Contractor shall coordinate his/her activities with any concurrently on-going projects in the area, adjacent to and/or affected by the subject project. No other projects are anticipated or known at the time this document is written.

1.4 WORK SEQUENCE

A. Operation of the irrigation system in the vicinity of the project which is fed by the Waiahole Water System and agricultural and maintenance activities by the State and tenant farmers must be maintained throughout the duration of the project and use of portions of the new work may be required prior to completion of the project to maintain operation. The Contractor’s sequence of construction must be approved by the Engineer and the Contractor will be responsible for maintaining the continuous availability of irrigation water throughout the project. The proposed sequence shall be in accordance with the approved schedule submitted by the Contractor.

1.5 CONTRACTOR'S USE OF PREMISES

A. The Contractor shall limit the use of the premises for the performance of the Work and storage of materials and equipment to allow for the Agribusiness Development Corporation’s (ADC’s) use in operating and maintaining the Waiahole Water System.

B. The Contractor shall coordinate with the Engineer necessary access for normal ADC maintenance requirements.

C. The Contractor shall assume full responsibility for the security of all his/her and his/her subcontractors materials and equipment stored on the site.

D. If directed by the ADC, the Contractor shall move any stored items that interfere with operations of the ADC.

E. The Contractor shall obtain and pay for the use of additional storage or work areas as needed to perform the Work.

END OF SECTION

SECTION 01 23 00 - ADDITIVE BID ITEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for additive bid items.

B. The description of additive bid items is not intended to give a detailed description of all additional or deductive work required by the additive bid item(s), as only the principal features of such additional or deductive work are listed.

C. Should anyone or all of the additive bid items become a part of the contract, the cost of all additional or deductive work required by the additive bid item(s), even though not specifically mentioned herein, are included in the lump sum bid price.

1.2 DEFINITIONS

A. Additive Bid Item: An amount proposed by Bidders (Offerors) and stated on the Proposal Form for certain work defined in the Bidding Requirements that may be added to the Total Lump Sum Base Bid Price amount if State decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost for each additive bid item is the net addition to the Contract Sum to incorporate additive bid item into the Work. No other adjustments are made to the Total Lump Sum Base Bid Price.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the additive bid item into the Project.

1. Include as part of each additive bid item, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of additive bid item.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each additive bid item. Indicate if additive bid items have been accepted, rejected, or deferred for later consideration.

C. Execute accepted additive bid items under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Additive Bid Items is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each additive bid item.

PART 2 – GENERAL (Not Used)

PART 3 – EXECUTION

3.1 SCHEDULE OF ADDITIVE BID ITEMS

A. Additive Bid Item 1:

B. Additive Bid Item 2:

C. Additive Bid Item 3:

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

As specified in Section 007200.

1.2 GENERAL REQUIREMENTS

A. The Contractor shall review, approve, and submit all items required for submittals as specified herein. Submit items well in advance of the time information will be needed so the Work will not be delayed.

Submittals may only be submitted by the Contractor to the Engineer.

Submittals that have not been checked and signed by the Contractor will be returned before they will be considered. The requirement of the Contractor's checking will not be construed as being fulfilled by stamping and initialing the submittal without checking. Any delay in progress of the work resulting from this situation is the responsibility of the Contractor.

B. Work requiring approval of submittals shall not be started until such submittal has been approved. Allow five (5) working days for review and approval, upon Engineer’s receipt of complete submittal. It shall be the responsibility of the Contractor to make sure submittals are made in a timely manner.

C. **Submittals which involve changes, deviations, or omissions from the Contract Documents, which change the design concept of the project or reduce the quality of the work, will be returned to the Contractor without review unless valid reason for the change is established at the time of submission.**

D. **Submit all inter-related submittals together**. If such coordinated submission is not made, the Contractor will be notified and approval of the submittals will be withheld until remaining items have been received. Any delay in the work resulting from the Contractor's failure to comply with this requirement shall be the latter's responsibility and no extension of time will be allowed.

E. Approval of submittals shall apply in a general sense only, and will not relieve the Contractor from responsibility for proper fitting and construction work, nor from furnishing material and work required by the Contract Documents but which may not be indicated on the approved submittals. Similarly, such approval shall not constitute acceptance of deviations from the Drawings, Specifications, or instructions, nor from Local, State, or Federal laws, nor regulations or requirements of Boards, Commissions, or Departments having jurisdiction, nor approval of conditions which may involve infringement of patents.

F. All required guarantees, warranties, operation manuals and as-built drawings shall be submitted to the Owner within seven (7) days after the Final Inspection. If the aforementioned submittals are not processed to the Owner within the seven (7) days, the Contractor shall issue a letter to the Owner assuming total responsibility for the

maintenance of site and all materials installed. This maintenance responsibility of the Contractor shall remain in effect until the respective guarantees, warranties, operation manuals and as-built drawings have been received by the Owner.

1.3 PRODUCT DATA

Product Data:

A. Clearly mark each copy to identify pertinent products.

B. Show performance characteristics and capacities.

C. Supplement standard information to provide information specifically applicable to the work, if required.

1.4 CONTRACTOR RESPONSIBILITIES

A. Review Product Data and Samples prior to submission.

B. Determine and verify:

1. Catalog numbers and similar data.

2. Conformance with specifications.

C. Coordinate each submittal with requirements of the work and of the contract documents.

D. Notify the Engineer in writing, at time of submission, of any deviations in the submittals from requirements of this specification.

E. Begin no work that requires submittals until return of submittals with Owner’s representative's approval.

1.5 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, or as requested and in such sequence as to cause no delay in the work.

B. Number of submittals required: The Contractor shall submit six (6) hard copies or a color PDF of the submittal. The Consultant shall retain 2 sets for the Owner in addition to Consultant(s) records. Contractor shall provide additional brochures/shop drawings as required for Contractor’s distribution.

1.6 BIDDER'S SPECIAL RESPONSIBILITY FOR COORDINATING CONTRACTUAL WORK AND SUBMITTALS:

A. The Contractor is responsible for the coordination of all contractual work and submittals.

B. The Contractor shall clearly mark submittal with notification that it has been reviewed prior to submission to Consultant. Similar to the following:

THIS SUBMITTAL HAS BEEN CHECKED BY THIS GENERAL CONTRACTOR. IT IS CERTIFIED CORRECT, COMPLETE, AND IN COMPLIANCE WITH CONTRACT DRAWINGS AND SPECIFICATIONS. ALL AFFECTED CONTRACTORS AND SUPPLIERS ARE AWARE OF, AND WILL INTEGRATE THIS SUBMITTAL INTO THEIR OWN WORK.

DATE RECEIVED
SPECIFICATION SECTION #
SPECIFICATION PARAGRAPH #
DRAWING NUMBER
SUBCONTRACTOR NAME
SUPPLIER NAME
MANUFACTURER NAME
CERTIFIED BY:

C. This stamp, "filled in", should appear on the title sheet of each shop drawing, on a cover sheet of submittals in an 8-1/2" x 11" format, or on one face of a cardstock tag (min.3" x 6") tied to each sample. The tag on the samples should state what the sample is, so that if the tag is accidentally separated from the sample, they can be matched up again. The back of this tag will be used by the Architect for his receipt, review, and log stamp and for any comments that relate to the sample.

D. All submittals for material, equipment, and shop drawings listed in the contract documents, shall be required and shall be reviewed and approved by the Engineer, prior to any ordering of materials and equipment.

E. All bidders shall be aware of, and allow for the Americans with Disabilities Act Accessibility Guidelines (ADAAG) requirements as it affects their supply of materials and work, and the work of other bidders in this project.

PART 2 - PRODUCTS
(Not Used)

PART 3 - EXECUTION
(Not Used)

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances

C. References.

D. Testing and inspection services.

E. Manufacturers' field services.

F. Examination.

G. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in the sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 TESTING AND INSPECTION SERVICES

A. Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.

1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full-time specialist and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Engineer.

1. Laboratory: Authorized to operate in State of Hawaii.

2. Laboratory Staff: Maintain full time specialist on staff to review services.

3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer or Owner.

D. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

H. Agency Responsibilities:

1. Test samples of mixes submitted by Contractor.

2. Provide qualified personnel at site. Cooperate with Engineer and Contractor in performance of services.

3. Perform specified sampling and testing of products in accordance with specified standards.

4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

5. Promptly notify Engineer and Contractor of observed irregularities or non-conformance of Work or products.

6. Perform additional tests required by Engineer.

7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to Engineer and to Contractor. When requested by Engineer, provide interpretation of test results. Include the following:

1. Date issued.

2. Project title and number.

3. Name of inspector.

4. Date and time of sampling or inspection.

5. Identification of product and specifications section.

6. Location in Project.

7. Type of inspection or test.

8. Date of test.

9. Results of tests.

10. Conformance with Contract Documents.

J. Limits on Testing Authority:

1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency or laboratory may not approve or accept any portion of the Work.

3. Agency or laboratory may not assume duties of Contractor.

4. Agency or laboratory has no authority to stop the Work.

1.6 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Provide off-site storage and protection when site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during bidding period to requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Bidder:

1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS: Provide all materials, labor, equipment and tools necessary to complete cast-in-place concrete work. The work includes formwork and reinforcement.

1.2 STORAGE OF MATERIALS: Cement and aggregates shall be stored in such a manner as to prevent their deterioration or the intrusion of foreign matter. Any material which has deteriorated or which has been damaged shall not be used for concrete and shall be promptly removed from the site.

1.3 TESTS

A. Slump: Standard slump tests as described in ASTM C143 (Modification: Sampling of concrete for slump test shall be taken by the Independent Testing Laboratory, approved by the Engineer, after at least 1/4 cubic yard of concrete has been discharged) will be made periodically during the placement of concrete to ensure that the slump for which the concrete has been designed is met. Any concrete batch tested and showing slumps exceeding the specified tolerance shall be rejected. Any concrete placed prior to slump testing shall be the sole responsibility of the Contractor and shall be rejected should the subsequent slump test of the batch in question indicate that the slump tolerance is being exceeded. All rejected concrete shall be promptly removed and properly replaced. All costs resulting therefrom shall be borne by the Contractor.

B. Compressive Strength: During the progress of the work compressive strength tests of concrete shall be made in accordance with ASTM C39. 6-inch x 12-inch cylinders shall be taken from each major pour by the independent Testing Laboratory at the rate of 3 cylinders for each 100 cubic yards. Notwithstanding this established rate, however, the Engineer may direct to take concrete cylinders in whatever quantity he deems fit and/or necessary from any concrete pour. For pours of less than 25 cubic yards the Engineer may omit the taking of cylinders.

1. The independent Testing Laboratory will make and identify all test cylinders. The Contractor shall provide the equipment, such as a shovel and a wheelbarrow as required to make and move the cylinders and shall also provide the labor and equipment to deliver the cylinders to the testing laboratory Inspector.

2. Cost of making concrete cylinders and testing will be borne by the Contractor.

3. The standard age for testing the cylinders shall be 28 days. However, 7-day tests may be made for indication of final 28-day strengths.

4. All cylinders shall be made and cured in accordance with ASTM C31.

5. In all cases where the strength of any group of cylinders falls below the minimum compressive strength specified, the Engineer shall have the right to require that test specimens be cut from the structure. Specimens shall be selected by the Engineer from the location in the structure represented by the test specimen or specimens which failed. Specimens shall be secured, prepared, and tested in accordance with ASTM C42 within a period of 60 days after placing the concrete. The testing shall be done by a laboratory approved by the Engineer. Concrete in the area represented

by the core tests will be considered structurally adequate if the average strength of 3 cores is no less than 85% and the strength of a single core is no less than 75% of the 28-days strength specified. Should laboratory analysis indicate, however, that the proper concrete mix has not been used by the Contractor, all such concrete placed using the improper mix shall be subject to rejection. The cost of cutting specimens from the structure, patching the resulting holes, and making the analysis, including laboratory and consultation costs, shall be borne by the Contractor.

The holes from which the cored samples are taken shall be packed solid with no-slump concrete proportioned in accordance with the ACI 211.3 "Standard Practice for Selecting Proportions of No-Slump Concrete". The patching concrete shall have an "extremely dry" consistency and the same design strength as the specified concrete.

6. If the strength of the specimens cut from the structure falls below the requirements stipulated above, the Engineer shall have the right to require any and all defective concrete to be replaced, and all costs resulting therefrom shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement shall conform to the requirements of ASTM C150, Type I, for all concrete work.

B. Concrete Aggregates:

1. Fine Aggregates shall be calcareous or basalt sands, or a combination thereof. They shall meet the grading requirements of ASTM C33 unless the concrete producer can provide past data that shows that a proposed non-conforming gradation will produce concrete with the required strength and suitable workability.

   If manufactured sands are used in the concrete mix, the Contractor may select and use a water-reducing and/or an air-entraining admixture as specified hereinafter to provide satisfactory workability in the concrete. The cement content of a mix shall be as specified hereinafter, and the use of an admixture shall in no way result in the reduction of the cement factor.

2. Coarse Aggregates shall be crushed close-grained, blue lava rock meeting the grading requirements of sizes 57 or 67 (ASTM D448) or both. The maximum size of aggregate shall not be larger than 1/5 of the narrowest dimensions between sides of the forms of the member for which the concrete is to be used nor larger than 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars.

C. Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement. Non-potable water shall not be used.

D. Expansion Joint Filler: A pre-molded material of 1/2" thickness, unless otherwise noted, composed of fiberboard impregnated with asphalt conforming to ASTM D 1751.

E. Joint Sealing Compound shall be a polysulfide or urethane compound conforming to ASTM C 920 or other approved equal, compatible with the floor finish to be applied. Color to be selected by the Engineer.

F. Bond-Break Filler: Mineral-surfaced roofing cap sheet or coated asphalt felt.

G. Colored Concrete shall be obtained by the application of a dry powder or approved equal pigment into fresh concrete slabs.

H. Non-Slip Grit shall be an abrasive aggregate of silicon carbide or aluminum oxide.

I. Admixture, if used, shall conform to ASTM C494 or ASTM C260 and shall be mixed in proper amount in accordance with directions of manufacturer.

J. Curing Compound shall be compatible with the floor finish to be applied. Unless otherwise required by the floor finish, the compound shall conform to the requirements of ASTM C 309.

K. Pervious Sheeting shall be burlap or other acceptable absorbent material, free from substances that will harm the concrete or cause discoloration.

L. "Keyed Kold Joint" shall be galvanized.

M. Cementitious Coatings shall be cement based polymer modified cement finishing materials ("Pro-Finish" by Bonded Materials Company, "Polycoat" by Tremcrete Systems Incorporated, "Durus" by Durus High Tech Cement, or approved equal).

N. Formwork shall incidental to concrete work.

O. Engineered Synthetic Fiber Reinforcement shall be 100% virgin polypropylane fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.91, and specifically manufactured to an optimum gradation and length for use as concrete secondary shall meet the requirements of ASTM C-Concrete or shotcrete.

P. Reinforcing bars shall be ASTM A 615, Grade 60. Accessories such as ties and other devices for properly placing, supporting and fastening shall be annealed steel wire of not less than 16-Gauge to secure reinforcement.

PART 3 - EXECUTION

3.1 DESIGN OF CONCRETE MIXES

A. Ingredients for concrete shall be Portland cement, fine and coarse aggregates and water.

B. Normal weight concrete shall meet the requirements outlined in Subsection C, D and E below.

C. Concrete shall be designed so that the concrete materials will not segregate nor cause excessive bleeding. Slump shall be 4 inches. A tolerance of 1" above the indicated slump will be allowed for individual batches.

For concrete used in ramps or other sloping construction, the slump tolerance shall be waived.

D. For each class of concrete up to Class 4,000, the test results for 28-day compressive strength shall meet the following requirements:

28-Day-Compressive-Strength-Test-Results

Class	Min. Average for 3 Cylinders, psi	Min. Average for 2 Cylinders, psi
4,500	4,500	4,250
4,000	4,000	3,750
3,000	3,000	2,750
2,500	2,500	2,250

E. For concrete designed for specified strengths in excess of 4,500 psi and/or containing admixtures other than those used exclusively for the purpose of entraining air, mixture proportions to provide the desired characteristics shall be developed in accordance with Sections 5.2, 5.3 and 5.4 of ACI 318-89.

F. The Contractor shall submit for approval by the Engineer the mixes he intends to use at least 14 calendar days before the actual concrete placing operations.

G. The Contractor shall use only approved mixes.

H. Unless otherwise noted, Class 3,000 concrete shall be used for exterior equipment pad on grade and slab-on-grade supporting tiles; Class 2,500 concrete for sidewalks, and other uses not included under Class noted above.

I. Engineered Synthetic Fiber Reinforcement shall be added to all concrete sidewalks on grade, headwalls and slabs.

J. Reinforcing bars shall be added to all structures as per plan.

3.2 JOINTS

A. Construction joints shall be provided as detailed at locations indicated on the plans. Construction joints not shown on the plans shall be so made as to least impair the strength of the structure and shall be approved by the Engineer. Joints shall be perpendicular to the main reinforcement.

B. All reinforcing steel shall be continuous across construction joints. Keys and/or inclined dowels shall be provided as required. Unless otherwise indicated, joints shall be sealed with joint sealing compound.

C. Expansion joints shall be provided as detailed at locations indicated on the plans. Reinforcement or other embedded metal items bonded to the concrete (except dowels in floors or walls bonded on only one side of joint) shall not be permitted to extend continuously through any expansion joint. Joints shall be sealed with expansion joint filler and sealing compound at least 3/8" deep.

D. Contraction/control joints shall be provided where shown on the plans and shall be 1/4 the depth of the slab or a minimum of 1" deep. Unless otherwise indicated on the plans, joints may either be tooled, formed-in-place or sawcut. When saw-cut joints are provided, cutting shall be timed properly with the set of the concrete so that it is firm enough not to be torn or damaged by the cutting blade and before random shrinkage cracking can form in the slab. In any case, cutting shall be completed not later than 12 hours after the concrete is placed and finished. Unless otherwise indicated on the plans, joints shall be sealed with joint sealing compound.

3.3 MIXING CONCRETE

A. All concrete throughout shall be either job or plant mixture in an approved type of power operated mixer that will ensure uniformity and homogeneity of the concrete produced. The Contractor shall provide a sufficient number of mixers to continuously carry on the work.

B. Mixing at jobsite shall be done in accordance with ACI 304 and as follows:

1. Concrete shall be thoroughly mixed in a batch mixer of an approved type and size which will insure a uniform distribution of materials throughout the mass. The machine shall have a control device to prevent materials from being discharged until they have been mixed for the specified minimum time.

2. The entire contents of the drum shall be discharged before materials of the succeeding batch are placed therein. No mixer shall be used which has a rated capacity of less than a 1-sack batch and no mixer shall be charged in excess of its rated capacity.

3. The first batch of materials placed in the mixer after the machine has been cleaned shall contain a sufficient excess of cement, sand and water to coat the inside of the drum without reducing the required mortar content of the mix. Upon cessation of mixing, the mixer shall be thoroughly cleaned.

C. Ready Mixed and Mixed-In-Transit Concrete shall be mixed to conform to the provisions of ASTM C94 and as follows:

1. The plant shall have sufficient capacity and transportation equipment to deliver concrete at the rate desired. The interval between batches for a pour shall not exceed 30 minutes.

2. The time elapsed between the introduction of the mixing water to the cement and aggregates or the cement to the aggregates, and the placing of concrete in its final position shall not exceed 90 minutes.

3. In hot weather (more than 90 degrees Fahrenheit ambient temperature) or under conditions contributing to quick stiffening of the concrete, the elapsed time in 2, shall not exceed 60 minutes, if no retarding admixture is used. If an ASTM C494 Type B or D admixture is added to the concrete, the elapsed time in 2, shall remain at 90 minutes.

4. Synthetic fibers for fiber reinforcement concrete shall be added at the batch plant at a rate of 1.5 lbs. per cubic yard.

D. Concrete shall be mixed only in such quantity as is required for immediate use.

No retempering will be permitted and concrete that has started to harden shall be discarded and promptly removed from the job.

E. Admixtures conforming to Part 2.1.I may be used in the concrete as recommended by the supplier and approved by the Engineer.

F. Hand mixing of concrete will not be permitted except to make up shortages for sidewalks, thresholds, and curbs and gutters.

3.4 PLACING CONCRETE

A. No concrete shall be placed in the absence of the Engineer or his representative who shall be given one day advance notice of starting time of concrete pour. Place no concrete until foundation, forms, reinforcing steel, pipes, conduits, sleeves, hangers, anchors, inserts, waterproofing, termite treatment and/or basaltic termite barrier and other work required to be built into or placed ahead of concrete placing have been inspected and approved by the Engineer. Concrete placed without such notice and approval shall be rejected.

B. Preparation

1. All sawdust, chips and other construction debris and extraneous matter shall be removed from interior of forms. Struts, stays, bracing, or blocking serving temporarily to hold forms in correct shape or alignment shall be removed when the concrete placing has reached an elevation rendering their services unnecessary.

2. Concrete shall be placed upon clean, damp surfaces with no free water, or upon properly compacted fills but never upon soft mud or dry, porous earth. Before pouring footings or foundations, bottoms of excavations shall be properly leveled off and tamped.

3. Before depositing new concrete on or against concrete which has set, all accumulations of mortar splashed upon reinforcing steel and the surfaces of forms shall be removed and the forms shall be retightened. The surfaces of previously set concrete shall be thoroughly roughened and cleaned of all foreign matter and laitance, saturated with water and slushed with a coat of cement grout. New concrete shall be placed before the grout has attained its initial set.

C. Conveying

1. Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods that will prevent segregation.

2. Concrete shall be deposited as nearly as practicable in its final position. Extensive spading as a means of transportation shall be avoided and in no case shall vibrators be used to transport concrete inside the forms.

3. Open troughs and chutes shall have a slope not to exceed 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

4. The concrete shall not be allowed to drop freely more than 6 feet except where specifically authorized by the Engineer. When placing operations would involve the dropping of concrete from a height of more than 6 feet, it shall be conveyed through pipes or flexible drop chutes.

5. If any appreciable segregation occurs through the conveying methods employed, their use shall be ordered discontinued by the Engineer and some other satisfactory method of placing concrete shall be used.

6. All chutes, troughs, pipes and other means of conveyances shall be kept clean and free from coatings of hardened cement or concrete by thoroughly cleaning with water and chipping after each pour. Water used for flushing shall be discharged away from the vicinity of the concrete or forms already in place.

D. Depositing

1. Unless adequate protection is provided, concrete shall not be placed during rain. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish. Fresh concrete that has been deposited but has not attained its initial set shall be protected in the event of rain.

2. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcing. As nearly as practicable, the concrete shall be dropped vertically without hitting reinforcement, sleeves or forms into its final position in order to avoid separation of coarse aggregates from concrete. After the initial set of concrete, the forms shall not be jarred and no strain shall be placed on the projecting reinforcing.

3. Formed concrete shall be deposited in horizontal layers not deeper than 2 feet avoiding inclined layers and inclined construction joints. The depth of layers shall be shallow enough so that the succeeding layer will be placed before the previous layer has attained its initial set.

   Concrete shall not be allowed nor shall it be caused to flow horizontally or on slopes in the form. Concrete placing on a slope shall begin at the lower end of the slope and progress upward.

4. Construction joints shall be made only where located on the plans unless approved otherwise by the Engineer. Pours shall be planned to provide for the continuous placing of concrete from one construction joint to another. The face edges of all joints that are exposed to view shall be carefully finished true to line and elevation.

5. In slab construction, placing of the concrete shall be started at the far end of the work so that each batch will be dumped against previously placed concrete, not away from it. The concrete shall not be dumped in separate piles and the piles then leveled and worked together. For floor slabs on earth, additional requirements shall apply.

6. If depositing of concrete must be stopped short of a full placement, it shall be leveled to a horizontal plane or stopped against a vertical bulkhead. Such bulkhead or horizontal plane shall be located only as approved by the Engineer.

E. Compaction

1. All concrete shall be consolidated by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. All compaction shall be done by use of high frequency internal vibrators. Where the vibrator cannot be inserted into the concrete, compaction shall be done by spading, rodding or forking.

2. Frequency of vibrator shall be not less than 7,000 impulses per minute. The Contractor shall provide a sufficient number of vibrators to properly consolidate all concrete immediately after placing. At least one standby vibrator shall be on hand at all times during placement of the concrete.

3. Vibration shall not be applied through contact with reinforcement of forms. Vibration shall penetrate previously deposited concrete sufficiently to prevent pockets or voids or construction joints from occurring between pours, but must not be applied to concrete which has set up sufficiently to cease to be plastic under vibration.

3.5 FINISHING OF SLABS

A. Finish B - Broom Finish. The concrete slab shall be given a coarse transverse scored texture by drawing a broom across the surface. The operation shall follow immediately after steel-trowelling performed under Finish B above.

B. Finish C - Non-Slip Finish. The surface shall be given a dust-on application of abrasive aggregates. Finish with steel trowel but avoid over-trowelling. The rate of application of abrasive aggregates shall be not less than 25 pounds per 100 square feet or application shall be in strict accordance with the manufacturer's recommendations.

C. Finishing Tolerances for slabs shall be in accordance with the following:

1. Finish shall be true planes within + or - 1/4" in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.

   Unless otherwise shown on the plans, all slabs shall meet this tolerance. The tolerances will be checked prior to removing of forms or shores.

3.6 SELECTION OF FLOOR FINISHES

A. Unless otherwise indicated on the plans, the following floor finishes shall be used:

1. Finish B - Broom Finish. For concrete driveways.

2. Finish C - Non-Slip Finish. For ramps and walkways.

3.7 REPAIR OF DEFECTS

A. After forms have been removed, any concrete which is not constructed as shown on the plans or is out of alignment or level beyond required tolerances or which shows a defective surface which in the opinion of the Engineer cannot be properly repaired or patched shall be removed.

B. Where cast-in-place concrete which is exposed to view or designated architectural requires repairing or patching, the texture of the surface of such repair or patch shall closely match that of the surrounding surface. If the concrete is to remain unpainted, the surface color shall also be closely matched to that of the surrounding surface.

C. All tie holes and all repairable defective areas shall be patched immediately after form removal as follows:

1. All honeycombed concrete shall be chipped out to sound concrete but in no case to a depth of less than 1 inch. If possible, edges of the chipped-out areas shall be undercut.

2. Rock pockets, form tie holes, deep holes not too large in area, other holes with relatively high ratio of depth to area, and similarly confined areas shall be dry packed.

   After the area to be patched has been thoroughly cleaned and dampened, mortar, which shall consist of 1 part cement, 2-1/2 parts sand passing a #16 screen, and only enough water to produce a mortar that will stick together upon being molded into a ball by slight pressure of the hands, shall be placed in the holes in layers having a compacted thickness of about 3/8". Each such layer shall be solidly rammed over its entire surface using a hardwood stick and a hammer.

3. Shallow depressions where lateral restraint cannot be obtained, voids behind reinforcement, and holes extending through concrete sections shall be patched using a commercially prepared bonding agent, a stiff mortar mix of 1 part cement and not more than 2-1/2 parts sand.

   For filling holes in exterior surfaces, an epoxy bonding agent shall be used. Application of the bonding agent shall be in strict conformance with the manufacturer's instructions.

4. An epoxy-and-sand mixture may be used in lieu of the mortar-and-bonding agent mixture for any of the patching above. The preparation of the surface to receive the patch, as well as the mixture proportions of the epoxy-and-sand, shall be in strict conformance with the manufacturer's instructions.

D. Any concrete which is not constructed as shown on the plans or is out of alignment and/or level beyond allowable tolerances may be patched using an epoxy-and-sand mixture, if directed by the Engineer.

The proportions of the mix and the preparation of the surface to receive the patch shall be in strict conformance with the manufacturer's instructions except as or unless otherwise specified herein. The minimum thickness of the patch shall be 1/4". No "feathering" to a lesser thickness will be permitted.

Misalignment which requires correction more than 1 inch thickness shall be repaired in the following manner:

1. The surface of the affected area shall be chipped, etched, or otherwise cleaned and roughened to provide a sound surface for bonding;

2. Concrete nails or other fasteners which can provide positive mechanical bonding of the patch shall be set into the surface at about 18 inches o.c. in all directions with a minimum of 2 rows;

3. Wire mesh reinforcement as approved by the Engineer shall be installed in those portions of the patch which exceed 2-inch thickness;

4. A bonding agent suitable for use in the repair location (epoxy required for exterior use) shall be applied over the entire surface to be patched;

5. Formwork to the true lines called for shall be installed over the area requiring the patch; and

6. Concrete or grout with aggregate sized appropriately for the cavity and which will provide strength equivalent to that of the base surface shall be placed in the form, properly compacted and suitably cured.

3.8 CURING AND PROTECTION

A. All concrete shall be cured for a period of not less than 7 days by one of the methods listed below. During this curing period, the concrete shall be maintained with minimal moisture loss at a relatively constant temperature. Fresh concrete shall be protected from heavy rains, flowing water, mechanical injury, and injurious action of the sun. Curing method selected must be compatible with the finish to be applied to the concrete.

Curing shall immediately follow the finishing operation.

To promote drying of slab on grade to receive floor finish and avoid moisture related flooring problems, once drying and the slab has started, it shall be protected from getting wet for a minimum of 90 days immediately prior to the placement of the floor finish. If the slab cannot be adequately protected, mechanical drying or other means shall be employed to reduce the vapor emission level to 5 lbs. Per 1000 s.f. or less prior to placement of the floor finish.

B. Water Curing - If cured with water, concrete shall be kept wet by mechanical sprinklers, by ponding, or by any other method which will keep the surfaces continuously wet.

C. Saturated Sand Curing - Surfaces cured with sand shall be covered with a minimum of 1-inch thickness of sand which shall be kept uniformly distributed and continuously saturated during the entire curing period.

D. Pervious sheeting - Overlap sheeting edges approximately 6 inches and keep sheets continuously wet throughout the curing period.

E. Curing Compounds - Curing compounds used on concrete surfaces that are to receive floor covering paint or color finish or acid stain shall be as recommended by the manufacturer to be compatible with the applied finish.

The Contractor shall submit to the Engineer a letter certifying that the curing compound is compatible with the applied finish. Application shall be in accordance with the manufacturer's recommendations. If curing, sealing or other compounds are used which are incompatible with applied finish, such compound shall be thoroughly removed by grinding with a terrazzo grinder.

F. Waterproof Paper - Waterproof paper or opaque polyethylene film conforming to ASTM C171 may be used. The paper or film shall be anchored securely and all edges sealed or applied in such a manner as to prevent moisture escaping from the concrete. Waterproof paper shall not be used on floors that will be exposed when finished.

3.9 CONCRETE FOR ELECTRICAL WORK

A. Unless otherwise noted on plans, concrete for handholes and manholes shall be 3,000 psi strength at 28 days. Concrete for encased ducts shall be Class 2,500. Maximum size of aggregates for concrete encased duct shall be 3/4".

B. All ducts shall have a minimum cover of 3 inches of concrete. Spacers shall be used for placing ducts and for rigidly holding the ducts during the concrete pour. Provide minimum earth cover of 18 inches over top of concrete encasement unless otherwise shown on plans.

C. The encased section of ducts to which a future connection is to be made shall end with a coupling. An un-encased 1-foot section of duct and end cap shall constitute the terminus of such ducts.

3.10 CLEAN UP

Contractor shall clean up all concrete and cement materials, equipment and debris upon completion of any portion of the concrete work and upon completion of the entire concrete and related work.

END OF SECTION

SECTION 26 00 00 – ELECTRICAL WORK

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The General Conditions and Special Provisions preceding this Section of Specification shall govern Electrical Work.

1.2 Specification and Drawings are prepared in abbreviated form and includes incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a", and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

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

B. Before bidding, visit project site, carefully review such section of the Specification and all Drawings of this Contract, and obtain and review the standards, specifications and drawings of the local utility companies.

C. Report any error, conflicts or omissions to the Owner's representative (hereafter referred to as Engineer) at least one week before submission of bids for interpretation or clarification. If errors or omissions are not reported, Contractor shall provide necessary work at no cost to the Owner to properly complete intent of Specification and Drawings.

1.3 SUBMITTALS:

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

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

1. Conduit

2. Conductors

3. Motor Control Center

4. Dry-Type Transformer

5. Panelboards

6. Enclosures

7. Junction Boxes

8. Handholes/Pullboxes

9. Disconnect Switches

10. Devices (Receptacles, switches, etc.)

11. Portable Generator Terminal Cabinet

12. Nameplates

1.4 WORK INCLUDED: This section covers the work necessary for the complete power and control systems at the well pump system site, including but not limited to the following.

A. Complete underground service entrance raceways, including all handholes and pullboxes required for electric and telephone utility services.

D. Complete electrical service and utility metering equipment.

E. Complete motor control center and SCADA cabinet, including motor control components and telemetering components and accessories.

F. Complete weatherproof MCC housing.

G. Complete electrical conduit and wire system for connection to pump, instruments, and controls.

H. Complete well pump control systems.

I. Coordination with utility companies for power and telephone services.

J. Complete grounding system.

K. Complete new outdoor NEMA 4XSS portable generator terminal cabinet.

L. Final adjustment and testing of the pumps and controls.

M. All incidental work where not specifically shown or specified, but is necessary and required to complete the work to an acceptable and operational stage.

1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. For Supervisory Control and Data Acquisition (SCADA) System, refer to Specification Section 40 63 00.

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

1. Motors

2. Flow Switches

3. Flow and Level Transmitters

4. Pressure Switches

5. Control Valves

1.6 QUALITY ASSURANCE: Comply with the latest applicable rules, regulations, requirements, and specifications of the following:

Local Laws & Ordinances
State & Federal Laws
National Electrical Code
City & County of Honolulu Electrical Code
State Fire Marshal
Underwriter's Laboratory
National Electrical Safety Code

Any conflicts that may exist between the above items will be resolved by the Engineer. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.

1.7 MATERIALS AND WORKMANSHIP

A. Materials and equipment shall be new and free from defects and shall be listed for the purpose for which they are to be used. Those items listed by Underwriters' Laboratories shall bear the "UL" label of approval.

B. Comply with applicable Rules, Standards, Regulations, and Requirements of respective utility company.

1.8 DRAWINGS

A. These specifications are accompanied by architectural plans of buildings, site plans and diagrammatic electrical plans showing locations of outlets, switches, service runs, feeder runs, devices, and other electrical equipment. Locations are approximate. Before installing, Contractor shall study adjacent construction details and make installation in most logical manner.

B. Before installing, verify all dimensions and sizes of equipment at job site. Circuit and

conduit routing is typical and may be altered in any logical manner; however, all changes shall be approved by the Engineer and shown on "as built" drawings.

1.9 SUBMITTALS

A. Departures from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these Contract Documents, and the reasons therefore, as soon as practicable and within 30 days after the award of the Contract. Make no such departures without the prior written approval of the Engineer.

1. Departures resulting from substitution of materials or system shall be accompanied by appropriate changes in all affected work of every trade. Such changes shall be at no increase in the contract amount and shall be the responsibility of the subcontractor or supplier responsible for the departures.

2. The General Contractor shall be responsible to coordinate, approve, and select systems that do not impose unaccounted for impact on the electrical work. It shall be understood that after the award of contract, all departures having electrical impact, unless otherwise noted, have been coordinated so that all appropriate changes to the electrical system required to accommodate the departures shall be at no additional cost to the Owner.

B. Pre-bid Equipment & Material Submittals: Manufacturer's trade names and catalog numbers stated herein are intended to indicate the type and quality of equipment or materials desired. Unless substitution is specifically forbidden, proposed alternates may be submitted for approval.

1. Manufacturers not listed require approval fourteen calendar days prior to bid opening. Make requests for approval in writing to the Engineer. Provide sufficient material or data to allow determination of compliance with these Contract Documents. List any proposed deviations from these Contract Documents, including equipment dimensions.

C. Post-Contract Award Equipment & Material Submittals: Within 30 days after the award of the Contract, provide manufacturer's complete descriptive information for the items of material, equipment, and systems listed hereinafter. Submit all data at one time electronically.

1. Provide shop drawings, literature, and requested samples showing item proposed for use, size, dimensions, capacity, special features required, schematic (elementary) control diagrams, equipment schedules, rough-in, etc., as required by the Engineer for complete check and for installation. Use NEMA device designations and symbols for all electric circuit diagrams submitted. Make content of schematic (elementary) connection or interconnection diagrams in accordance with the latest edition of NEMA IC 1.

2. The Contractor shall check submittals for number of copies, adequate identification, correctness, and compliance with Drawings and Specifications, and initial all copies. Revise, change, and/or resubmit all submittal information until acceptable to the Engineer. Obtain Engineer's acceptance, and respective utility company approvals, before commencement of fabrication or installation of

any materials or equipment.

3. Review of submittal information by the Engineer shall not relieve the Contractor from responsibility for deviations from Drawings and Specifications, unless he has in writing at time of submission requested and received written approval from the Engineer for specific deviations. Review of submittal information shall not relieve the Contractor from responsibility for errors and omissions in shop drawings or literature.

4. Provide required copies, according to the specifications, of submittal information to the Engineer for distribution after review.

D. Furnish submittal information on the following items:

1. Motor Control Equipment -- outline & schematic (elementary drawings, descriptive information, and component schedule).

2. MCC -- outline & one-line drawings, descriptive information, and component schedule.

3. Service Equipment.

4. Weatherproof MCC Enclosure.

5. Panelboards.

6. Disconnect Switches.

7. Portable Generator Connection Cabinet.

8. Any built-to-order equipment.

9. Special pull boxes, junction boxes & cabinets.

E. Instructions Books: Provide one set of hard-backed ring binder and one electronic set containing:

1. Operation, maintenance, and renewal parts information for all equipment furnished under this section.

2. Set of complete as-approved information herein required to be submitted for review following contract award.

3. As-built electric circuit and equipment drawings.

4. List of all equipment suppliers or current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.

5. Record Drawings marked with red indelible pencil to show all departures from the original Drawings, underground cable, conduit, or duct runs dimensioned

from established building lines, and all electrical work revisions.

6. All test results.

7. All material to be clean and filed under dividers with heading in accordance with specification item title.

8. Submit material to Engineer for approval prior to delivery. Make additions or changes as required by the Engineer.

1.10 PRODUCT HANDLING

A. Provide protection for materials and equipment against loss or damage. Protect everything from the effects of weather.

B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction.

C. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

1.11 SITE INSPECTION: Prior to submitting a bid, visit the project, ascertain conditions affecting the proposed work, and make allowance as to the cost thereof.

1.12 RESPONSIBILITY: Be responsible for:

A. Complete systems in accordance with the intent of these Contract Documents.

B. Referring to all of the Drawings and Specifications, and shop drawings for other trades for details of facility equipment and construction which affect the work covered under this section.

C. Coordinating electrical work with Engineer, Hawaiian Electric Company (HECO), and work of other trades to avoid conflicts, errors delays, and unnecessary interference during construction.

D. Checking the approximate locations of electrical equipment, and other electrical system components shown on plans for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make necessary changes at no additional cost to the Owner.

E. Installing materials and equipment in a workmanlike manner.

F. Installing materials and equipment in strict accordance with manufacturer's recommendations, unless otherwise specified or directed by the Engineer.

G. Furnishing and installing all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein.

1.13 INTENT OF DRAWINGS

A. Drawings are partly diagrammatic and are intended to show circuiting and switching details which shall be exactly as shown.

B. Exact conduit locations are not shown unless so indicated or specifically dimensioned.

C. One-line diagrams are schematic and do not show physical arrangement of equipment.

1.14 PERMITS AND INSPECTION:

A. All materials and workmanship are subject to inspection at any time by the Engineer or his representatives. Correct any work or materials not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the Engineer at no additional cost to the Owner.

B. Obtain and pay for electrical permits and arrange for all necessary electrical inspections by the County and all other agencies having jurisdiction.

1.15 ELECTRICAL SERVICE:

A. Arrange with utility company and pay for all monthly service charges until final acceptance as made by the Owner. If water distribution pumping begins, for use by the Owner, before final acceptance is made by the Owner, the monthly service charges will be adjusted and the Owner shall pay for the portion of power used to operate the pump(s). All nonrecurring utility costs shall be paid by the Owner. Contractor shall coordinate for timely installation of electrical service to the project by HECO.

B. Perform all work to meet the standards and requirements of HECO where such work is under their jurisdiction.

C. Coordinate with HECO to rectify any malfunction in the electrical service respectively to provide fully operational services to the project.

1.16 COORDINATION

A. The Contractor shall coordinate the equipment supplied from various manufacturers and vendors. This includes but is not limited to:

1. Obtaining specific information on equipment ratings and sizes and verifying that electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.

2. Contractor shall provide equipment that will fit within the space allocated on the Drawings and meet NEC clearances.

3. Contractor shall coordinate with the other disciplines to ensure construction delays are not caused by equipment conflicts resulting from other discipline's equipment installations not being installed in accordance with schedule.

4. Providing power and control equipment, wiring, and raceways to meet the

requirements of the mechanical equipment supplied.

PART 2 – PRODUCTS

2.2 GENERAL: Unless otherwise indicated, provide all first quality, new materials, free from any defects, in first class condition, and suitable for the space provided. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

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

2.4 ENCLOSURES:

A. For outdoor weather exposed locations, enclosures shall be NEMA 4X Type 316 Stainless Steel (SS) type. Exterior junction boxes shall be NEMA 4X Type 316 SS, gasketed type.

2.5 MOUNTING HARDWARE: All electrical equipment mounting hardware for outdoor installation shall be Type 316 Stainless Steel, unless otherwise noted.

2.6 EQUIPMENT FINISH: Electrical equipment may be installed with manufacturer's standard finish and color, except where specific color, finish, or choice is indicated. If the manufacturer has no standard color, equipment shall be painted ANSI G1, Light Gray.

2.7 CONDUIT:

A. Conduit, Rigid Steel, Zinc-Coated: Rigid steel conduit, including couplings, elbows, and nipples shall be galvanized by hot-dipping, electroplating, sherardizing, or metallizing process, and shall meet the requirements of ANSI C80.1, UL, and the NEC.

B. Conduit, Rigid PVC: Rigid polyvinyl chloride (PVC) conduit shall be Schedule 40 UL listed for concrete encased. Rigid PVC conduit shall be Schedule 80 UL listed for direct burial underground and exposed use. Rigid PVC conduit, including couplings, elbows, and nipples, shall conform with the requirements of the latest edition of NEMA TC-2, NEC, Federal Specification W-C-1094, and shall meet applicable ASTM test requirements for the intended use.

C. Conduit, Flexible: All flexible conduit shall be moisture proof flexible steel, polyvinyl chloride jacketed type, UL approved, with continuous copper ground path in the flexible steel tube.

D. Conduit Fittings, Metallic: Metallic conduit fittings shall be of the type indicated or required for the anticipated purpose, and shall meet applicable requirements of ANSI C80.4, UL, NEC, and NEMA FB 1.

E. Conduit Fittings, PVC: PVC conduit fittings shall be of the type indicated or required for the anticipated purpose and shall meet the requirements of NEMA TC-3, Federal

Specification W-C-1094, UL, and NEC.

2.8 CONDUCTORS:

A. Conductors 600 Volts and Less: Conductors in raceways, ducts, and cables shall be copper with the type of insulation specified. Conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, shall meet all applicable requirements of IPCFA S-19-81 and S-61-402, the NEC, and UL. Conductor sizes shall not be less than those shown.

Conductors smaller than No. 8 for lighting and convenience outlets shall be solid. All other conductors No. 12 and larger shall be stranded. Conductors No. 8 AWG or larger shall have insulation of a heat and moisture resistant grade THW. Smaller conductors shall have thermoplastic insulation type THW or THWN, and shall be factory color coded with separate color for each phase and neutral used consistently throughout the system.

All conductors and cables for underground or aerial use shall carry the UL labeling "Type USE", and shall have RHW insulation and heavy-duty, black, neoprene sheath meeting the physical requirements and minimum thickness requirements of IPCEA S-19-81.

B. Equipment Grounding Conductors: Conductors for equipment grounding shall be stranded copper. Conductors shall have green Type TW insulation with a minimum thickness of 2/64-inch.

2.9 OUTLET BOXES:

A. Each outlet in the wiring or raceway system shall be provided with an outlet box to suit the conditions encountered and shall be of the same material as the conduit to which it is connected unless otherwise indicated or approved.

B. Exterior boxes shall be gasketed Type 316 Stainless Steel type having threaded hubs.

2.10 JUNCTION BOXES:

A. Junction boxes of the required type and size shall be provided where indicated. The junction boxes shall be provided with terminal strips or terminal blocks with a separate connection point for each conductor entering or leaving the box. These terminal strips or blocks shall have a minimum of 25 percent spare terminal points. Weatherproof boxes shall be gasketed Type 316 Stainless Steel with conduit hubs.

2.11 DEVICE PLATES:

A. Provide one piece device plates of satin finish stainless steel, unless otherwise specified. Screws shall be of metal with countersunk heads and color to match the finish of the plate.

B. Plates for areas exposed to the elements, damp, or wet installations shall be weatherproof with lockable U.V. stabilized covers. Covers shall permit plugs to be connected without compromising the integrity of the protective nature of the cover.

2.12 RECEPTACLES:

A. Duplex Convenience Receptacles: Each receptacle shall be specification grade and rated 20 amperes at 125 volts. Each receptacle shall have a grounding pole. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Bases shall be of gray phenolic composition with side-mounted terminals. Receptacles shall be capable of receiving two-wire parallel-blade caps or three pole caps. All receptacles shall be UL listed.

B. Weatherproof Receptacles: Each shall consist of a duplex receptacle as specified mounted in a cast metal box with gasketed, weatherproof, cast metal cover plate, and cap over each receptacle opening. The weatherproof cover shall be U.L. Listed while-in-use, locakable. Receptacles for use in damp or wet locations shall be UL Listed for wet locations.

2.13 PANELBOARDS: Panelboards shall be circuit breaker type as indicated, copper bussed with bolted molded plastic case circuit breaker complement, and shall meet the standards established by UL, NEMA PB 1, and the NEC. Assembly shall be flush mounted in motor control center, or surface mounted type, as indicated.

A. Provide surge protective device in panelboard where indicated on the drawings. Each SPD shall be bus connected for parallel operation, rated for 120/240V, 1-phase, 3-wire systems, and have a minimum surge rating of 120kA per phase. The SPD shall be UL 1449 Listed, Latest Edition, and CSA certified per CSA 22.2. Each SPD shall have an audible alarm with silence switch, an alarm indicator light, and indicator lights for line-to-neutral, line-to-ground, and neutral-to-ground monitoring.

2.14 TRANSFORMERS: NEMA ST20, general-purpose, dry-type, self-cooled, ventilated. Transformer shall be mounted in MCC as indicated, with six 2-1/2 percent full capacity taps (4 below and 2 above the primary winding rating). Transformer shall have 220 degrees C insulation system with a temperature rise not exceeding 80 degrees C under full rated load in a maximum ambient temperature of 40 degrees C. Transformer shall be capable of carrying 115% of the nameplate KVA without exceeding insulation rating.

2.15 EQUIPMENT DISCONNECT SWITCH: Heavy-duty, horse-power rated when used as motor disconnect, lever-operated contacts, spring-loaded, NEC standard fuse rejection type holders when used with current limiting fuses. When installed in damp or wet locations, enclosure shall be NEMA 4X Type 316 Stainless Steel. General Electric Co. Type TH, Cutler-Hammer, Square D, or approved equal.

2.16 Portable Generator Termination Cabinet: Portable generator power and control connection via twin termination/lug landing for three phases and neutral plus ground, rated 800A, 600V at 105 deg C, 35,000 AIC, UL 1773 Listed. Access provided at bottom of cabinet for temporary generator connection via hinged cover and fixed mounting plate for permanent generator connections. Cabinet rated NEMA 4X type 316 stainless steel with padlock hasp and padlock. Secure cabinet to finished grade as specified by manufacturer. Eaton Roll-Up Generator Termination Box or pre-approved equal.

2.17 SURGE PROTECTIVE DEVICE (SPD):

A. Branch Feeder Circuit SPD:

1. General Specifications:

   a. Provide solid-state surge protection unit.

   b. The unit shall be latest UL 1449 listed.

   c. Units shall have integral, replaceable fusing per phase, with status indicators (except for pin base mounted 120V surge suppressor, which shall have internal fusing).

   d. Unit enclosure shall be resistant to oil, moisture, and dust, and other industrial airborne contaminants.

   e. Each unit shall include installation instructions, and be warranted for a minimum of five (5) years.

   f. Lead lengths must be supplied by manufacturer, and be no longer than 30 inches.

2. General Construction:

   a. Enclosure shall be nonconductive, corrosion resistant, and shall withstand temperatures of -40° to 200° F.

   b. Electrical components are manufactured specifically for surge suppression.

   c. Units are fast acting externally or internally fused per phase, thereby eliminating code requirement for adding circuit breaker or fused switches at panel.

   d. Units shall have blown fuse indicator lights, one for each phase (except for pin base mounted 120V surge suppressor).

3. General Electrical Characteristics:

   a. Response time/component response time shall be sub-nanosecond.

   b. Enclosure shall be rated for NEMA 1, 2, 3, 3R, 4, 4X, 12 and 13 (except for pin base mounted 120V surge suppressor, which shall be rated for NEMA 1 only).

   c. Frequency range: 50-400Hz

   d. EMI-RFI noise attenuation: to 40dB

   e. Operating Temperature: -40° to 85°C

   f. Operating Humidity: 1% to 95%

g. Maximum peak transient power line voltage @ 120V - 2.4 megawatts

h. Capacitance: 1 to 1.5 - microfarad per line

i. Rated power dissipation: 1 watt per line

j. Latest UL 1449 Listed

4. Specific Technical Specifications:

a. System: 480V, 3 phase, 3 wire (delta)

1) Max. continuous line voltage (RMS): 528

2) Nominal clamping voltage (peak): 558

3) Max. peak current (8 x 20) sum: 90,000

4) Transient energy (joules): 3150

5) Fuses: 5 Amp, 600V (Buss KTK-5)

6) Manufacturer: MVC Model MV400P or approved equal

b. System: 277/480V, 3 phase, 4 wire (wye)

1) Max. continuous line voltage (RMS): 300

2) Nominal clamping voltage (peak): 423

3) Max. peak current (8 x 20) sum: 90,000

4) Transient energy (joules): 3150

5) Fuses: 5 Amp, 600V (Buss KTK-5)

6) Manufacturer: MVC Model MV400 or approved equal

c. System: 120/208V, 3 phase, 4 wire (wye)

1) Max. continuous line voltage (RMS): 130

2) Nominal clamping voltage (peak): 198

3) Max. peak current (8 x 20) sum: 90,000

4) Transient energy (joules): 1345

5) Fuses: 5 Amp, 250V (AGC or equal)

6) Manufacturer: MVC Model MV200 or approved equal

d. System: 120/240V, 1 phase, 3 wire

1) Max. continuous line voltage (RMS): 130

2) Nominal clamping voltage (peak): 198

3) Max. peak current (8 x 20) sum: 60,000

4) Transient energy (joules): 930

5) Fuses: 5 Amp, 250V (AGC or equal)

6) Manufacturer: MVC Model MV100 or approved equal

e. System: 120V, 1 phase, 2 wire

1) Max. continuous line voltage (RMS): 130

2) Nominal clamping voltage (peak): 170

3) Max. peak current (8 x 20) sum: 6,500

4) Transient energy (joules): 155

5) Fuses: Internal

6) Failure indicators

7) Alarm (120V) allows user to be notified, or various other features such as shutdown can be performed

8) Pin base mounted with eight pin base socket and spring retainer.

9) Manufacturer: MVC Model ICP-110 or approved equal

2.18 MOTOR CONTROL CENTER:

The motor control center and telemetering cabinets shall be General Electric Co., Cutler Hammer, Square D, Siemens, Allen-Bradley, or approved equal.

THE ELECTRICAL CONTROL CENTER SHALL BE FACTORY ASSEMBLED, WIRED, AND TESTED BY THE MAKER OF THE MAJOR COMPONENT PARTS. All component parts listed in this portion of the specifications shall be General Electric, Cutler Hammer, Square D, Siemens, Allen-Bradley, or approved equal.

The motor control center and telemetering cabinet shall be constructed in accordance with the latest NEMA PB-2 and UL 845 standards, with necessary steel plates, angle iron supports and bolts, and shall be of the cubicle type as shown on the drawings. Motor control center shall be NEMA Class II, Type C. All wires shall be identified by wire number wherever terminated with an approved type

slip-thru wire marker. (Submit sample for review by the Owner). The wire number, terminal block number and terminal block arrangement within the MCC shall be indicated on the shop drawings.

Terminal blocks shall be control type, one piece, 600 volt, 30 amperes, phenolic marking strip, screw with wire saddle-type clamps on both sides, total number of points as required. General Electric CR151 series or equal.

Wire markers shall be slip-thru type, white bands with black numbers, compression type of heat shrink, identification numbers to match shop drawings.

Nameplates shall be installed as shown on the drawings.

The Contractor shall be responsible for securing all dimensions and hole spacing for mounting the required displays and appurtenances on the telemetering cabinet.

The MCC shall be arranged in one continuous assembly and shall include, but not be limited to, the following:

A. SCADA Cabinet: For housing telemetering and supervisory control equipment, RTU, PLC, touch panel, and for flush mounting displays and instruments as shown on plans.

B. Motor Control Center Panels: Number of panels as shown on plans.

1. For housing motor starter, molded case circuit breaker, control circuit relays, wiring, and appurtenances.

2. For flush mounting the digital multi-function power monitor.

3. For mounting circuit breakers and selector switches and panelboard, as shown on drawings.

4. For mounting main and emergency power breaker.

5. For mounting panelboard and step-down dry-type transformer.

C. The following is a list of the major component parts of the electrical control center. All component parts shall be Square D, General Electric Co., Cutler Hammer, Siemens, Allen-Bradley, Motortronics.

1. Motor Starter:

a. Scope of Work:

1) These specification requirements are for solid-state reduced voltage motor controllers herein referred to as soft starts.

2) They are for use with NEMA design B, AC motors to reduce the current in-rush as well as mechanical shocks that can result from starting or stopping a motor across the line.

b. Quality Assurance:

1) The soft start shall be listed by an independent testing laboratory in accordance with Electric Industrial Control Equipment Specification UL 508.

2) The soft start shall carry the CE mark for indication of compliance to low voltage and EMC directives.

3) The manufacturer shall be a certified ISO 9002 facility.

c. Warranty: An eighteen (18) month warranty shall be provided on materials and workmanship from date of acceptance of the project completion.

d. General Description:

1) The soft start shall be provided by the manufacturer in a configuration suitable for panel mounting. The component must be suitable for mounting in a pollution degree 3 environment. All power devices and components must be inaccessible during routine maintenance or set-up.

2) The soft start shall utilize a thyristor (SCR) bridge consisting of at least two SCRs per phase to control the starting and stopping of industry standard motors.

3) The soft start shall provide torque control for linear acceleration without external feedback independent of motor load or type of application. The gating of the thyristors will be controlled in such a manner to ensure smooth and stable acceleration ramp.

4) The soft start shall be controlled by a microprocessor that continuously monitors the current and controls the phasing of the SCRs. Analog control algorithms shall not be allowed.

5) All soft start power ratings will utilize the same control module.

6) Integral protective capabilities and selectable deceleration control shall be available even if a shorting contactor is used with soft starts rated 47 A or above. Power terminals shall be provided to simplify integration shorting contactor integration without additional components.

e. Motor Data: The soft start shall be designed to operate a pump motor with a nameplate rating as indicated on the drawings, rated for continuous operation at 480 volts (Provide one standard size larger than nameplate rating of motor being provided, for cooler operation of the SCRs).

f. Ratings:

1) The soft start shall be designed to operate in an ambient

temperature 0°C to 40°C. For ambient temperatures between 40°C and 60°C, derate the current by 1.2% per °C above 40°C.

2) Storage temperature range shall be -25°C to 70°C.

3) Maximum relative humidity shall be 93% at 40°C, non-condensing.

4) The soft start shall be designed to operate in altitudes up to 3300ft. For higher altitudes, derate by 0.5% for each additional 330 ft.

5) The soft start shall be capable of operation between -15% and +10% of normal voltage rating.

6) The soft start shall automatically adapt for operation at 50 or 60 Hz. Frequency tolerance shall be ±5% when starting between +5% and -15% during steady state operation.

7) The soft start shall be capable of supplying 300% of rated full load current for 30 seconds at maximum ambient temperature.

8) The SCRs shall have minimum P.I.V. rating of 1400 VAC. Lower rated SCRs with protection by MOVs are not acceptable.

g. Adjustments and Configurations:

1) All dialogue functions, display units, remote functions, terminal blocks, configuration switches and adjustment potentiometers shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.

2) Digital indication shall provide, as a minimum, the following conditions:

a) Soft starter status – ready, starting/stopping, run.

b) Motor status – current, torque, thermal state, power factor.

c) Fault status – Motor thermal overload, starter thermal fault, phase fault, frequency fault, supply fault, locked rotor fault, motor underload, max start time exceeded, external fault, serial link fault, phase inversion, internal failure, overcurrent.

3) The starter must be preset to the following for adjustment-free operation in most applications:

a) Torque acceleration ramp of 10 seconds.

b) Current limitation to 300% of the motor full load current rating.

c) Class 10 overload protection.

d) Motor current preset per NEC and UL tables for standard hp motors.

4) A digital keypad shall be utilized to configure the following operating parameters as required:

a) Motor full load amps adjustable from 50 to 130% of the controller's rating.

b) Current limitation on starting adjustable from 1.5 to 7 times rated motor current.

c) Torque ramp adjustable from 1 to 60 seconds.

d) Initial torque adjustable from 10 to 100% of nominal motor torque.

e) Torque limit adjustable from 10 to 200% of nominal motor torque.

f) Maximum start time adjustable from 10 to 999 seconds.

g) Voltage boost adjustable from 50 to 100% of the nominal supply voltage.

h) Selection of freewheel, soft stop or braking.

i) Adjustable soft stop torque ramp time from 1 to 60 seconds.

j) Threshold to change to freewheel following a soft stop from 0 to 100% of the nominal motor torque.

k) Braking torque level adjustable from 0 to 100% effectiveness.

l) Selection of Class 2, 10, 10A, 15, 20, 25, or 30 motor thermal overload protection.

5) A digital keypad shall be utilized to configure the following controller parameters as required:

a) Selectable automatic reset operation.

b) Cancellation of the torque control loop for multi-motor installations.

c) Adjustment of the stator loss estimation for specialty

installations.

d) Assignment of controller inputs and outputs.

e) Activation of phase reversal protection.

f) Reset of motor thermal state.

g) Return of factory settings.

h) Activation of test mode for use with low power motors.

i) Indication of elapsed time in hours of starting, running and stopping.

6) Output relay shall provide the following status indications:

a) One form A and one form B minimum for indication of fault or control of an isolation contactor.

b) One form A for indication that torque ramp is complete and current is below 130% motor FLA (End of start).

c) Additional inputs and outputs shall be available to provide the following status indications:

i. One logic input for force to freewheel, indication of external fault, force to local control, control of cascading motors, or external motor overload reset.

ii. One logic output for indication of motor thermal overload pre-alarm or presence of motor current and one logic output to indicate overcurrent alarm.

iii. One analog output shall be available for 4 to 20 milliamp indication of motor current, torque, thermal state, or power factor.

7) Relay and I/O functions listed above must be isolated with respect to common.

h. Protection:

1) A microprocessor controlled thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft start and provides:

a) An overload pre-alarm that indicates by relay contact that the motor has exceeded its rated temperature rise by 110%. This function shall be annunciation only.

b) A thermal fault condition that stops the motor if the temperature-rise exceeds 120% of the motor thermal capacity.

c) An analog electronic circuit with a time-constant adjustable to the motor's thermal cooling time-constant ensuring the memorization of the thermal state even after power supply disconnection or shorting out of the power semiconductors.

2) The soft start shall provide phase loss, phase reversal, underload, stall, and jam protection.

3) The integral protective features shall be active even if an external shorting contactor is used to bypass the SCRs during steady state operation.

i. Control Operations:

1) The soft start's control circuit shall be completely independent of its power circuit and adaptable to 240, 380 or 460 VAC, 50 or 60 Hz. The peripheral soft start control circuitry shall be operated at 120 VAC, 60 Hz from a control power transformer included within the MCC soft start's section.

2) The soft start shall accept control logic either by operator devices (pushbuttons, selector switches, etc.) wired directly to the unit or from external relay logic, including but not limited to the following:

a) Three position H-O-A switch that provides for manual (HAND) start or remote signal (AUTO) start from remote relay contacts.

b) Red RUN pilot light illuminated whenever the soft start is provided with a run command and no fault condition is present.

c) Green STOP pilot light illuminated whenever the soft start is supplied with control power and no run command is present.

d) All operator devices shall be panel door mounted using supplied 120 Vac control logic. Clearly labeled terminals shall be provided.

j. Shorting Contactor:

1) A microprocessor shall control the operation of the shorting contactor via an output relay.

2) The shorting contactor shall close, shorting the thyristors after the motor current is below 130% of motor FLA and voltage is below nominal voltage (indicating ramp complete) and open on a stop command to allow a deceleration ramp.

3) Overload protection integral to the soft start shall continue to protect the motor when shorting is utilized.

k. Manufacturer: Square D ALTISTART 46 Soft Start Motor Controller, Benshaw RBX-1, Cutler Hammer, General Electric, Motortronics, or approved equal.

2. Hand-Off-Auto: Hand-off-auto selector switch shall be 3 position type, Square D Class 9001, single pole, double throw control switch or approved equal. Switches shall be marked HAND-OFF-AUTO.

3. Nameplates: Nameplates shall be 1/8 inch black-white-black laminated plastic plates with identifying nomenclature engraved into plate to expose white Commercial Gothic letters. Nameplates screwed to switchboard or motor control center.

4. Control Circuit Sequence Timer:

a. Shall be as manufactured by the Siemens Energy & Automation, Inc. LOGO! 230RL Series, or approved equal.

b. The timer control shall be equipped with required circuits to perform the functions as indicated on the plans.

c. The timer shall operate on 120 volt, 60 cycle power. Time range of the timer shall be adjustable from 0-30 minutes.

5. Emergency Stop Switch: The emergency stop switch shall be push-pull type, complete with Square D Class 9001 switch or approved equal, with maintained contact attachments, and Type TR red mushroom push button unit. The switch shall be labeled EMERGENCY STOP.

6. Relays: The relays in the pump motor control circuit shall be 120 volts, size 0, four pole minimum.

7. Indicating Lights: Indicating lights shall be 22mm panel mounted, with LED pilot lights and push-to-test circuits.

The lights shall indicate the following functions:

a. RED LIGHT: PUMP RUNNING; MAINLINE FLOW

b. GREEN LIGHT: PUMP STOPPED

c. AMBER LIGHT: NO MAINLINE FLOW; VARIOUS ALARMS

d. BLUE LIGHT: ON RESERVOIR LEVEL CONTROL

8. Control switches shall be oiltight type for switchboard panel mounting with knob handles and 6 amperes, 300 volts, cam operated contacts. Contact and cam assembly enclosed in a plastic enclosure. Position of switch identified by engravings on a metal legend plate.

9. Running Time Meter: Running time meters shall be conventional 3-1/2" square case meters designed for flush mounting. The meter shall display elapsed running tine of each motor in hours by 6 digit dials. The meters shall be operable on 120 volt, 60 Hertz power.

10. Cabinets: Cabinets fabricated from galvanized NEC code gage steel with hinged door and latch, finished to match panelboards and with one-inch termite treated plywood backing inside.

11. Wireways: Wireways shall be fabricated from NEC code gage steel, square cross-section, galvanized, prime painted and enamel finished. Manufacture and install in accordance with NEC Articles 362 and 374.

12. Control Relays: Control relays shall be A.C., magnetic instantaneous operating type with coil for 120 volts A.C. and 15 amperes, 120 volt contacts.

13. Three Phase Digital Multi-Function Power Monitor:

a. The Monitor shall be UL listed and CE marked.

b. Power meter shall be designed for Multifunction Electrical Measurement on 3 phase power systems.

1) Meter shall support 3-Element Wye, 2.5 Element Wye, 2 Element Delta, 4 wire Delta systems.

2) Surge withstand shall conform to IEEE C37.90.1 and ANSI C62.41 (6 kV).

3) The power meter shall be user programmable for voltage range to any CT or PT ratio.

4) Meter shall have a burden of not more than 0.36VA per phase, Max at 600V, 0.014VA at 120 Volts.

5) Meter shall have a burden of not more than 0.005VA per phase, Max at 11 Amps.

6) The meter shall accept a voltage input range from 20 up to 576 Volts Line to Neutral, and a range from 0 up to 721 Volts Line to Line.

7) Meter shall accept a current reading of up to 10 Amps continuous.

Start up current for a 5 Amp input shall be no greater than 0.005 Amps.

c. Power meter shall use a dual input method for current inputs. Method one shall allow the CT to pass directly through the meter without any physical termination on the meter, ensuring the meter cannot be a point of failure on the CT circuit. The second method shall provide additional termination pass-through bars, allowing the CT leads to be terminated on the meter. The meter must support both termination methods.

1) Fault Current Withstand shall be 100 Amps for 10 seconds, 300 Amps for 3 seconds, and 500 Amps for 1 second.

2) Pass through wire gauge dimension of 0.177" / 4.5 mm shall be available.

3) All inputs and outputs shall be galvanically isolated to 2500 Volts AC.

4) The meter shall accept current inputs of class 10: (0 to 10) A, 5 Amp Nominal, and class 2 (0 to 2) A, 1A Nominal Secondary.

d. The meter hall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions. The meter shall meet the accuracy requirements of IEC687 (Class 0.2%) and ANSI C12.20 (Class 0.2%).

1) The meter shall provide true RMS measurements of voltage, - phase to neutral and phase-to-phase; and current, per phase and neutral.

2) The meter shall calculate RMS readings, sampling at over 400 samples per cycle on all channels measured readings.

3) The meter shall utilize 24 bit Analog to Digital conversion.

4) The meter shall provide %THD (% of total Harmonic Distortion). Harmonic magnitude recording to the 40^{th} order shall be available for voltage and current harmonics.

e. The meter shall provide a simultaneous voltage and current waveform recorder.

1) The meter shall be capable of recording 512 samples per cycle for a voltage sag or swell or a current fault event.

2) The meter shall provide pre- and post-event recording capability.

3) The meter shall have a programmable sampling rate for the waveform recorder.

4) The meter shall have an advanced DSP design that allows power quality triggers to be based on a 1 cycle updated RMS.

5) The meter shall allow up to 170 events to be recorded.

6) The meter shall store waveform data in a first-in, first-out circular buffer to insure that data is always being recorded.

f. The meter shall include a three-line, bright red, .56" LED display.

1) The meter shall fit in both DIN 92mm and ANSI C39.1 round cut-outs.

2) The meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load bar shall have not less than 10 segments.

g. The meter shall be available in transducer only version, which shall not include a display.

1) The meter shall mount directly to a DIN rail and provide RS485 Modbus or DNP 3.0 output.

h. Power meter shall include virtual measurement upgrade packs, which shall allow user to upgrade in field without removing installed meter.

1) The six up upgrade packs shall be:

a) Volts, Amps, kW, kVAR, PF, kVA, Freq., kWh, kVAh, kVARh, and I/O Expansion - V1

b) Above with 2 Megabytes of memory for Data-logging - V2

c) Above with Power Quality Harmonics - V3

d) Above with Limit and Control Functions - V4

e) Above with 64 samples per cycle Waveform Recorder and 3 Megabytes of memory for Data-logging - V5

f) Above with 512 samples per cycle Waveform Recorder and 4 Megabytes of memory for Data-logging - V6

2) The virtual upgrade packs must be able to be implemented without physically removing the installed meter.

3) Meter shall be a traceable revenue meter, and shall contain a utility grade test pulse allowing power providers to verify and confirm that the meter is performing to its rated accuracy.

i. The meter shall include 2 independent communications ports on the back

and face plate, with advanced features.

1) One port shall provide RS485 communication speaking Modbus ASCII, Modbus RTU, or DNP 3.0 protocol through back plate.

2) Baud rates shall be from 9600 baud to 57600 baud.

3) The meter shall provide an optical IrDA port (through faceplate), as the second communication port, which shall allow the unit to be set up and programmed using a PDA or remote laptop without need for a communication cable.

4) The meter shall have Pocket PC based software available for remote programming and integration.

j. The meter shall provide user configured fixed window or rolling window demand. This shall allow the user to set up the particular utility demand profile.

1) Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.

2) All other parameters shall offer max and min capability over the user selectable averaging period.

3) Voltage shall provide an instantaneous max and min reading displaying the highest surge and lowest sag seen by the meter.

4) The meter shall provide upgrade rate of 6 cycles for Watts, Var and VA. All other parameters shall be 60 cycles.

k. The meter shall support power supply of 90 to 265 Volts AC and 100 to 370 Volts DC. Universal AC/DC Supply shall be available and shall have burden of less than 11VA.

l. The meter shall provide Limits Alarms and Control Capability as follows:

1) Limits can be set for any measured parameter.

2) Up to 16 limits per parameter can be set.

3) Limits shall be based on % of Full Scale settings.

4) Manual Relay Control shall be available through software.

5) Relay set delays and reset delays shall be available.

m. The meter shall have data-logging capability with the 2, 3, and 4 Megabyte memory upgrade (Upgrade packs 2-6). The meter shall have a real-time clock allows for time stamping of all the data in the meter when log events are created. The meter with Upgrade packs 2-4 shall have six logs; the

meter with Upgrade packs 5 and 6 shall also have the Waveform Log:

1) The meter shall have three historical logs for trending profiles. Each log shall be capable of being programmed with up to 64 parameters. The user shall have the ability to allocate memory between the three historical logs in order to increase or decrease the memory allotted to each of the logs.

2) The meter shall have a log for Limits Alarms. The Limits log shall provide magnitude and duration of an event, time-stamp, and log value. The log must be capable of recording to 2048 events.

3) The meter shall have a log for System Events. The System Events log shall record the following occurrences with a time-stamp: Demand Resets, Password Requests, System Startup, Energy Resets, Log Resets, Log Reads, Programmable Settings Changes.

4) The meter shall have a log for I/O changes. The I/O Change log shall provide a time-stamped record of any Relay Outputs and any Input Status changes. The log must be capable of recording up to 2048 events.

5) The meter with Upgrade packs 5 and 6 shall have a log which is capable of recording a waveform both when a user-programmed value goes out of limit and when the value returns to within limit.

n. The meter shall have I/O expandability through two Option card slots on the back.

1) The cards shall be capable of being installed in the field, without removing the meter from installation.

2) The meter shall auto-detect the presence of any I/O Option cards.

3) The Option card slots shall accept I/O cards in all of the following formats: 100BaseT Ethernet Communication Card; Four Channel Bi-directional 0-1mA Output Card; Four Channel 4-20mA Output Card; Two Relay Outputs/2 Status Inputs Card; Four Pulse Output/4 Status Inputs Card; Fiber Optic Card.

4) The meter shall be capable of accepting any combination of up to two cards.

5) The Ethernet Option Card shall provide the meter with 100BaseT Ethernet functionality. The Ethernet Option card shall:

a) Allow the meter to speak with 12 simultaneous sockets of Modbus TCP, so that multiple requests for data can be received simultaneously.

b) Allow auto transmit/receive detection for straight or null

RJ45 cables.

6) The1mAO Option Card shall provide the following features:

   a) Four channel, bi-directional from 0-1mA Outputs.

   b) Assignable to any measured parameter.

   c) 0.1% of Full Scale accuracy throughout range and load.

   d) Maximum load impedance to 10k Ohms, with no accuracy losses.

7) The 20mAO

   a) 4 channel, 4-20mA outputs

   b) Assignable to any measured parameter.

   c) 0.1% of Full Scale accuracy throughout range and load.

   d) Maximum load impedance to 850 Ohms, with no accuracy losses.

   e) Loop powered using up to 24 Volts DC.

8) The Relay Output/Status Input Option Card shall provide the following features:

   a) 2 Relay outputs, 2 Status inputs.

   b) Status Inputs – Wet/Dry Auto Detect up to 150 VDC.

   c) Trigger on User Set Limits/Alarms (with upgrade pack 4).

   d) Set delays and Reset delays.

9) The Pulse Output/Digital Input Option Card shall provide the following features:

   a) 4 KYZ pulse/4 Status inputs.

   b) Programmable to any energy parameter and pulse value.

   c) Programmable to End of Interval Pulse.

   d) Can function for manual relay control and limit based control (with upgrade pack 4).

   e) 120mA continuous load current.

10) The Fiber Optic Option Card shall provide the following features:

a) Built in logic to mimic RS485 half-duplex bus, allowing the user to daisy chain meters for low installation cost.

b) ST Terminated Option

c) Versatile Link Terminated Option

d) Modbus and DNP 3.0 protocols available

o. The meter shall have transformer loss, line loss, and total substation loss compensation.

1) Substation losses shall be programmable for Watts and VARs, and for Ferris and copper losses.

p. The power meter shall have a standard 4-year warranty.

q. Power meter shall be able to be stored in (-20 to +70) degrees C.

1) Operating temperature shall be (-20 to +70) degrees C.

2) NEMA12 faceplate rating shall be available for the power meter.

r. Acceptable product is Electro Industries/GaugeTech, Model Shark 250 Meter or approved equal.

14. Transistor Sensitive Relay: Resistance sensitive device, plug-in DPDT, Cutler Hammer or equal.

15. Backspin Sequence Timer:

a. Shall be four circuits, as manufactured by the Siemens Energy & Automation, Inc. LOGO! 230R Series, or approved equal.

b. The timer control shall be equipped with circuits to perform the functions as indicated on plans.

c. Time range of the timer shall be adjustable from 0-30 minutes.

16. Three Phase Electric Motor Protector shall be a SymCom, Inc. Model No. 777 or approved equal.

a. Input Voltage:

1) 200 - 480 VAC, 3 phase (Standard)

2) (500-600 VAC, 3 phase (Available)

b. Frequency: 50 or 60 Hz

c. Motor Full Load amp Range:

1) 2 - 90 Amps, 3ø (Direct)

2) 91 - 800 Amps, 3ø (External CT's)

d. Programmable Operating Points

1) LV - Low Voltage Threshold: 170V (450V*) - HV Setting

2) HV - High Voltage Threshold: LV Setting - 528V (660V*)

3) VUB - Voltage Unbalance Threshold: 2 - 15% or 999

4) MULT - # of Loops or CT Ratio (XXX:5): 1 - 10 Loops or 100-800

5) OC - Over Current Threshold: (20 - 100A) / MULT

6) UC - Under Current Threshold: (0, 10 - 98A) / MULT

7) CUB - Current Unbalance Threshold: 2 - 25% or 999 (OFF)

8) TC - Over Current Trip Class: 5, J5, 10, J10, 15, J15, 20, J20, 30, J30

9) RD1 - Rapid Cycle Timer: 2 - 500 Seconds

10) RD2 - Restart Delay After All Faults Except Under Current (Motor Cool Down Timer: 2 - 500 Minutes

11) RD3 - Restart Delay After Under Current (Dry Well Recovery Timer): 2 - 500 Minutes

12) #RU - Number of Restarts After: 0, 1, 2, 3, 4, A (Automatic)

13) ADDR - RS485 Address: A01 - A99

14) #RF - Number of Restarts After All Faults Except Under Current: 0, 1, oc1, 2, oc2, 3, oc3, 4, oc4, A, ocA

15) UCTD - Under Current Trip Delay: 2 - 60 Seconds

16) GF - Ground Fault Current Threshold: (3 - 20A) / MULT or OFF

e. Physical Specifications

1) Low Voltage: 4 seconds

2) Output Contact Rating (Pilot Duty) SPDT: 480 VA @ 240 VAC

3) Transient Protection (Internal): 2500 V for 10 mSeconds

f. Accuracy

1) Voltage: +/- 1%

2) Current: +/- 3% (<100 amps direct)<>

3) Timing: 5% +/- 1 Second

g. Repeatability

1) Voltage: +/- 0.5%

2) Current: +/- 1% (<100 amps direct)<>

h. Temperature Range: 0 - 70 degrees Celsius

i. Dimensions: 3.0" H x 5.1" D x 3.6" W

j. Power Consumption: 10 Watts (Max.)

k. Weight: 1.2 lbs.

17. Three Phase Electric Motor Protector Remote Manager shall be a SymCom, Inc. Model RM-2000 with an RS485MS-2W serial interface for connection to the SymCom, Inc. Model 777 Motor Protector, or approved equal.

a. Control Voltage - 115VAC +/- 10%; 50-60 Hz

b. Transient Protection (Internal) - 2500 V for 10ms

c. Power Consumption - 3 Watts (Maximum)

d. Communication Ports

1) 1 Port for MS777

a) Setup: Even Parity, 1 Stop Bit

b) Baud Rate: 9600

c) Protocol: Modbus RTU

d) Available Addresses: 01

e) Serial Interface: RS485

2) 1 Port for PC, PLC, etc.

a) Setup: None, Odd, or Even

b) Baud Rate Parity Protocol: 1 or 2 Stop Bits

c) Available Addresses: 300 – 28800

d) Serial Interface: Modbus RTU; A01 - A99; RS485

e) Real-time Clock

i. Y2K: Compliant

ii. Battery Back-up Life: 10 years @ 25 degrees Celsius without external power

iii. Last fault memory: Stores up to 4 faults with time and date stamp, includes voltages and currents at the time of trip

f) Output Relays

i. (option 1): Consult Factory for Function of Relays

ii. Configuration: Two Independent Electro-Mechanical Form C(SP DT)

iii. Contact Material: Silver/Tin Oxide

iv. Pilot Duty Rating: 240 VA @ 120 VAC

v. General Purpose Rating: 5 A @ 120 VAC

g) Analog Output (option 2)

i. Types: 0-20 mA, 4-20 mA, 0-5 VDC, 0-10 VDC (specify with order, for others consult factory)

ii. Output Signal: KW, PF, Amps, or Volts

iii. Maximum Load: (Software Selectable)

(1) 0-20 mA: 500 Ohms max.

(2) 4-20 mA: 500 Ohms max.

(3) 0-10 VDC: 2 kilo Ohms min.

(4) 0-5 VDC: 2 kilo Ohms min.

iv. Accuracy: +/- 1% @ 25 degrees Celsius

v. Isolation: 1 kVrms

h) Analog/Digital

i. Inputs (option 3): Consult Factory

i) Physical Specifications: Remote Manager

i. Certifications

(1) UL 508

(2) cUL: cUL 508

(3) CE: Pending

j) Environment

i. Class of Protection: NEMA 4x (Pending)

ii. Ambient Operating Temp.: -20 - 70 degrees Celsius

iii. Ambient Storage Temperature: -30 – 70 degrees Celsius

iv. Humidity: Up TO 85%, non-condensing

k) Enclosure

i. Dimensions: 6.1" L x 6.5" W X 1.1" D

ii. Weight: 1.2 lbs.

iii. Material: Black Polycarbonate

l) Display: Liquid Crystal with extended temp range

i. Size: 2 rows x 20 characters

ii. Lighting: LED Back-Light

m) Keypad: Eight 0.5" stainless steel dome buttons for tactile feedback

i. Mechanical Life: 50,000 actuation's

ii. Overlay Material: Polyester

iii. UV Exposure without degradation: 2000 Hrs.

a) Terminal: Depluggable terminal block

18. Capacitors and Capacitor Circuit Breakers: The KVAR rating of the capacitors shall be per the motor manufacturer's recommendation and such that the power factor of the individual motor and related control be as near unity as standard size capacitors permit at line voltage and no load conditions. Capacitors shall be designed and manufactured according to NEMA standards, and rated in continuous KVAR, voltage and frequency for operating within the ambient temperature range of -40ºC to +46ºC. They shall be subject to all NEMA standard dielectric tests. They shall be filled with nonflammable high dielectric liquid and be individually fused with current-limiting fuses. Askarel and insulating liquids containing poly-chlorinated biphenyls (PCB's) shall not be provided.

a. Capacitor circuit breakers shall be thermal-magnetic type and be suitable for capacitor furnished. Breaker rating shall be approximately 150 percent of capacitor rated current.

b. Capacitors and capacitor circuit breakers shall be mounted in motor control center.

19. Capacitor Isolation Contactor: The capacitor isolation contactor shall be provided to isolate the capacitors from the pump motor feeder circuit during starting of the pump motor. Rating of the isolation contactor shall match or exceed the capacitor circuit breaker rating.

20. Surge Protection Device shall be designed for use in ANSI/IEEE Location Category C, and shall meet or exceed the following:

a. Electrical:

Max. Continuous Operating Voltage:	115% of rated line voltage
Response:	<5 nanoseconds
Surge Current (8x20 microseconds):	250kA/phase
Design Life:	>20 years
Power Consumption:	<5 watts/phase
UL:	UL 1449 3rd Edition

b. Monitoring:

Normal Operation:	Green LED
Protection Event:	Yellow LED/Reset + Visual Count/Reset

Remote Indication:		Relay contact (make or break)
Self-Test:		Yes

c. Environment:

Temperature	-Operating:	-40° to +70°C
	-Storage:	-40° to +85°C
Operating Altitude:		13,000 ft (4000m)

d. Mechanical:

Enclosure:	NEMA 1, 16 gauge steel, and entire enclosure mounted within MCC
Dimensions:	10" x 10" x 4"
Mounting:	Surface mounted within Motor Control Center
Shipping Weight:	12 lbs.

e. Manufacturer: MCG Electronics Inc. Model PT250 series or approved equal.

21. Motor Control Center Approval: Prior to installation, the Contractor shall submit to the Owner for their approval, one electronic copy and one hard copy of the dimensional drawings and connection diagram of the motor control center, including the telemetering section. The Contractor shall also provide one electronic copy and one hard copy of neatly bound instruction books which fully cover installation, operation and maintenance of the motor control center, including a spare parts list for each component of the control center.

22. Ordering of Motor Control Center: The motor control center shall be ordered and written confirmation submitted to the Owner within twenty (20) calendar days after all shop drawings and catalog data relating to the motor control center have been approved by the Engineer.

23. Motor Control Center Tests: The motor control center shall be shop tested and checked for proper connections and operating of all component parts before shipment to the job site. A warranty stating that shop test has been satisfactorily conducted shall be furnished to the Owner prior to delivery of the motor control center at the job site. The Contractor shall be held responsible for all delays caused by faulty operation of the control center due to improper connections or defective parts.

2.19 NEMA 3R WEATHERPROOF ENCLOSURE: The complete assembly shall be construction of Grade 316 Stainless Steel and shall be rated NEMA 3R. Ventilation slots shall be provided with

Grade 316 Stainless Steel small eye mesh to prevent insects from entering. All doors and removable panels shall have positive seal and shall be gasketed. All conduit entries shall be sealed. All areas between concrete pad and enclosure bottom frames shall be gasketed or sealed. Size of the housing shall be as required to provide working clearances in front of the MCC, to comply with the N.E.C. Working clearance in front of the metering section shall be as required to comply with the local utility company metering requirements. All hardware shall be stainless steel type 316. All doors shall have provisions for padlocking. Doors in front of utility metering compartments shall have provisions for double padlocking.

2.20 SERVICE ENTRANCE: Provide a meter base and other materials, as required by the electric utility which will provide service to the facility, for installation of metering equipment and attachment of service conductors.

PART 3 – EXECUTION

3.1 GENERAL: Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. All work shall present a neat and finished appearance.

3.2 MATERIAL & EQUIPMENT INSTALLATION: Follow manufacturer's installation instructions explicitly unless otherwise indicated. Follow Engineer's decision, at no additional cost to the Owner, wherever any conflict arises between manufacturer's instructions, codes and regulations, and these Contract Documents. Keep copy of manufacturer's installation instructions on the job site available for review at all times.

3.3 LOAD BALANCE: Balance electrical load between phases as nearly as possible on panelboards, motor control centers, etc.

3.4 MOTOR ROTATION: After final service connections are made, check and correct, if necessary, the rotation of all motors. Coordinate all such task with the pump contractor.

3.5 CLEANING & TOUCH-UP PAINTING: Keep the premises free of accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish.

3.6 INSTALLATION METHODS:

A. Grounding Systems:

1. General

a. All ground connections that are embedded or buried in the ground No. 2 AWG and larger shall be by compression connectors utilizing diamond or hexagon dies:

1) Use a hand compression tool for sizes 2/0 and smaller and hydraulic pump and compression head for 2/0 AWG and larger.

2) Prepare compression connections in accordance with manufacturer’s instructions.

b. Final connections to ground rods and equipment may be made by the exothermic weld process or irreversible compression connection.

c. Exposed ground connections to equipment shall be made by bolted clamps unless otherwise specified.

d. Embedded ground cables and fittings shall be securely attached to concrete reinforcing steel with tie wires and prevented from displacement during concrete placement. Ground cable connection to reinforcing steel shall be with exothermic weld or irreversible compression connection.

e. Ground conductors, except signal conductor shields, entering enclosures shall be bonded together to the enclosure if it is metallic and to metallic raceways within or terminating at the enclosure. Prior to making ground connections or bonds, the metal surface at the point of connection shall be cleaned.

f. Grounding system shall be provided in compliance with the NEC.

2. Raceway Ground

a. Metallic conduits shall be assembled to provide a continuous ground path. Metallic conduits shall be bonded using insulated grounding bushings.

b. Provide and install an equipment grounding conductor per NEC for any raceway that contains circuits serving equipment required to be grounded per NEC.

c. Grounding bushings shall be connected to the grounding system using conductors sized in compliance with NFPA 70.

d. All services, motors, metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of National Electric Code.

3. Duct Bank Ground

a. Duct bank grounding conductor shall be bonded to the ground bus of the source and the destination equipment where the duct bank is routed from or to a panel or equipment.

b. Duct bank ground conductor may be spliced in order to ground separate manholes or handholes. The splices shall be compression type.

c. Duct bank grounding conductor shall be bonded to the ground rod in each handhole/manhole the conductor is routed through.

B. Conduit and Raceways:

1. Exposed conduit: Install parallel or perpendicular to structural members and

surfaces. Install conduit horizontally and allow minimum headroom of 7 feet.

2. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.

3. Space exposed conduit installed on supports not more than 10 feet apart. Space multiple conduits in parallel and use framing channel.

4. Install conduits with spacing from any heat source that would place the conduit in an ambient above 104 degrees F.

5. Route conduit clear of structural openings and indicated future openings.

6. Grout conduits into openings cut into concrete and masonry structures.

7. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as “future”, “spare”, or “empty” and include a pulling line rated a minimum of 200 pounds accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.

8. Determine concealed conduit stub up locations from the manufacturer's shop drawings. Terminate concealed conduit for future use in specified equipment.

9. Install conduit flush with structural surfaces with galvanized couplings and plugs. Caps and plugs shall match the conduit system.

10. Provide concealed portions of conduits for future equipment where the drawings indicate future equipment. Match the existing installation for duplicate equipment.

11. Terminate conduits that enter enclosures with fittings that match the NEMA rating of the enclosure.

12. Underground metallic or nonmetallic conduit that turn out of concrete, masonry or earth: Install a 90-degree elbow of PVC-coated rigid steel conduit before emergence above ground.

13. Motors shall be connected to the raceway system using liquid-tight flexible conduit.

14. Provide O-Z Gedney "Type DX" or Crouse-Hinds "Type XD" bonded, weathertight expansion and deflection fitting for the conduit size where conduit across structural joints that allows structural movement.

15. All conduits below finish grade shall be concrete encased polyvinyl chloride (PVC) Schedule 40, as routed on the drawings. All conduit above finish grade or slab shall be hot dipped galvanized rigid steel conduit (GRS), except for conduit transitions from below to above grade shall be PVC coated GRS. PVC coated GRS shall extend a minimum of 6 inches above finish grade of slab. Provide pullwire in all empty conduits as noted on the drawings.

16. Conduits cut square and inner edges reamed. Butt together evenly in couplings.

17. Bends and offsets made with hickey, conduit-bending machine, or as recommended by equipment manufacturer. Do not use vice or pipe tee. Bends made so that interior cross-sectional area will not be reduced. Radius of curve of inner edge of field bend shall not be less than ten times the internal diameter of conduit. Use of running threads not permitted. Where conduits cannot be joined by standard threaded couplings, approved watertight conduit unions shall be used.

18. Cap conduits during construction with plastic or metal-capped bushings to prevent entrance of dirt or moisture. All conduits swabbed out and dried before wires or cables are pulled in.

19. Insulating bushings and two locknuts installed on each end of every run of conduit at enclosures and boxes. Provide grounding bushings as required for grounding receptacles.

20. Securely fastened in place to all outlet boxes and to structure or support. Project adequate number of conduit threads through box for bushings. Anchorage for 1-1/2 inches and smaller conduit shall be made with one-hole conduit straps or clamps; 2 inches or larger conduit shall be anchored with "U" clamps or approved equivalent fittings. All mounting and fastening hardware shall be Type 316 stainless steel.

21. Exposed conduit parallel with or at right angles to structural or architectural elements. Securely fastened in place with pipe straps with screws or bolts and spaced not more than 5 feet apart; or with approved beam clamps or approved single or gang pipe hangers spaced not more than 5 feet apart as the conditions require. Vertical runs supported at intervals not exceeding 5 feet by approved clamp hangers. All mounting and fastening hardware shall be Type 316 stainless steel.

22. Fish wires, cords, strings, chains, or the like shall not be placed or inserted in the conduit system during installation.

23. Conduit fittings shall not be used with conductors larger than #2 AWG unless indicated otherwise.

24. Separate parallel runs of two or more conduits in a single trench with spacers designed for the purpose. Install spacers at intervals not greater than that specified in the NEC for support of the type conduit used. Support conduits installed in fill areas suitably to prevent accidental bending until backfilling is complete.

25. Final connection to motors, dry-type transformers, and to other equipment where flexible connection is desired or required to minimize vibration shall be made with 18-inch minimum lengths of liquid-tight, polyvinyl chloride jacketed, flexible steel conduit where the required conduit size is three inches or less. Where the required conduit size is greater than three inches, rigid steel conduit shall be continued to the motor terminal box.

C. Boxes and Enclosures:

1. Boxes on exterior walls or outside of buildings shall be minimum weatherproof-rated with threaded hubs and mounting lugs, or as noted. Provide outlet boxes in hollow tiles or concealed in other spaces with extensions or raised rings of such depth that metal will be flush with surrounding surfaces of opening.

2. Use gang boxes wherever 2 or more switches are installed at one location. Concealed boxes installed with edges flush with surrounding wall surface. Boxes plumb and exactly flush.

3. Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

4. Switch boxes shall be mounted 48 inches above the floor. Receptacles installed in cast device boxes shall be located 18 inches above the floor.

D. Conductors:

1. General

a. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.

b. Pulling tensions shall not exceed wire manufacturer's recommendation.

c. Conductors shall be identified at both ends. Conductor tag numbers shall be unique.

d. Conductors which are in parallel or in series between equipment shall have the same conductor number. Neutral conductors shall have the same conductor number. Wherever possible, the conductor number shall be the same as the terminal to which it connects.

e. When factory-wired equipment has terminal numbers different from the conductor numbers shown on the control diagrams, both shall be shown on the interconnection diagram, and a copy of the interconnection diagram shall be fastened to the inside of the equipment cabinet.

f. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Where wire or cable exits a raceway or tray, a means of wire or cable support shall be provided.

g. Where necessary, powdered soapstone used as lubricant for drawing wires through conduit. No other means of lubricating allowed.

2. 600V Conductor and Cable

a. Slack shall be provided in junction and pull boxes and handholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls. Amount of slack shall be equal to largest dimension of the enclosure. Provide dedicated electrical wireways and insulated cable holders mounted on unistrut in handholes. Cables shall be tied to the cable holders in these locations.

b. Power conductors feeding 480V or higher rated equipment shall be identified by colored phase tape at both ends.

c. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors.

d. Terminations at solenoid valves, 120 volt motors, and other devices furnished with pigtail leads shall be made using self-insulating tubular compression connectors within the termination box.

3. Signal Cable

a. Provide terminal blocks at instrument cable junctions within dedicated terminal boxes provided by the installer. Signal circuits shall be run without splices between instruments, terminal boxes, or panels.

b. Circuits shall not be made using conductors from different pairs.

c. Shields are not acceptable as a signal path, except for circuits operating at radio frequencies utilizing coaxial cables. Common ground return conductors for two or more circuits are not acceptable.

d. Shields shall be bonded to the signal ground bus at the control panel only and isolated from ground at the field instrument or analyzer and at other locations. Shields or drain wires for spare circuits shall not be grounded at either end of the cable run. Terminals shall be provided for running signal leads and shield drain wires through junction boxes.

e. Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes.

f. Where instrument cable splicing is required, provide an instrument stand with terminal box mounted approximately 3 feet high for instrument cable splices with the circuits and individual conductors provided with label as specified in this Section.

g. Cable for security and telephone systems shall be installed and terminated in compliance with the manufacturer’s recommendations.

4. Splicing:

a. Wires shall be formed neatly in enclosures and boxes.

b. Splices made according to NEC. Conductors #10 and smaller twisted and dip soldered. Conductors #8 through #4/0 spliced with solderless clamp or compression (indent) connectors.

c. Splices reinsulated according to wire manufacturer's instructions. Splice insulation shall be 150% in thickness of original wire insulation and of the same electrical and mechanical characteristics. Insulating type (600V use) shall be neoprene, Okoprene by Okonite Company or approved equal. Jacketing and insulating tape shall be high density cold setting polyethylene adhesive tape, Scotch No. 33 by Minnesota Mining and Manufacturing Company or approved equal.

5. Wire Markers:

a. Each conductor shall be identified at each terminal to which it is connected. Conductors size No. 8 AWG or smaller shall have identification sleeves.

b. The figures shall be 1/8-inch high. Sleeves shall be yellow or white tubing, sized to fit the conductor insulation. The sleeves shall be shrunk to fit the conductor with hot air after installation. They shall be TMS Thermofit Marker System by Raychem Co., sleeve style wire marking system by W. H. Brady Co., or approved equal. Adhesive strips are not acceptable.

c. Conductors No. 6 AWG and larger shall use slotted tags, each secured to the cable with two nylon tie-wraps. Tags shall be white plastic with conductor identification number permanently embossed.

E. Raceway Markers:

1. Raceway markers shall be 22 gauge minimum thickness, solid Type 316 stainless steel tags with raceway number laser engraved 3/16-inch minimum height characters. Tags shall be attached to the raceway with Type 316 stainless steel wire. Raceway markers shall be as manufactured by Impact Inc., or approved equal.

F. Nameplates:

1. Exposed: Nameplates shall be made from laminated phenolic plastic. The nominal size of the nameplates shall be 3/4 inches high by 2 inches wide.

a. Nameplates shall have black backgrounds with 3/16-inch white letters.

b. Nameplates shall be fastened using self-tapping Type 316 stainless steel screws or rivets. Prior to fastening of the nameplate, a thin layer of RTV silicone sealant shall be applied to the back of the entire nameplate. Excess sealant (squeeze-out) shall be cleaned up immediately following installation. Nameplates should be installed such that there are no sharp protrusions on the inside of the enclosure. Where self-tapping screws are used, the sharp point of the screw shall be removed (ground or cut off)

after installation and a rubberized cap provided.

2. Interior: Nameplates located inside equipment enclosures shall be machine embossed metal tags.

G. Panelboards:

1. The Contractor shall provide a new typed panel schedule for the circuit descriptions for all panels that have had new or modified circuitry associated with the panels. See circuit schedule(s). Notations for replaced or new circuits shall match as-built conditions.

H. Electric Motors:

1. Grounding and Bonding: Verify the circuit ground cable (green) is identified and connected to the grounding lug in the motor terminal box.

I. Motor Control Center:

1. Install equipment in strict accordance with approved drawings and manufacturer's recommendations. Secure motor control centers and other free-standing motor control rigidly to floors or mounting pads with anchor bolts, Phillips Drill Company concrete anchors, or other approved means. Grout mounting channels provided with motor control into the floor or mounting pads, unless the control is firmly anchored with the specified concrete anchors, in which case the channels may be removed.

2. Concrete Pad: Concrete pad shall be constructed as indicated. Tops of concrete pads shall be level and shall project 3 1/2 inches above finished floor. Conduits for secondary and grounding conductors shall be set in place prior to pouring of concrete pad.

3. Field wiring shall meet the requirements of this Section. Cables larger than No. 6 AWG which hang from their vertical connections shall be supported within 2 feet of the connection.

4. Circuit breakers shall be adjusted by the Contractor to the lowest setting not causing false tripping.

5. Install motor control center level and plumb and bolted to concrete housekeeping pad per the manufacturer’s installation instructions.

J. Pullboxes: Construct pull boxes, where specified or required, of code-gauge galvanized sheet metal of not less than the minimum size required by the NEC. Pull boxes for exterior use shall be cast metal or stainless steel, as indicated. Furnish boxes with screw-fastened covers. Where several feeders pass through a common pull box, tag the feeders to indicate clearly their electrical characteristics, circuit number, and panel designation. All boxes shall be readily accessible and shall not be installed in finished areas unless approved by the Engineer. Provide pull boxes not more than 150 feet apart in long runs.

K. Device Plates: Install plates with all four edges in continuous contact with the finished

wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Install plates vertically and with an alignment tolerance of 1/16-inch. Do not use sectional type device plates.

L. Terminal Blocks:

1. Power and Control:

a. Unless otherwise specified, terminal blocks shall be panhead strap screw type. Terminals shall be provided with integral marking strips which shall be permanently identified with the connecting wire numbers as shown on the drawings.

b. Terminal blocks for P-circuits (power 120-600 volts) shall be rated not less than the conductor current rating and shall not be rated less than 600 volts AC. Terminal blocks for C-circuits (control and/or 120 volts or less power) shall be rated not less than 20 amperes and shall not be rated less than 600 volts AC.

2. Signal and Instrumentation:

a. Terminal blocks for S- and J-circuits (signal and instrumentation) shall be rated not less than 20 amperes at 300 volts AC. Terminals shall be tin-plated. Signal and instrumentation terminal blocks shall be cage-clamp spring type, Wago Corporation, Phoenix Contact, or approved equal.

M. Control Stations and Safety Disconnect Switches:

1. Control stations, contactors and safety disconnect switches shall be mounted 48 inches above the floor, ground, or slab to center of device.

N. Equipment Finish:

1. Unless otherwise specified, electrical and instrumentation equipment and materials shall be coated by the equipment manufacturer as specified below.

a. Finish: Electrical equipment shall be treated with zinc phosphate, bonderized or otherwise given a rust-preventive treatment. Equipment shall be primed, coated with enamel, and baked. Minimum dry film thickness shall be 3 mils.

2. Before final acceptance, the Contractor shall touch up scratches on equipment with identical color coating. Finish shall be smooth, free of runs, and match existing finish.

3. Color: Exterior color of electrical equipment shall be FS 26463 (ANSI/NSF 61) light gray. Interior shall be painted FS 27880 white. Nonmetallic electrical enclosures and equipment shall be the equipment manufacturer's standard grey color.

3.7 TESTING:

A. General

1. After completion of all wiring, insulating resistance testing of all power and control circuits shall be performed with a 500-volt megger. The test on each circuit shall be performed for one minute in the presence of the Engineer or his representative, and a written test report of the results shall be submitted to the Engineer before acceptance can be obtained. Equipment which may be damaged during this test should be disconnected. The tests shall be performed with all other equipment connected to the circuit. After the electrical system installation is completed, and at such time as the Engineer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of these specifications. The test shall be performed in the presence of the Engineer or his authorized representative. The Contractor shall furnish all instruments, electric power and personnel required for the tests.

2. Prior to functional testing, all protective devices shall be adjusted and made operative. Prior to energization of equipment, the Contractor shall perform a functional checkout of the control circuit. Checkout shall consist of energizing each control circuit and operating each control, alarm or malfunction device, and each interlock in turn to verify that the specified action occurs. The Contractor shall provide a description of the proposed functional test procedures prior to the performance of functional checkout.

B. Motor Control Center Tests: The motor control center shall be shop tested and checked for proper connections and operating of all component parts before shipment to the job site. A warranty stating that shop test has been satisfactorily conducted shall be furnished to the Engineer prior to delivery of the motor control center at the job site. The Contractor shall be held responsible for all delays caused by faulty operation of the control center due to improper connections or defective parts.

C. Motors:

1. The Contractor shall verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation.

2. Motor running current shall be measured on each phase with the motor operating under load. Current imbalance shall be less than 5 percent difference between phases.

D. Low Voltage Motor Starters

1. Verify that the solid-state overload settings are correct per the motor nameplate data.

2. All control features, including remote control and all modes of operation shall be tested in accordance with the motor starter manufacturer’s instructions, to the fullest extent possible.

3.8 ELECTRICAL EQUIPMENT LABELING:

A. Electrical equipment shall have factory third party listed labels to meet the NEC's suitable for use requirements.

B. Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.

C. Electrical distribution equipment and utilization equipment shall be field labeled to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

D. After the new motor control center has been installed, and before the equipment and sections are energized, the Contractor shall provide third party inspection and field labeling services to meet NEC listing requirements.

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

3.10 MEASUREMENT AND PAYMENT: The electrical work shall be measured and paid for at the contract lump sum price bid.

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

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

C. Utility Installation Costs: Payment for the nonrecurring utility installation costs will be made by the Owner.

END OF SECTION

SECTION 31 10 00 - CLEARING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Furnish materials, labor and equipment necessary to clear and grub the entire construction area within the limit of grading, to accumulate and dispose of all debris and waste materials, to lay out the entire work, as shown on the drawings and as specified herein.

B. It shall be the responsibility of the Contractor to examine the project site and determine for himself the existing conditions.

C. Obvious conditions which exist on the site shall be accepted as part of the work, even though they may not be clearly indicated on the drawings and/or described herein, or may vary therefrom.

D. All debris of any kind accumulated from the work of this section shall be disposed of from the site.

E. Burning on site will not be permitted.

F. All aboveground vegetation, rubbish, existing abandoned structures, stockpiles of organics and construction debris and other deleterious materials should be removed and wasted off-site.

1.2 STANDARDS

Except as modified herein, all earthwork shall meet the requirements of Section 10 of the Standard Specifications for Public Works Construction dated September 1986 and Soils Investigation Report by Geolabs, Inc. entitled “Geotechnical Engineering Exploration, Waiahole Water System Improvement, Kunia, Oahu, Hawaii,” January 26, 2021.

PART 2 - PRODUCTS

2.1 MATERIALS

Weed Killer:

Trade Name	Manufacturer
RAD-E-Cate 25	Vineland Chemical Co., Vineland, New Jersey
Weed-B-Gon	Chevron Chemical Co., Ortho Division Richmond, California
Amitrol - 7	Amchem Products, Inc., Fremont, California
Ranger Pro	Monsanto Company, St. Louis, Missouri

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING

A. The Contractor shall clear the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of other work specified in this contract.

B. Within the construction access areas, cut all trees as shown on the plans, or as required to complete the work and treat all stumps remaining in the soil with weed killer applied in full strength and in accordance with the manufacturer's instructions. All debris accumulated from this operation shall be completely removed from the premises by the Contractor.

C. Soft and yielding areas encountered during clearing and grubbing work should be over-excavated to expose firm natural material, and the resulting excavation should be backfilled with well-compacted engineered fill. The excavated soil may be used as fill, provided that it meets the requirements for fill material.

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

E. The Contractor shall protect from injury and damage all surrounding plants, pavements, buildings, utilities, rock walls, etc., and shall leave all in as good a condition as at present. Any damage to existing improvements shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

F. The Contractor shall confine his construction operations to the immediate area of work or as directed by the Engineer.

3.2 CLEAN-UP OF PREMISES

Clean-up and remove all debris accumulated for construction operations from time to time as directed. Upon completion of the construction work and before final acceptance of the Contractor's work, remove all surplus materials, equipment, etc., and leave entire job site clean and neat to the satisfaction of the Engineer.

3.3 VERIFICATION OF EXISTING GRADES

Existing grades, inverts and improvements shall be verified by the Contractor before any clearing and grubbing work is done. Any discrepancy shall be immediately brought to the attention of the Engineer and any changes shall be made in accordance with his instructions. Starting of clearing and grubbing operations shall be construed to mean that the Contractor agrees that the existing grades, inverts and improvements are essentially correct as shown. No extra compensation will be allowed the Contractor if existing grades, inverts and improvements are in error after his verification thereof or if he fails to report the discrepancies before proceeding with the work.

END OF SECTION

SECTION 31 23 16 – EXCAVATION, TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Furnish all materials, labor and equipment required to accomplish all excavation, filling and grading as indicated on the drawings and specified herein.

B. Contractor shall provide an archeological monitor and comply with the requirements of the archaeological monitoring, if required by the State Historic Preservation Division (SHPD).

C. During excavation, if any archaeological significant items, such as artifacts, shell, bone, or charcoal deposits are found, stop work and notify the Engineer. The Owner shall pay for any investigation.

D. Permits, Notice, Etc.:

1. The Contractor shall procure and pay for all necessary permits or certificates that may be required in connection with this work.

2. The Contractor shall work with DLNR and R.M. Towill Corporation to finalize all permit applications with their construction means and methods.

3. The Contractor shall serve proper notices and consult with the Engineer regarding any temporary disconnections of electrical or other utility lines in the area which may interfere with the removal work, and all such lines where necessary shall be properly disconnected before commencing with the work.

E. Protection: Throughout the work, protection shall be provided for all roads, etc., along the excavation. Safe working conditions shall be maintained at all times for all personnel and barricades shall be provided and maintained.

1.2 REFERENCE SPECIFICATIONS

Except as modified herein, all excavation and backfilling shall conform to the following specifications.

A. Excavation, Grading, Embankment:

The following sections of the Standard Specifications for Public Works Construction dated September 1986:

Section 11 ..... Trench Excavation and Backfill
Section 13 ..... Structure Excavation and Backfill
Section 15 ..... Crushed Rock
Section 16 ..... Borrow
Section 17 ..... Embankment
Section 29 ..... Subgrade
Section 44 ..... Cement Rubble Masonry

B. Trench Excavation and Backfill:

Water System Standards, City and County of Honolulu, State of Hawaii 2002.

1.3 APPLICABLE PUBLICATIONS

The following publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Copies of the soil reports and addendums are available for review at the Engineer's office.

1. Subsurface Investigation Report by Geolabs, Inc. entitled "Geotechnical Engineering Exploration, Waiahole Water System Improvement, Kunia, Oahu, Hawaii," January 26, 2021.

2. American Society for Testing and Materials (ASTM) Publications

D1557-78 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457mm) Drop

1.4 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method D, abbreviated hereinafter as a percent of laboratory maximum density.

1.5 OPTIMUM MOISTURE

Optimum moisture is the water content (percentage by weight) corresponding to the maximum dry density.

PART 2 - PRODUCTS

2.1 MATERIALS

Pipe cushion and trench backfill material shall conform to Section II – Trench Excavation and Backfill and Water System Standards, City and County of Honolulu, State of Hawaii 2002.

PART 3 - EXECUTION

3.1 EXCAVATION

A. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for backfilling shall be placed in an orderly manner, according to the plans, a sufficient distance from the banks to avoid overloading and to prevent slides, cave-ins or contamination. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated or as directed. Grading shall be done as may be necessary to prevent surface water from flowing into waterways or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods. Unless otherwise indicated, excavation shall be by open cut.

B. Soft and yielding areas encountered should be overexcavated to expose firm natural material and the resulting excavation should be backfilled as stated in Section 31 23 23, Part 3.4.B.

C. Adequate shoring and bracing should be provided by the Contractor in accordance with DOSH and other governmental regulations for the utility trenches and other similar deep excavations.

D. Excavation for Appurtenances: Excavation for structures and appurtenances shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the

embankment or timber that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances that has not been directed by the Engineer will be considered unauthorized and shall be refilled with sand, gravel, or concrete, as directed, at no additional cost to the Owner.

E. Trench Excavation and Backfill shall be in accordance with Section II – Trench Excavation and Backfill and Water System Standards, City and County of Honolulu, State of Hawaii 2002.

F. Construction materials and excavated materials shall be covered during high winds to mitigate dust problem.

3.2 PROTECTIVE MEASURES

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

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

C. All excavations shall be kept free from standing water. The Contractor shall pump and drain as necessary to remove water to the extent required in carrying on work. Grading shall be controlled so that the ground surface is properly sloped to prevent water runoff into structural foundation, open trenching excavations and adjacent buildings.

D. The Contractor shall conduct operations with minimum interference to traffic. The Contractor shall confine all work equipment, materials and personnel as much as possible to the work area as indicated, so as not to interfere with the normal function of the adjacent roadway. The Contractor shall schedule all work that involves excessive noise, dust, dirt, or any other detrimental aspect of this work in order that there will be minimum disruption in normal roadway functions.

E. When necessary and when directed by the Engineer, the Contractor shall provide and erect barriers, etc., with special attention to protection of personnel.

F. Existing utilities are shown on the drawings in approximate locations for the convenience of the Contractor. The fact that any utility is not shown on the drawings shall not relieve the Contractor of his responsibility under this section. It shall be the Contractor's responsibility to ascertain the location of all existing utilities which may be subject to damage by reason of his operations.

The Contractor shall:

1. Support and protect all utilities during construction;

2. Notify the Engineer immediately of any damage to existing utilities caused by construction under this Contract; and

3. Reconstruct, at his expense, damaged portions of the utility system in accordance with the requirements and specifications of the Owner.

3.3 LAYING OUT

A. The laying out of base lines, establishment of grades and staking out the entire work shall be done by a surveyor (licensed in the State of Hawaii) at the expense of the Contractor and he shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batter boards showing construction lines and levels.

B. Should any discrepancies be discovered in the dimensions given on the drawings, the Contractor shall immediately notify the Engineer before proceeding any further with the work; otherwise he will be held responsible for any costs involved in correction of construction placed due to such discrepancies.

3.4 BACKFILLING

Except as otherwise specified for special conditions of overdepths, areas improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as permitted by the Engineer.

3.5 FILL TESTING

All fill shall be tested by an independent testing agency and all test results submitted to the Engineer for approval. All costs of testing shall be borne by the Contractor. Testing shall be made throughout the area for each 6-inch compacted layer at locations determined by the Engineer. All test results must be approved before the Contractor can proceed with placing of topsoil, or base course.

END OF SECTION

SECTION 31 23 23 - GRADING AND EARTHWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This work shall include the construction of embankments, berms, and the excavating, hauling, placing and compacting of suitable material obtained on-site, from borrow pits or from designated sites approved by the Officer-in-Charge to the finish grades and dimensions shown in the Construction Drawings and in accordance with these Specifications.

B. The Contractor shall retain a Geotechnical Engineer to inspect, conduct tests and assure that the earthwork is performed in accordance with the Contract Drawings and Specifications.

C. Observation by the Owner's Geotechnical Engineer includes periodic observation and testing of the contractor's grading work but does not include supervision or direction of work done by the contractor, his workers, or subcontractors. The absence or presence of the Owner's Geotechnical Engineer on the site does not relieve the contractor of his responsibility to accomplish the work in accordance with all applicable project documents and governmental ordinances.

D. The presence of the Owner's Geotechnical Engineer is to observe the work on behalf of the Owner but not to perform as the contractor's quality control. The contractor shall be responsible to conform with these project specifications and all other project documents whether or not their work is observed or tested by the Owner's Geotechnical Engineer.

E. The contractor shall have sole responsibility for the means, methods, sequencing, or implementation of site safety, trenching, and dewatering.

l.2 STANDARD CODES AND SPECIFICATIONS

A. The "Standard Details for Public Works Construction," September 1984 and the "Standard Specifications for Public Works Construction", September 1986, of the Department of Public Works, City and County of Honolulu, except as amended in the drawings and specifications herewith, shall govern work covered under this section.

1.3 APPLICABLE PUBLICATIONS

The following publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Copies of the soil reports and addendums are available for review at the Engineer's office.

1. Subsurface Investigation Report by Geolabs, Inc. entitled "Geotechnical Engineering Exploration, Waiahole Water System Improvement, Kunia, Oahu, Hawaii," January 26, 2021.

2. American Society for Testing and Materials (ASTM) Publications:

D 1557 (2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3).

1.4 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method D, abbreviated hereinafter as a percent of laboratory maximum density.

1.5 SUBSURFACE DATA

Subsurface soil boring logs are provided in the Subsurface Investigation Report by Geolabs, Inc. The data represents the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6 FIELD TESTING CONTROL

Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Field density and moisture content tests shall be performed on every 5,000 square feet of each 6-inch compacted lift placed. Density tests shall be performed in accordance with ASTM D 1557.

1.7 VERIFICATION OF EXISTING GRADES

Existing grades, inverts and improvements shall be verified by the Contractor before any grading work is done. Any discrepancy shall be immediately brought to the attention of the Engineer and any changes shall be made in accordance with his instructions. Starting of grading operations shall be construed to mean that the Contractor agrees that the existing grades, inverts, and improvements are essentially correct as shown. No extra compensation will be allowed the Contractor if existing grades, inverts and improvements are in error after his verification thereof or if he fails to report the discrepancies before proceeding with any work.

1.8 GRADING WORK

All grading work shall be done in accordance with Chapter 14, Articles 13, 14,15 and 16 as related to grading of the Revised Ordinances of the City and County of Honolulu, 1990 and the Soil Erosion Standards & Guidelines, Supp. 1 dated November 1996, as amended.

PART 2 - PRODUCTS

2.1 GENERAL

A. Approval Required: All earthwork and fill material to be incorporated into the project shall be tested by the Owner's Geotechnical Engineer and is subject to approval by the Engineer. Notify the Engineer at least five working days in advance to schedule and coordinate soil testing for approval.

B. Testing: The Owner's Geotechnical Engineer shall conduct soils testing to determine the suitability of the borrow material, the results of which shall be submitted to the Engineer for review and approval. The Contractor shall notify the Engineer 48 hours prior to the start of the soils testing. All costs associated with this testing will be borne by the Contractor. No imported fill shall be delivered to the site prior to its approval by the Engineer. The Contractor shall permit the Engineer to sample as necessary from the borrow area for the purpose of making acceptance tests to check the quality of the material.

C. Rocks: Rocks greater than 6 inches in diameter shall be removed off-site or stockpiled for use other than as an engineered fill. Rocks may be placed in areas suitable for rock disposal in accordance with the recommendations by the Owner's Geotechnical Engineer.

2.2 ON-SITE FILL MATERIAL

A. Definition: Materials within the project site excavated for the well site and waterlines that are tested and approved by the Owner's Geotechnical Engineer shall be considered as on-site fill material.

B. All on-site material to be used as embankment shall be existing soil that is free from organic matter, clayey soil, and all other deleterious substances, and shall be no greater than 6 inches in maximum dimension as approved by the Owner's Geotechnical Engineer.

C. General Fill: On-site material excavated within the project limits may be utilized as general fill, unless otherwise specified in the plans or otherwise directed by the Engineer during construction. Roots, trees, branches and all other organic matter missed during clearing and grubbing shall be removed from the fill material. The on-site material shall be free of particles greater than 6 inches in maximum dimension. Hard clayey clumps within the on-site material shall be thoroughly broken down and mixed by compaction equipment until a relatively uniform moisture condition is achieved.

2.3 SELECT BORROW FOR SUBBASE

A. Composition: Select borrow for subbase course shall consist of crusher run waste, mudrock, coral, sand, or cinders. The material shall be free of organic matter clayey soil and other deleterious substances and shall have a minimum CBR value of 25.

B. Size: The maximum size of any particle in its greatest dimensions shall not exceed 3 inches. The material shall be well graded from coarse to fine so as to form a dense compacted layer. The amount of material passing the 200 mesh sieve shall be less than 15 percent. Filler shall be added to the select borrow if required to obtain a well graded mixture.

2.4 SELECT GRANULAR MATERIAL

A. Composition: Non-expansive select granular material shall consist of such materials as crushed coral, mudrock, basalt or cinder sand. The material shall be well-graded from coarse to fine with no particles larger than 3 inches in largest

dimension and shall contain between 10 and 30 percent particles passing the No. 200 sieve. The material shall have a laboratory CBR value of 20 or more and shall have a maximum swell of 1 percent or less.

B. All bedding materials shall conform to the requirements of the Standard Specifications for Public Works Construction for the City and County of Honolulu.

2.5 IMPORTED GENERAL FILL MATERIAL

A. Definition: Materials obtained from borrow pits outside of the project limits shall be considered as imported borrow.

PART 3 - EXECUTION

3.1 GENERAL

A. All grading work shall conform to Chapter 23 and Chapter 14, Articles 13, 14, 15 and 16 as related to grading, soil erosion and sediment control, of the Revised Ordinances of Honolulu, 1990, as amended and as specified herein.

B. Familiarization: Prior to all work of this section, become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this section.

C. All fills shall be monitored and tested by the Contractor's Quality Control personnel to assure that all grading work is accomplished in accordance with the requirements of this Specification.

D. All cuts and fills to be constructed shall be monitored by the Owner's Geotechnical Engineer, who shall approve all preparation, fill material, methods of placing and compaction and perform field density tests during the grading. Written approval shall be issued upon completion of cuts and fills. No deviation from these specifications shall be made except upon the written approval of the Engineer and/or other public agencies having jurisdiction.

3.2 TECHNICAL DEFINITIONS

A. Relative Compaction: Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM 1557-91 test Procedures.

B. Optimum Moisture: Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

3.3 LAYING OUT

A. Preparation: In advance of setting line and grade stakes, the subgrade area shall be cleared of brush, weeds, vegetation, and debris, all of which shall be satisfactorily disposed of to the satisfaction of the Engineer and in accordance with Section 31 10 00 CLEARING of these specifications.

B. Licensed Surveyor: The laying-out of base lines, establishment of finish grades and staking out of the entire work shall be done by a registered Surveyor licensed in the State of Hawaii. The contractor shall carefully preserve all data and all monuments set by the Surveyor and, if displaced or lost, immediately replace them to the approval of the Officer-in-Charge and at no additional cost to the Owner.

C. Discrepancies: Should any discrepancies be discovered in the dimensions given in the Plans, the Contractor shall immediately notify the Engineer before proceeding any further with the work, otherwise he will be held responsible for any costs involved in the correction of the construction placed due to such discrepancies.

3.4 SITE PREPARATION

A. Unsuitable Materials: Loose, dumped soils shall be removed and shall not be reused. Unsuitable materials and rocks and boulders greater than 6 inches in greatest dimension encountered during the course of the grading operations shall be removed and disposed of properly off-site in accordance with these specifications.

B. Clearing: The natural ground surface within the contract grading limits shall be thoroughly cleared and grubbed of vegetation, stored materials, rubbish, junk, surface vegetation, root systems, and other organic matter and shall be inspected by the Officer-in-Charge before placing the general fill or embankment material. Clearing and grubbing of the project site shall be done in accordance with the requirements of Section 31 10 00 CLEARING of these specifications. After completion of clearing and grubbing, the upper 12 inches of the soils below the existing ground surface shall be stripped and removed, as unsuitable material.

After removal of the upper 12 inches of the soils below the existing ground surface, over-excavation shall be conducted in the fill areas to a minimum of 12 inches, moisture conditioned to between 2 and 4 percent above the optimum moisture, and replaced as fill compacted to a minimum of 90 percent relative compaction. Prior to replacement as fill, scarification shall be conducted at bottom of the over-excavation to a depth of at least 12 inches, moisture-conditioned to about 4 percent above the optimum moisture content, and compacted to a minimum of 85 percent relative compaction.

Due to the hard, dry and friable in-situ clayey and silty soils, the materials generated from the excavation, over-excavation and scarification process would likely contain large clumps. To moisture-condition the soils effectively, the hard clayey clumps should be thoroughly broken down and mixed by the compaction equipment, such as sheepsfoot compactor and/or large dozer, until achieving a relatively uniform moisture condition.

The gravel roadway pavement sections shall be supported on a minimum of 18-inch thick layer of selected granular fills. Bottom of the selected granular fill layer shall be scarified a minimum of 12 inches, moisture-conditioned to about 4 percent above the optimum moisture content, and compacted to a minimum of 85 percent relative compaction for roadway.

Soft and/or yielding areas encountered at the bottom of the over-excavation shall be over-excavated to expose stiff and/or dense materials. The resulting excavation shall be backfilled with compacted on-site soils or replaced with well-compacted fill materials. The excavated soft and/or organic soils shall be disposed properly off-site or used in landscaped areas, if appropriate.

After the soil is recompacted, it must be protected to retain the moisture content by keeping it moist or immediately capping it with new fill. If the recompacted soil is allowed to dry and shrinkage cracks develop, it shall be scarified, moisture conditioned and recompacted again.

Where shrinkage cracks are noted after compaction of the subgrade, the soil shall be prepared again as above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage shall require over-excavation of the soft areas and replacement with well-compacted fill at no cost to the owner. The Owner's Geotechnical Engineer representative shall evaluate the need for over-excavation in the field

C. Proofrolling: Prior to fill operations, the exposed recompacted ground should be proof-rolled with a fully loaded scraper or other heavy equipment to check for subsurface voids or cavities.

D. Sloped Areas: When the fill or embankment is to be constructed on a slope greater than five horizontal to one vertical, the existing slope shall be keyed and benched to receive the new fills. The excavated material, if acceptable, shall be recompacted along with the new material at the Contractor's expense. Ground with flatter slopes shall be terraced when directed by the Officer-in-Charge or as specified in the contract documents.

E. Over-Excavated Areas: Over-excavated areas due to the removal of unsuitable, soft or yielding soils shall be scarified to a depth of about 8 inches, moisture-conditioned to at least 2 percent above the optimum moisture, and compacted to a minimum of 90 percent relative compaction. The Contractor shall remove these soils and the resulting excavation backfilled with well compacted engineered fill. The excavated soft and/or organic soils shall not be used as fill and shall be properly disposed of.

F. Where shrinkage cracks are noted after compaction of the subgrade, the soil shall be prepared again as above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage shall require over-excavation of the soft areas and replacement with well-compacted fill at no cost to the owner. The Owner's Geotechnical Engineer representative shall evaluate the need for over-excavation in the field.

G. The roadway gravel pavement sections shall be supported on a minimum of 18-inch thick layer of selected granular fills. Bottom of the selected granular fill layer shall be scarified a minimum of 12 inches, moisture-conditioned to about 4 percent above the optimum moisture content, and compacted to a minimum of 85 percent relative compaction for roadway.

H. Areas to receive fill should be observed by the Owner's Geotechnical Engineer prior to fill placement to verify that adequate clearing, stripping, and grubbing have occurred. A sufficient number of water trucks must be maintained by the site contractor throughout all site clearing, grubbing, and grading operations to avoid creating dust, and to keep the exposed materials in a moist condition.

3.5 SITE GRADING

A. Once the site has been properly prepared, grading operations may begin to generate the finished grades.

B. Areas designated to receive fills and finished subgrades in cuts shall be proof-rolled with a minimum 20-ton vibratory drum roller for a minimum of eight passes to help detect and collapse near-surface cavities and/or voids.

C. Excavated materials may be reused as a source of fill materials provided that the materials meet the requirements of Part 2 Section 2.1 and 2.2 herein.

D. Non-usable material such as mud, soft material, and expansive soils shall become the property of the Contractor and shall be properly disposed of outside the project boundary limits.

E. Structural fill material shall be placed in level lifts not exceeding 12 inches in loose thickness. Compaction of structural fill shall be accomplished by using a large vibratory drum roller having a static weight of at least 20 tons traveling no faster than 300 feet per minute. Where compaction equipment is limited in size to less than 5 tons in static weight, structural fill material shall be placed in level lifts not exceeding 8 inches in loose thickness. Structural fills shall be compacted to a minimum 95 percent relative compaction, respectively. The roller shall pass every point on the surface at least eight (8) times for structural fill.

F. Select granular fill, retaining wall backfill, and aggregate base course shall be placed in maximum loose lifts of 8 inches in thickness, moisture conditioned to above optimum moisture content and uniformly compacted to at least 90 percent of their maximum dry density as determined by ASTM D 1557. Fill materials placed within 3 feet (vertically) of the pavement finish grade elevation shall be compacted to at least 95 percent relative compaction.

G. Cut and fill slopes may be constructed as steep as 2H:1V for heights up to 15 feet. Slopes exceeding this height are not anticipated on this project and should be individually evaluated by the Owner's Geotechnical Engineer should they occur.

H. Fill slopes shall be laterally over-constructed during the mass grading and subsequently cut back to the desired lines and grades such that the finished slopes face is a tight, well compacted surface.

3.6 FOUNDATIONS

Any unsuitable material or soft spots encountered in the foundation excavations should be removed down to firm material or compacted fill acceptable to the Owner's Geotechnical Engineer, and the resulting depression backfilled in accordance with this section.

3.7 EXCAVATIONS

A. Cut Slopes: Permanent cut slopes shall be constructed no steeper than 2:1 for cuts less than 15 feet. Temporary cut slopes shall be evaluated by the Contractor for stability.

B. Shoring and Sloping of Excavations: Shoring and sloping of excavations shall conform to applicable governmental safety regulations and shall be designed to prevent undermining of all adjacent structures, pavements, utilities and other elements and properties. The Contractor is responsible for all shoring and sloping methods, design, implementation, maintenance and related site safety.

3.8 PLACING ENGINEERED FILL

A. Description: This section covers placement of fill material in all applicable areas.

1. Fill placement should commence only after the stripping, clearing, grubbing, moisture-conditioning, recompaction, and proof-rolling described in Part 3.4.C above have been completed.

2. Suitable Materials: Approved imported borrow or approved onsite excavated material conforming to these specifications shall be used in construction of fills in all applicable areas. Fill materials shall contain no vegetation, debris, junk, clay, or other deleterious matter, including toxic or hazardous substances.

3. A sample of any imported fill material should be submitted to the Owner's Geotechnical Engineer at least 5 working days prior to its intended delivery date for testing, evaluation and approval. No fill or backfill should be delivered to the site prior to this approval. Environmental clearances should be provided by the contractor for all imported fill materials.

4. Compaction Requirements: After completion of the subgrade preparation, fill shall be placed in uniform layers not exceeding 8 inches in loose thickness, moisture conditioned to about 4 percent above the optimum moisture content, and compacted to a minimum of 90 percent (95% if subjected to vehicular traffic) of its maximum dry density as established by ASTM D1557. Each layer shall be thoroughly compacted completely to the edge before the next layer is laid thereon. Compaction shall be obtained with the use of conventional equipment designed for the purpose. The incidental compaction achieved by the passage of hauling units over the fill will not be considered adequate.

If the soils moisture content is too high or too low, it shall be adjusted by suitable means before placing. Compaction of each layer of fill, including slopes, berms, etc., shall be continued until the density as determined by field tests reaches a minimum of 90 percent relative compaction by the aforementioned methods. For embankment slopes, embankments shall be overfilled past the design slope and then cut back to obtain a well-compacted slope face.

In all cases where the existing ground slope is steeper than 5 horizontal to 1 vertical, the existing slope shall be keyed and benched when fill is placed on the slope to provide stability of the new fill against sliding. The filling operations shall start at the lowest point and continue up in level horizontal compacted layers in accordance with the above fill placement requirements.

5. Shrinkage Cracks: Where shrinkage cracks are noted after compaction of the subgrade, the soil shall be rescarified and prepared as recommended above or be thoroughly moistened to close all cracks. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft or wet areas and replacement with well compacted engineered fill at no additional cost to the Owner.

6. Sloped Areas: The filling operations shall start at the lowest point and continue up in level horizontal compacted layers in accordance with these specifications.

7. Fill Slopes: All fill slopes shall be constructed by overfilling and cutting back to the design slope ratio or shall be well compacted with heavy equipment during the embankment process to obtain a well compacted slope face. Water shall be diverted away from the top of slopes and slope planting shall be provided as soon as possible to reduce potential erosion of the finished slopes. Fill slopes shall be well compacted and shall be no steeper than 2.5H:1V for the interior slope of the reservoir and 4H:1V for the exterior slope of the reservoir with an 8-foot bench as shown on the plans. All other fill slopes shall be no steeper than 2H:1V.

B. Drainage: Care shall be exercised during grading so that areas involved will drain properly. Water shall be prevented from running over the slopes by the temporary berms.

C. Field Testing: The Owner's Geotechnical Engineer will determine the need for field density tests. All cost for these tests will be paid for by the Owner. When tests or inspections indicate that the density of uniformity of any portion of the fill is inadequate, that particular portion shall be removed and reworked until the required density has been satisfactorily obtained.

D. Supervision: At all times the Contractor shall have a responsible field superintendent on the project in full charge of the work with authority to make decisions. He shall cooperate with the Engineer in carrying out the work. Any instructions given to him by the Engineer shall be considered to have been given to the Contractor personally.

E. Inclement Weather: No fill shall be placed, spread or rolled during unfavorable weather.

3.9 UNSUITABLE EXCAVATED MATERIAL: The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer.

Removal of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

3.10 RETAINING WALLS

Backfill behind retaining walls should be placed and compacted in accordance with paragraph 3.5 SITE GRADING of this section. Compaction shall be attained with small, light compaction equipment and should not exceed 95 percent relative compaction in order to minimize the lateral earth pressures against the walls.

3.11 FINISHED EXCAVATION FILLS AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Swales shall be finished to permit adequate drainage. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 0.05 foot from the established grade and approved cross section. Surfaces other than those that are to be paved shall be finished not more than 0.04 foot above or below the established grade or approved cross section.

3.12 PROTECTION

Newly graded areas shall be protected from traffic and from erosion. Any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

END OF SECTION

SECTION 31 25 00 - TEMPORARY SOIL EROSION CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED: Furnish all labor, materials, services, equipment and related items necessary to implement the temporary erosion control measures as shown on the drawings, as required by these specifications and as ordered by the Engineer during the life of the contract to control water pollution though the use of sand bags, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion devices of methods.

A. Temporary erosion and siltation control measures as described herein shall be applied to any erodible material within this project, including local material sources and work areas.

B. The Contractor shall be responsible for providing the necessary erosion control measures which are shown on the plans or which may be ordered by the Engineer. All grading operations shall be performed in conformance with the applicable provisions of the "Water Pollution Control and Water Quality Standards" contained in the "Public Health Regulations," Owner Department of Health.

C. The Contractor shall be responsible for removing all silt and debris resulting from his work and deposited in the stream, drainage facilities, roadways, neighboring lands, and other areas.

1.2 RELATED WORK IN OTHER SECTIONS

Excavation, Trenching and Backfilling- Section 31 23 16
Grading and Earthwork – Section 31 23 23

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mulches: To be bagasse, hay, stray, fiber mats, netting, wood cellulose, bark, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious materials.

B. Slope Drains: To be constructed of pipe, fiber mats, rubble, Portland cement concrete, bituminous concrete, plastic sheets, or other materials acceptable to the Engineer.

C. Grass: To be a quick growing species (such as rye grass, Italian rye grass, or cereal grasses) suitable to the area and which provides temporary cover that does not later compete with the permanent cover.

D. Fertilizer and Soil Conditioners: To be a standard commercial grade acceptable to the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

TEMPORARY EROSION CONTROL

A. The Engineer has the authority to limit the surface area exposed by clearing and grubbing and to limit the surface area exposed by excavation, borrow and fill operations. The Engineer may also direct the Contractor to provide immediate, permanent, or temporary pollution control measures to prevent contamination of streams, lakes, ponds, drainage channels and pipes, roads, neighboring lands, and other areas.

Except for specified measures which may be shown on the plans the Contractor shall determine the appropriate erosion control measures to use. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, and slope drains, and the use of temporary mulches, mats, and grassing, or the construction and use of other control devices or methods as necessary to control erosion.

B. The Contractor shall incorporate all erosion control measures shown in the plans. The plans may be modified as necessary to adjust to conditions that develop during construction.

C. The Contractor shall limit the surface area exposed by grubbing, stripping of topsoil, and grading to that which is necessary for him to perform the next operation and which is within his capability and progress in keeping the finish grading, mulching, grassing, and other such pollution control measures current.

The grubbing of the vegetative root mat and stumps and the stripping of topsoil shall be confined within the limits of grading which can be actively and continuously prosecuted within 15 calendar days. The area to be graded shall be limited to the minimum area necessary to accommodate the Contractor's equipment and work force and shall not at any time exceed 15 acres without prior approval of the Engineer.

Any area remaining bared or cleared for more than 10 calendar days and which is not within the limits of active construction shall be immediately hydro-mulch seeded or remedied as directed by the Engineer at the Contractor's expense without cost to the Owner. All areas where finish grading has been completed shall be grassed within 3 calendar days after the completion of grading for that area.

The maintenance of these grassed areas shall include the following:

1. Grass germination in all areas specified with 80% coverage required by the end of the maintenance period. Any area of one foot square or more in which grass has failed to grow after 60 days of maintenance shall be regrassed.

2. All germinated areas shall be healthy and living at the end of maintenance period.

3. Weeds shall not exceed an area greater than 10 percent in any grass area.

4. All depressions and erosion fills shall be filled to proper grade and area regrassed as required.

Acceptance of the ground cover planting after the maintenance period shall be contingent upon an 80 percent coverage.

D. The Contractor shall, at the end of each work operation in any one day, shape the earthwork in such a manner as to control and direct the runoff to minimize the erosion of soils. He shall construct earth berms along the top edges of embankments or along the property line with adjacent properties, streams and water channels, to intercept any runoff. Temporary slope drains shall be provided to carry runoff from the top of cuts and fills. Temporary facilities for controlled discharges shall be provided for runoff impounded, directed, or controlled by project activities or by any erosion control measure employed.

E. Cut slopes shall be shaped, topsoil added if necessary, and planted as the work progresses. In no case shall the exposed surface be greater than 15 feet in height. Whenever major excavation is suspended or halted and the slope is bare for more than 15 consecutive days, the exposed surfaces shall be hydro-mulch seeded or protected as directed by the Engineer at the Contractor's expense without cost to the Owner.

Fill slopes shall be finished as specified and in accordance with the requirements outlined for cut slopes above.

F. Construction of berms, cofferdams, or other such construction in or near the vicinity of streams, ponds, waterways, or other bodies of water shall be approved materials.

G. The temporary erosion and siltation control measures outlined in these specifications are minimum requirements and shall not preclude the provision of any additional measures which the Contractor may deem necessary. Damages caused by the erosion of soils and the pollution of downstream areas shall be the responsibility of the Contractor and all costs for repairing, correcting, replacing, and cleaning damaged or polluted facilities shall be borne by the Contractor.

END OF SECTION

SECTION 32 11 23 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gravel Access Road

2005 Standard Specifications for Road and Bridge Construction, Department of Transportation, Highways Division, hereafter referred to as “State’s Standards”.

Section 703 - Aggregates

B. Related Sections:

1. Geotechnical Engineering Exploration, Waiahole Water System Improvement, Kunia, Oahu, Hawaii,” January 26, 2021, by Geolabs, Inc.

2. Section 31 23 16 - EXCAVATION, TRENCHING AND BACKFILLING

3. Section 31 23 23 - GRADING AND EARTHWORK

4. Section 33 14 16 - SITE WATER SYSTEM.

1.2 REFERENCE STANDARDS

A. Hawaii Standard Specifications for Road and Bridge Construction (2005).

1.3 QUALITY ASSURANCE

Perform Work in accordance with Section 105 of the State’s Standard.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials in accordance with Section 703 of the State’s Standard for the gravel access road.

PART 3 - EXECUTION

3.1 INSTALLATION

Perform Work in accordance with Section 203 of the State’s Standard.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCE AND GATE

PART 1 - GENERAL

1.1 SUMMARY

Furnish all labor, materials and equipment and related items necessary to complete, in place, chain link fencing and gate in conformity with the dimensions and details shown on the drawings. Work shall comply with the requirements of Section 54 of the Standard Specifications and Standard Details referenced below.

1.2 SUBMITTALS

A. Before installation, submit to the Engineer, affidavits from the manufacturers or suppliers of the fabric, post and rails, fittings and hardware proposed to be furnished and installed under this section certifying that such materials delivered to the project conform to the requirements of these specifications.

1.3 REFERENCE SPECIFICATIONS

A. Standard Specifications for Public Works Construction, September 1986, Department of Public Works, City and County of Honolulu, State of Hawaii, hereafter referred to as the "Standard Specifications".

B. Standard Details for Public Works Construction, September 1984, Department of Public Works, City and County of Honolulu, State of Hawaii, hereafter referred to as the "Standard Details".

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain Link Fence and Gate: Fabric, post and rails, fittings, wires and rods shall conform with Section 54 Chain Link Fence.

B. Concrete Footing: Class B concrete shall conform to Section 39 – Portland Cement Concrete.

PART 3 - EXECUTION

3.1 CHAIN LINK FENCE

Chain link fence shall be constructed in accordance with Section 54 - Chain Link Fence.

END OF SECTION

SECTION 33 11 00 - DRILLING THE WELL

PART 1 - GENERAL

This section covers the requirement for drilling a well at the location shown on the plan. The Contractor shall comply with all requirements of the Well Construction Permit for the well, the Hawaii Well Construction and Pump Installation Standards, and the State Water Code (Chapter 174, HRS).

Final depth of the well will depend on conditions encountered and measurements made during the progress of drilling. Initially, a 12-inch (minimum) diameter pilot borehole will be drilled to the depth directed by the Engineer to evaluate the borehole's completion as a production well. This evaluation will include a video log of the entire length of the borehole by the Contractor, measurements taken by the Engineer, and, if directed, a pump test in the open borehole for up to eight (8) hours.

PART 2 - PRODUCTS

An initial pilot borehole of 12-inch (min.) diameter, a reamed borehole of 24-inch (min.) diameter, and a completed well with a 16-inch casing cement grouted into place.

PART 3 - EXECUTION

3.1 DRILLING

The borehole shall be drilled plumb and straight as specified herein and shall be to the diameter specified in the Proposal. Only air, clear water, or a mixture of air, water and foam may be used in drilling the borehole unless specifically approved prior to use by the Engineer. The diameter of the reamed borehole shall provide a minimum of three (3) inches all around the outside of the casing, including casing couplings if couplings are used.

The exact depth of the well shall be determined by the Engineer based on conditions encountered during drilling. The borehole may cave-in when drilling through loose or fractured rock formations and sandy or cinder layer formations. The well may also cave-in due to earthquake or other causes. The Contractor may concrete-grout the caved-in portion of the well, re-drill the well or use other methods with prior approval by the Engineer to keep the caved-in well open until the project is completed and accepted by the Engineer at no cost to the Owner.

3.2 DISPOSAL OF WATER

In order to avoid NPDES requirements, water from drilling shall be properly disposed of on site. Seepage pits are acceptable. If drilling by reverse circulation, solids-free fluid may be run back into the well. Use of a centrifuge, geofabric filters, temporary berms, barriers, and above-ground detention containers to confine and rid water of solids may be required. No water, foam, or drill cuttings shall be allowed to leave the site for the duration of this job.

The Contractor understands that no compensation will be paid due to any difficulty encountered incidental to the disposal of waste water and all damages resulting therefrom shall be the responsibility of the Contractor.

3.3 ORDER OF WORK

The Contractor shall not conduct drilling operations in excess of eight hours a day except with the written consent of the Engineer. Not less than 72 hours prior to the commencement of any such overtime work, the Contractor shall submit to the Engineer a written notice of his intention and schedule. Deviation from the vertical for the completed well shall be no more than one half the inside diameter of the well casing per any 100 feet of depth. The general order of major work shall be as follows:

A. Install and grout into place surface casing to prevent the surface loose sands from caving.

B. Drill the 12-inch borehole to the depth ordered by the Engineer using only air, clear water, or a combination of air, clear water, and foam as the circulating medium.

C. Video log the entire length of the 12-inch drilled borehole.

D. If directed by the Engineer, run a pump test in the pilot borehole at rates up to 500 GPM for up to eight (8) hours.

E. Ream the pilot borehole to 24-inch (min.) diameter.

F. Video log the entire length of the reamed borehole.

G. Furnish and install the lengths of 16-inch (ID) solid and louvered casing as directed by the Engineer, including double cement baskets, casing shoe, and casing centralizers.

H. Furnish and install cement grout in the annular space.

I. Provide, install, and subsequently remove a line shaft turbine test pump and related equipment capable of delivering up to 1750 GPM to the ground surface.

J. Develop the well by surging with the test pump and then run the pump tests as directed by the Engineer.

K. Perform the plumbness and alignment tests in the completed well.

L. Video log the entire length of the completed well.

M. Clean the well site and demobilize.

3.4 MEASUREMENT, DRILLER'S LOGS, AND SAMPLES

The Contractor shall keep a daily driller's log of all well construction activities on forms acceptable to the Engineer, recording the characteristics of the geologic materials encountered, including (1) depth, (2) thickness, (3) color, (4) hardness, and (5) all other data which may be helpful in the interpretation of the subsurface geology and hydrology. The log shall indicate the depths where water is encountered and the pertinent facts connected with its occurrence. All other information such as the location of lava tubes and cave-ins shall also be noted in the log. The daily driller's logs shall be kept current and available at the well site for inspection by the Engineer.

Samples of drill cuttings shall be taken at successive intervals of five (5) feet of depth and at every change in formation. Samples of drill cuttings shall be obtained by bailing the hole, by screening the circulating medium or by any other method acceptable to the Engineer. These samples shall be collected in 4 112" x 6" HUBCO brand Protexo sand sample bags provided by the Contractor and shall be properly labeled and delivered to the Engineer periodically as requested.

Water level measurements shall be taken immediately when water is encountered in the well during the drilling work and after the casing has been installed. An electrical sounding probe with cable calibrated and marked to the nearest one-hundredth of a foot shall be used to make all water level measurements. When ordered and in the manner directed by the Engineer, the Contractor shall obtain water samples.

3.5 PROTECTION

During the progress of the work, the Contractor shall secure the well for safety and to prevent contamination from surface runoff, debris, etc., when the crew is not at the well site. The Contractor shall preserve the well in good condition until the Engineer has accepted the work.

3.6 ABANDONED WELL

A well will be considered abandoned if the Contractor does not complete the well to the depth ordered by the Engineer or if the Contractor should abandon the well due to loss of tools or for any other cause or if the Owner does not accept the well due to faulty plumbness and alignment. Such an abandoned well shall be sealed by the Contractor, in compliance with the provisions and requirements of Chapter 174, C- 87, HRS, the State Water Code. If casing has been installed, the Contractor, at his own expense, may remove the casing prior to backfilling the abandoned well.

No payment will be made for any work done on an abandoned well. All partial payments received by the Contractor for work done on a well that has been abandoned shall be refunded to the Board and the Contractor shall drill another well in the vicinity of the abandoned well as directed by the Engineer. The cost of moving from the location of the abandoned well to the above-mentioned new site will be at the Contractor's expense and will not be paid for by the Owner.

Upon completion of the work the Contractor shall leave the site of the abandoned well in a neat and presentable condition free of all debris and in a state comparable to its original condition.

3.7 VIDEO LOGGING

The Contractor shall run a color video log at the following three times: after completion of the pilot borehole; after reaming the borehole to its full diameter is completed; and after well construction and testing has been completed. The video logging system shall be a color digital system capable of side scan and recording the video camera's depth in feet in the image. The original and one copy of the DVD disc record shall be delivered to the Engineer upon completion of each logging event and shall become the property of the Owner. The Contractor is responsible to cleanse the well prior to making the video log such that the water column is clear and that the image of the walls of the borehole is easily seen.

3.8 MEASUREMENT

The depth of the pilot borehole to be paid for shall be the actual depth in lineal feet measured vertically from the prepared ground surface to the bottom of the borehole as ordered by the Engineer.

The depth of the reamed borehole to be paid for shall be the actual depth in lineal feet measured vertically from the ground surface to the bottom of the reamed borehole as ordered by the Engineer.

Each of the three color video logs shall be paid for when this work item is completed to the satisfaction of the Engineer.

3.9 PAYMENT

The depth of the borehole, acceptably drilled and measured as provided above, will be paid for at the applicable contract unit price per lineal foot for:

A. Drilling 12-inch (min.) diameter borehole from the ground surface to the depth directed by the Engineer;

B. Reaming the 12-inch borehole to 24-inch (min.) diameter.

END OF SECTION

SECTION 33 11 00.1 - MOBILIZATION AND DEMOBILIZATION (Well Drilling)

PART 1 - GENERAL

This section covers the requirements for mobilization and demobilization of a well drilling rig at the project site.

PART 2 - PRODUCTS

2.1 MOBILIZATION

Mobilization shall consist of the transporting, assembling, constructing, installing and making ready for use at the well site all equipment, machinery, structures, utilities and incidentals necessary to do the work covered by this contract.

2.2 DEMOBILIZATION

Demobilization shall consist of the dismantling and removal from the project site all of the above-mentioned equipment, machinery, structures, utilities and incidentals not incorporated in or made a necessary part of the completed well.

PART 3 - EXECUTION

Prior to mobilization on site and drilling the well, the Contractor shall have a survey performed by a surveyor registered in the State of Hawaii to verify the location of the well in the property. The required survey will not be paid for directly, but shall be considered incidental to mobilization.

3.1 GUIDELINES

The Contractor shall clear and grade the site prior to moving and setting up the drilling rig at the site.

The Contractor shall be completely mobilized at the project site and begin drilling operations within 30 calendar days after he has been notified, in writing, to proceed under this contract. Any provision in the Standard Specifications to the contrary is hereby deleted.

If the Contractor utilizes private lands other than the well site and access road for mobilization purposes, the provisions of this section shall still apply, and the mobilization and demobilization work on said private lands shall also be in accordance with the agreement between the Contractor and the land Engineers.

When the project is completed the Contractor shall clean up the well site and shall be responsible for all grading work required to leave the site in a neat and orderly condition to the satisfaction of the Engineer. Payment for the clean-up work will not be paid for separately but shall be included in the contract unit price for Demobilization subject, however, to all provisions specified hereinabove.

The maximum total amount that will be paid for Mobilization, and for Demobilization shall be as shown in the Proposal. All additional mobilization or demobilization costs in excess of the maximum amounts specified above shall be included in the appropriate unit prices bid in the

Proposal. The Contractor shall not be entitled to receive any compensation for mobilization or for demobilization in addition to those specified herein and in the Proposal.

3.2 MEASUREMENT

Measurement for payment of the work under this section of the specifications will be made as follows:

A. The contract lump sum price for Mobilization will be paid when 50 feet of the pilot borehole has been acceptably drilled and in the Engineer's opinion the Contractor has fully mobilized.

B. The contract lump sum price for Demobilization will be paid after the well has been completed and accepted by the Board and the project site cleaned to the satisfaction of the Engineer.

Should the Department terminate the contract before 50 feet of the pilot borehole has been acceptably drilled for reasons other than those specified in the Standard Specifications and in the Engineer's opinion the Contractor has fully mobilized at the well site, the full amount of the contract unit price for Mobilization shall become due and payable subject, however, to all the provisions specified hereinabove. The full amount of the contract unit price for Demobilization shall also become due and payable after the above-mentioned termination of the contract, subject however, to all the provisions specified hereinabove.

3.3 PAYMENT

Mobilization and demobilization will be paid for at the applicable contract unit prices for:

Mobilization (not to exceed $30,000.00),

Demobilization (not to exceed $15,000.00), as the case may be, which prices shall be full compensation for all the work specified in this section.

END OF SECTION

SECTION 33 11 00.2 - FURNISHING AND INSTALLING WELL CASING

PART 1 - GENERAL

This section covers the requirement for furnishing and installing the well casing. The casing shall be installed in the well only when ordered in writing by the Engineer and as specified herein. The Engineer will specify the total lengths of the solid and louvered casing to be installed. Installation shall be made only during normal daylight working hours.

PART 2- PRODUCTS

2.1 WELL CASING

The solid well casing shall be manufactured in accordance with the applicable parts of ASTM A 139. The steel from which the casing is manufactured shall conform to ASTM A606 Type 4 (high strength low alloy). Casing diameter shall be as specified in the Schedule of Prices of the Proposal. The solid casing shall have a minimum wall thickness of 3/8-inch and shall be clean, round, straight, and free from kinks. Use of casing couplings is preferred. However, if butt welding is used, the individual lengths of solid casing shall be provided with beveled ends suitable for butt welding.

The louvered casing to be furnished and installed in the well shall be of the same material as specified for the solid casing. The inside casing diameter shall be identical to that of the solid casing and shall have a minimum wall thickness of 5/16 inch. The openings in the casing shall be machine made, perpendicular to the axis of the casing, and of a louver form with the aperture facing downward. The openings shall be 1/4 inch. The louvered casing shall provide not less than 90 square inches of intake area per lineal foot.

After completion of all testing and video logging, the top of the installed solid casing shall be capped with a 3/8-inch steel plate and 6-inch diameter threaded coupling with a plug as shown on the Construction Plans.

2.2 WELL CASING MARKINGS

Each length of casing shall be marked by the casing manufacturer with the following information:

A. Manufacturer's identification

B. Nominal thickness of the casing wall

C. ASTM Designation and trade name of the steel used for the manufacture of the casing

All markings shall be clear and legible and shall be within three (3) feet from one end of the casing.

2.3 WELL CASING CERTIFICATION

Prior to the delivery of any casing to the project site, the Contractor shall submit for approval the casing manufacturer's certification to the Engineer. The certificate shall clearly indicate the total footage and number of casing shipped; the name of the customer; and the physical and chemical properties of the casing material. ASTM Designation and trade name of steel may be used to designate the physical and chemical properties respectively.

PART 3 - EXECUTION

3.1 INSTALLATION OF WELL CASING

The well casing shall be installed in the presence of and as directed by the Engineer. The casing shall be properly aligned and welded by qualified welders and shall also be continuous for its entire length. Every precaution shall be taken to prevent the casing from dropping into the hole. Driving of the casing in any manner will not be permitted.

The Contractor shall cleanse the drilled hole of drill cuttings by bailing or rotary circulation and then carefully lower the casing in the drilled hole and temporarily secure the casing string. After the casing is in place, filling of the annular space as called for in Section 33 11 00.3 - Filling the Annular Space shall then be completed. At no time during the installation of the casing shall the total weight of the casing rest on the bottom of the drilled hole.

3.2 INSTALLATION OF DOUBLE CEMENT BASKETS

Two commercially made cement baskets, to be approved by the Engineer, are to be installed five feet apart at the depth specified by the Engineer.

3.3 INSTALLATION OF CASING GUIDES

During the installation of the well casing, the Contractor shall furnish and install casing guides at three locations: midway along the louvered casing; midway between the cement baskets and ground surface; and 80 feet below the ground surface. The casing guides may be commercially made or fabricated by the Contractor with the Engineer's approval.

3.4 MEASUREMENT

The lengths of well casing installed below the prepared ground surface shall be measured vertically to the nearest foot from the ground surface.

3.5 PAYMENT

The total footage, measured as provided above, of well casing acceptably installed below the prepared ground surface will be paid for at the contract unit price per lineal foot for:

- Furnish and install the 16-inch (ID), 3/8-inch wall thickness solid casing
- Furnish and install the 16-inch (ID), 5/16-inch wall thickness louvered casing.

END OF SECTION

SECTION 33 11 00.3 - FILLING THE ANNULAR SPACE

PART 1 - GENERAL

This section covers the filling of the annular space between the drilled hole and the casing with gravel, sand, and cement grout. All work required in this section shall be done during normal daylight working hours. The Contractor shall notify the Engineer not less than 48 hours prior to the start of filling the annular space.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement shall conform to the requirements of ASTM C 150, Type I for grout mix.

B. Coarse aggregate shall be crushed fine-grained lava rock meeting the grading requirements of size nos. 67 and 8 (ASTM C33).

C. Fine aggregate shall consist of basaltic sand meeting the grading requirements of ASTM C33.

D. Water used in mixing cement grout shall be potable.

PART 3 - DESCRIPTION

This section covers the installation of cement grout in the annular space between the wall of the drilled hole and the casing. All work required in this section shall be done during normal daylight working hours. The Contractor shall notify the Engineer not less than 48 hours prior to performing any work under this section

PART 4 – EXECUTION

4.1 CEMENT GROUTING THE ANNULAR SPACE

Cement grout shall consist of a mixture of one part Portland cement and not more than six (6) gallons of water per sack of cement to form a consistency such that the grout may be placed. Grout shall be placed in the annulus from the upper cement basket to the ground surface.

Grout placed in the annulus shall be installed by tremie pipe starting from the bottom of the space to the grouted and proceeding upward in such a manner that the hydrostatic pressure of the grout will not distort or collapse the casing.

It is essential that the entire annular space around the grouted section of the casing be completely filled with grout. Grout shall be placed in a manner that will avoid segregation of materials, inclusion of foreign material, and bridging of grout materials. No drilling operation or other work in the well shall be permitted within 72 hours of grouting the annular space.

PART 5 - MEASUREMENT AND PAYMENT

Acceptable filling of the annular space with cement grout will be measured and paid for at the contract unit price for:

“Provide and install cement grout in the annular space”

END OF SECTION

SECTION 33 11 00.4 - PUMP TESTING

PART 1 - GENERAL OVERVIEW

1.1 TWO TYPES OF PUMP TESTING

Pump testing shall consist of development and test pumping to determine yield, drawdown, recovery, and quality of water at various rates of pumping. A pump test will be conducted after installation of the casing and grouting the annulus. At the Engineer’s election, a pump test shall also be conducted in the open pilot borehole.

PART 2 - PUMP TESTING IN THE PILOT BOREHOLE

2.1 EXECUTION

Upon completion of the pilot borehole and if directed by the Engineer, the Contractor shall provide and install all equipment necessary to run a pump test in the uncased borehole for up to eight (8) hours continuously. The pump shall be capable of delivering a minimum of 500 GPM to the ground surface. A flow meter and valve on the discharge line shall be provided by the Contractor so that performance at various rates of discharge can be determined. Two 1-inch (minimum) diameter sounding tubes shall also be provided by the Contractor so that drawdown at the various rates of pumping can be measured manually with an electric sounder and also recorded with a downhole pressure transducer, the latter to be furnished and installed by the Engineer.

PART 3 - PUMP TESTING IN THE COMPLETED WELL

3.1 EQUIPMENT

The Contractor shall furnish and install all necessary equipment and supply the power required to perform the pump test as directed by the Engineer. All Contractor-furnished equipment and appurtenances shall be in good operating condition. A line shaft turbine pump is to be used for development and pump testing in the completed well. A submersible pump is not acceptable. The pump bowl and two 1-inch (min.) diameter sounding tubes will be set to the depths directed by the Engineer. The pump shall be capable of delivering up to 1750 GPM to the ground surface to develop the well and for subsequent testing.

The rate of discharge from the well shall be controlled by an appropriate valve and/or engine speed and shall be measured with a water meter to be furnished by the Contractor. The Contractor shall furnish any and all other equipment and materials that may be required to measure the rate of discharge and it shall be the Contractor's responsibility to determine and provide the necessary and proper fittings to connect the water meter. The Contractor shall also provide the necessary facilities and make arrangements for the proper disposal of the pumped water as acceptable to the Engineer and in accord with all applicable government regulations. The Contractor shall provide adequate lighting for safe night operation of all the test equipment in the working area.

Two 1-inch (min. diam.) sounding tubes shall be furnished and installed in the well by the Contractor, one for manual measurements of the depth to water using an electric sounder and the other for the installation of a downhole recording pressure transducer, the latter to be furnished and installed by the Engineer.

3.2 INSTALLATION OF THE TEST PUMP

When a pumping test is ordered by the Engineer, the Contractor shall clean the well by bailing and swabbing to the satisfaction of the Engineer prior to the installation of the test pump. The Contractor shall satisfy himself that the well is adequately prepared for the proper installation and operation of the test pump assembly.

3.3 DEVELOPMENT AND TEST PUMPING

The complete pump test equipment shall be acceptably installed and tested for proper operation in the presence of the Engineer. Development and test pumping shall be scheduled to begin only during daylight hours. The Contractor shall notify the Engineer of his readiness to begin at least three days prior to the scheduled pumping.

Initially, development pumping shall be conducted by starting, running, and stopping the pump intermittently at rates up to 1750 GPM. This development by surging shall be directed by the Engineer. The Contractor shall keep a log of the development pumping. Development pumping will be continued until, in the judgment of the Engineer, water pumped from the well is substantially free from sand, stone, drill cuttings, and foreign material and development is complete and satisfactory.

Conduct of the pump test shall be prescribed by the Engineer during the course of the testing. The pumping shall be started, regulated and stopped as directed by the Engineer. The testing shall include measuring the rate of discharge and drawdown at the various pumping rates, the rate of recovery at the end of pumping, and collecting water samples at intervals directed by the Engineer. Testing may be conducted during the night, and possibly on Saturdays, Sundays, and National and State holidays. Records will be kept throughout all tests showing the pumping rates, corresponding water levels in the well, temperature of the water being discharged, and time that samples are collected.

During the entire testing period, the Contractor shall have at least one man available at the well site to operate and maintain the test pump and appurtenant equipment, to collect data, and to perform other incidental work required for the pump test. The Contractor shall be responsible for efficient sustained operation of the pumping unit and appurtenances during the tests. The Owner will not pay for any damages to the pumping test equipment for any cause.

PART 4 - MEASUREMENT AND PAYMENT

4.1 PILOT BOREHOLE PUMP TEST

Performance of the pilot borehole pump test shall be considered complete when the eight hours of pumping has been satisfactorily completed and the pumping equipment has been removed from the borehole.

4.2 PUMP TESTING IN THE COMPLETED WELL

The installation and removal of pumping test equipment and material to be paid for shall be considered complete when the unit has been satisfactorily tested and accepted by the Engineer and when the removal has been completed to the satisfaction of the Engineer.

Development and test pumping time to be paid for will be the actual number of hours that the pump is operated under the direction and to the satisfaction of the Engineer measured to the nearest hour. The measurement of time will begin after the Engineer orders the pumping begun and shall end when the Engineer orders the pumping test to be terminated. Time lost due to any failure, inability to meet Technical Specifications requirements, or inefficient operation of the pumping equipment or measuring devices will not be measured for payment.

END OF SECTION

SECTION 33 11 00.5 - PLUMBNESS AND ALIGNMENT

PART 1 - GENERAL

1.1 DESCRIPTION

The well shall be drilled circular and plumb and true to line. In compliance with this requirement, the Contractor shall furnish all labor, tools, and equipment necessary and shall conduct the tests described herein to the satisfaction of the Engineer.

PART 2 - REQUIREMENTS

2.1 PLUMBNESS AND ALIGNMENT

The testing described in this section shall be done after the casing and annular materials have been installed, the grout has set, and before final acceptance of the well. Plumbness and alignment shall, except as hereinafter modified, be in accordance with the requirements of the latest revision of American Water Works Association Specification A100 "Standard Specifications for Deep Wells". The maximum deviation from the vertical shall not be more than half the inside diameter of the well casing per any 100 feet of depth. A log of the drift at 20-foot intervals shall be made during the plumbness test.

PART 3 - EXECUTION

3.1 METHODS

The alignment shall be tested by lowering a section of pipe 40 feet long or a dummy of the same length to the bottom of the well. If a dummy is used, it shall consist of a spindle and not less than three rings. The band width of each ring shall be a minimum of 12 inches. The rings shall be truly cylindrical and shall be spaced one at each end of the spindle and one ring at the center thereof. The outer diameter of the rings shall be equivalent to the inside diameter of the casing less 1/2-inch.

The plumbness test shall be done using an expandable cage adjusted to the inside diameter of the casing less one-half inch and suspended on a steel cable from a pulley not less than 20 feet above the top of the well casing. Measurements of the well’s deviation from vertical shall be made at 20-foot intervals over the entire length of the casing.

Should the section of pipe or dummy used for the test fail to move freely throughout the length of the cased well or should the well vary from the vertical in excess of one half the inside diameter of the casing per any 100 feet of depth as measured during the plumbness test, the well shall be deemed to have failed the plumbness and alignment test. Such a failure of plumbness or alignment shall be corrected by the Contractor, at his own expense, before proceeding further with the work. Should he fail to make the necessary corrections, the Engineer will not accept the well and the Contractor will be required to drill an acceptable well at his own expense.

If a dispute as to the accuracy of the plumbness and alignment test is raised by the Contractor or Engineer, the party raising the dispute may resolve it by paying for plumbness and alignment retesting using a gyroscopic-type survey instrument subject to its prior approval by the Engineer. Results of such retesting shall be deemed final and conclusive.

3.2 PAYMENT

The tests for plumbness and alignment shall be paid for at the lump sum price in the Proposal. Any retesting shall be paid for by the party requesting the test.

END OF SECTION

SECTION 33 14 16 - SITE WATER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

Furnish all labor, materials, equipment, and tools to install exterior water system as indicated on the plans and specified herein.

1.2 SUBMITTALS

A. Before installation, submit to the Officer-in-Charge, affidavits from the manufacturers or suppliers of the pipe, fittings and appurtenances proposed to be furnished and installed under this section certifying that such materials delivered to the project conform to the requirements of these specifications.

1.3 REFERENCE SPECIFICATIONS

A. The WATER SYSTEM STANDARDS, Board of Water Supply, City and County of Honolulu, 2002, hereafter referred to as "BWS Standards". Measurement and payment provisions of these specifications are not applicable to this project.

B. 2009 UNIFORM PLUMBING CODE (UPC).

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall conform to the BWS Standards and/or the 2009 UPC.

B. Water mains shall be Polyvinyl Chloride (PVC) AWWA C900 DR 14 or ductile iron CL 53 AWWA C151.

C. All fittings, appurtenances and other incidental materials required for installation of the water system shall be in accordance with the BWS Standards and/or the 2009 UPC.

D. Ball valves shall be installed for valves 3-inches and smaller.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall be responsible for precisely laying out the water line shown on the contract drawings. The location shown on the contract drawings of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract drawings. The Contractor shall verify the location and inverts of existing utilities prior to construction.

B. In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Officer-in-Charge at the Contractor's expense.

C. The installation, testing, disinfection and acceptance of the water system shall be governed by the BWS Standards and the 2009 UPC.

D. Connections to existing water lines shall be done by the Contractor in accordance with BWS Standards. The Contractor shall furnish all necessary pipe, fittings, appurtenances and other incidental materials required for connection.

E. Trenching, pipe cushion and backfilling for water lines shall be in accordance with the BWS Standards.

F. The Contractor shall coordinate the connection of the new water lines with the Officer-in-Charge. Contractor shall inform the Officer-in-Charge a minimum of one week prior to the date of the actual connection. The Contractor shall adjust the slope of the new water line as necessary to construct a fully functional and acceptable system. The Contractor shall ensure that all piping, fittings, materials, tools, equipment and incidentals are at the site prior to connection.

END OF SECTION

SECTION 33 14 16.1 - HIGH DENSITY POLYETHYLENE PIPE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

The Contractor shall have a copy of the manufacturer's installation instructions at the construction site at all times and shall furnish all labor, materials, equipment, and tools to install the high density polyethylene piping (PE or HDPE) as indicated on the plans and specified herein.

This section covers materials and installation of the HDPE piping system and includes the following: pipe, fittings and flanges.

The pipe manufacturer shall provide results of all quality control tests as specified herein.

A. Reference Section

Section No.	Section Title
01 01 90	General Specifications
01 33 00	Submittal Procedures
31 23 16	Excavation, Trenching and Backfilling

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

D 638-03	Standard Test Method for Tensile Properties of Plastics
D 696-03	Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics between -30C and 30C with a Vitreous Silica Dilatometer
D 746-04	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
D 790-03	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique
D 1693-05	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
D4776	Test Methods for Rubber Property-Adhesion to Textile Cord

D2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2657	Standard Practice for Heat Joining of Polyolefin Pipe and Fittings
D2837	Standard Test Method of Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
D3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Plastics Pipe and Fittings Materials
D3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
E 494-05	Standard Practice for Measuring Ultrasonic Velocity in Materials
E 1316-06	Standard Terminology for Nondestructive Examinations
F 37-00	Standard Test Methods for Sealability of Gasket Materials
F 146-04	Standard Test Method for Fluid Resistance of Gasket Materials
F714	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
F 1248-96(2002)e1	Standard Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe

B. American Water Works Association (AWWA)

C906	Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 65-in, for Waterworks

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

A. Pipeline materials including joints, fittings, and couplings.

B. Submit manufacturer's standard drawings or catalog cuts.

C. Precostruction Submittals

1. Heat fusion work plan

2. Pipe joint test methods, procedures, and apparatus

3. Leakage test plan

D. Certificates include:

1. Fusion equipment experience requirements

2. Certification for Non-Destructive Examination (NDE)

3. Certification for Heat Fusion Technician

E. Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise. Production control tests shall have been performed at the intervals or frequency specified in the referenced publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project. Test Reports include:

1. Leakage test reports

2. Heat fusion daily logs

3. Bent Strap Testing

4. Ultrasonic Testing

F. Fusion Equipment

1.4 DELIVERY, STORAGE, AND HANDLING

A. The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project neatly, intact, and without physical damage. The transportation carrier shall use appropriate method and intermittent checks to insure the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

B. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The handling of the pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

C. Sections of pipe having been discovered with cuts or gouges in excess of 10 percent of the wall thickness of the pipe shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the butt fusion joining method.

D. Fused segments of pipe shall be handled so as to avoid damage to the pipe. When lifting fused sections of pipe, chains or cable type chokers must be avoided. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections. Care must be exercised to avoid cutting or gouging the pipe.

PART 2 - PRODUCTS

2.1 MATERIAL

The pipe shall be made from polyethylene resin compound with a minimum cell classification of PE 445474C for PE 4710 materials in accordance with ASTM D3350. This material shall have a Long Term Hydrostatic Strength of 1600 psi when tested and analyzed by ASTM D2837, and shall be a Plastic Pipe Institute (PPI) listed compound.

The raw material shall contain a minimum of 2 percent well dispersed carbon black. Additives which can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe product meets the requirements of this standard.

The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification and from the same raw material supplier.

Compliance with the requirements of this section shall be certified in writing by the pipe supplier.

Bolts and nuts for buried mechanical joining components such as flanges shall be made of noncorrosive, high-strength, type 316 stainless steel having the characteristics specified in ANSI/AWWA C111/A21. The nuts shall be finished with TRIPAC 2000 coating system to minimize galling and ensure proper torque.

2.2 PIPE DESIGN

The pipe shall be designed in accordance with the relationships of the ISO-modified formula (see ASTM F714):

$$P = \frac{2S}{(D/t) - 1}$$

where: S = Hydrostatic Design Stress (psi)
P = Design Pressure Rating (psi)
D = Pipe Outside Diameter (inches)
t = Minimum Wall Thickness (inches)
D/t = Dimension Ratio

The design pressure rating P shall be derived using the ISO-modified formula above, and shall be its maximum normal working pressure in pounds per square inch at temperatures up to 73°F.

The Hydrostatic Design Stress shall be 1000 psi @ 73.4°F for PE 4710 materials.

2.3 MARKING

General: The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 5 feet:

Name and/or trademark of the pipe manufacturer.
Nominal pipe size.

Dimension ratio.

The letters PE followed by the polyethylene grade per ASTM D1248, followed by the Hydrostatic Design basis in 100's of psi, e.g., PE 4710.

Manufacturing Standard Reference, e.g., ASTM F714.

A production code from which the date and place of manufacture can be determined.

2.4 JOINING METHODS

Wherever possible, the polyethylene pipe should be joined by the method of thermal butt-fusion, as outlined in ASTM D2657, Heat Joining Polyolefin Pipe and Fittings except where required to connect with other pipe, valve or equipment materials.

Butt-fusion joining of pipe and fittings shall be performed in accordance with the procedures laid out by the manufacturer. Joining must be conducted by, or under the supervision of, factory trained personnel.

The pipe supplier shall be consulted to obtain machinery and expertise for the joining by butt-fusion of polyethylene pipe and fittings. No pipe or fittings shall be joined by fusion by any contractor unless he is adequately trained and qualified in the techniques involved.

Heat Fusion Daily Logs: Maintain and submit to the Officer-in-Charge by 10:00 a.m. the following day, daily logs of each individual fusion, including verification of visual witness of fusion. Log shall include actual temperature, duration (identifying warm-up, weld, and cool down times), and applied butt pressure for each weld. Each log shall be certified by the Fusion Technician and QC Manager. Electronic data acquisition of log information may be used in lieu of manual recording. No pipe or fittings shall be joined by fusion by any contractor unless he is adequately trained and qualified in the techniques involved.

Heat Fusion Technician Qualifications: Pipe and fitting joints shall be heat fused by a qualified fusion technician who has been trained by an approved manufacturer’s representative and in accordance with the manufacturer’s recommended fusion procedures. The Contractor shall provide written certification from the pipe manufacturer for each fusion technician employed by the Project. Training or re-qualification shall have been obtained within the 12 months prior to the beginning of work. Fusion technician shall have performed fusion on at least 3 prior projects of similar size and length.

Heat Fusion Work Plan: Submit work plan demonstrating ability to perform work in compliance with specifications, and ASTM D 2657, ASTM D 3261, and ASTM D 3350, including procedures, equipment specifications, manufacturer's recommendations, sample fusion log, sequence of work, work areas, and safety measures.

Fusion Equipment Experience Requirements: The fusion equipment and operator shall be required to demonstrate 5 years successful field experience. Provide equipment specifications and a list of past projects and verify conformance to these specifications.

The polyethylene pipe may be adapted to fittings or other pipe elements by means of a suitable flange assembly or transition coupling.

Flange assemblies shall consist of the following items:

A. A polyethylene stub end made from the same resin as the pipe. The polyethylene stub end shall be factory machined from a molded polyethylene blank.

B. A back-up flange of ductile iron or other suitable material, made to Class 150, ANSI B16.5 dimensional standards with exceptions.

Flange assemblies are connected by bolts of compatible material with suitable gaskets, for the fluid and pressure characteristics, cut to fit the joint. In all cases, the bolts shall be drawn up evenly and in line. Bolts, nuts, and washers shall be type 316 stainless steel.

C. Polyethylene pipe, in sizes 2 inches IPS to 12 inches IPS, may be joined by way of specially designed mechanical couplings. These couplings shall contain a malleable or ductile iron body, elastomeric gasket (Grade E), hot dipped galvanized nuts, bolts, and washers, Victaulic Style 995 or approved equal.

D. Polyethylene pipes of the same outside diameter but different wall thickness shall be joined by means of a flange assembly or suitable mechanical couplings.

2.5 MITERED FITTINGS

Mitered fittings shall be produced by butt fusion from pipe the same size and SDR rating as the main pipe line. Fittings destined for pressure service shall receive an FRP overlay to provide additional mechanical strength.

Mitered fittings shall be available in both flanged and plain ends.

2.6 QUALITY ASSURANCE PROGRAM

A. Finished Goods Evaluation: Each length of pipe produced shall be checked by production staff for the items listed below. The results of all measurements shall be recorded on production sheets which become part of the manufacturer's permanent records. Submit three copies to the Engineer.

1. Pipe in process is checked visually, inside and out for cosmetic defects (grooves, shafts, hollows, etc.) which are cause for rejection.

2. Pipe outside diameter is measured using a suitable periphery tape to ensure conformance with ASTM F714.

3. Pipe wall thickness is measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.

4. Pipe length is measured.

5. Pipe marking is examined and checked for accuracy.

6. Pipe ends are checked to ensure they are cut square and clean.

7. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

B. Test Equipment Evaluation: The quality assurance staff shall check each manufacturing line on each of the above items twice a day, as well as carry out the following:

1. Check on accuracy of all micrometers and periphery tapes used by production staff.

2. Check on all production records for accuracy and adherence to manufacturing specification

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS FOR INSTALLATION OF PIPELINES

A. Construction and installation shall be performed in compliance with the manufacturers Design Guidelines and Installation Guidelines, and with the applicable requirements of ASTM D 2774.

B. Earthwork: Perform earthwork operations in accordance with Section 31 23 16 Excavation, Trenching and Backfilling.

C. Haunching and Initial Backfill: Haunching and initial backfill shall be done in accordance with the manufacturer’s instructions. Materials used and compaction rates shall be as specified in Section 31 23 16 Excavation, Trenching and Backfilling.

D. Special Conditions: ASTM D2321-Section 11.2, Minimum Cover for Load Application, Section 11.3, Use of Compaction Equipment, and Section 11.4, Removal of Trench Protection should apply unless directed otherwise by the Engineer.

E. Polyethylene flanges must be at the ambient temperature of the surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene. Flange bolts must be retightened at least once 24 hours after initial flange bolt tightening.

F. All polyethylene pipe must be at the temperature of the surrounding soil at the time it is backfilled and compacted.

3.2 FIELD QUALITY CONTROL

A. Field Tests and Inspections: The Engineer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications. Testing requirements shall conform to Section 33 14 16 Site Water System and this Section. Do not bury or conceal piping until it has been inspected, tested, and approved.

B. Leakage Tests: Leakage tests shall conform to Section 33 14 16 Site Water System and this Section.

1. Perform hydrostatic and leakage tests with water on all pipe installed in this project in accordance with manufacturer's recommendations, ASTM D 2837, ASTM D 2774, ASME B31.1, PPI Handbook and Section 214 Leakage Testing.

2. Furnish all equipment, material, personnel and supplies to perform the tests, including all taps and other necessary temporary connections.

3. Test pressure must be witnessed by the Engineer. The Contractor's superintendent and the Officer-in-Charge shall record the test results and certify the documentation. Measurement and correction for temperature and make-up water will be required. Hydrostatic and leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Engineer. Discharge of hydro test water shall be in accordance with SECTION 163, "ENVIRONMENTAL POLLUTION CONTROL."

4. Pressure Test Schedule shall be in accordance with Section 214 Leakage Testing.

5. Accessories: It shall be the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

6. Testing Apparatus

   Provide pipe taps, nozzles and connections as necessary in piping to permit testing including valves to isolate the new system, addition of test media, and draining lines and disposal of water, as is necessary. Provide all required temporary bulkheads.

7. Correction of Defects: If leakage exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

8. Hydrostatic and Leakage Test Reports

The Contractor shall keep records of each piping test, including:

a. Description and identification of piping tested.

b. Makeup water, test pressures, pipe temperature, and ambient air temperature recorded at maximum 15 minute interval from beginning to end of test.

c. Date of test.

d. Witnessing by Contracting Officer

e. Test evaluation.

f. Remarks, to include such items as:

i. Leaks (type, location).

ii. Repairs made on leaks. Test reports shall be submitted to the Engineer.

9. Venting: Where not shown on the Plans, the Contractor may install valved "tees" at high points on piping to permit venting of air. Valves shall be capped after testing is completed.

C. Bent Strap Testing and Ultrasonic Testing: A minimum of 45 calendar days prior to production fusion of HDPE-pipe joints, each person making butt or socket fusion joints shall demonstrate proficiency by making trial joints and destructively testing the trial fusions by bent strap testing and ultra-sonic testing. Trial joints shall be allowed to cool completely before testing, and shall not fail at the joint. During construction, the first fusion of the day shall be a trial fusion which shall be allowed to cool and destructively bent strap tested. If the fusion fails, additional trial fusions shall be made and tested until successful fusions are made. The successful fusion procedure shall be used for the balance of the day's construction provided the procedure is within the limitations recommended by the manufacturer. One hundred percent ultrasonic testing (UT) shall then be performed on all heat fusion joints by a qualified independent NDE testing firm. UT shall be performed in accordance with ASME V, Article IV, ASTM E 494, and ASTM E 1316 prior to hydrostatic testing. A copy of bent strap and UT test results shall be submitted to the Contracting Officer within 24 hours of the test completion.

NDE Fusion Technician Qualifications: NDE testing shall be performed by a qualified NDE technician with a Level Ill certification for ultrasonic testing (UT) methods and with prior experience testing HDPE pipe in accordance with ASTM E 494 and ASTM E 1316. Field ultrasonic testing (UT) calibration using radiographic test (RT) methods shall be performed by a qualified Level III NDE technician and in accordance with NRC, and State of Hawaii DOT requirements.

3.3 CLEANING

At the conclusion of the work, the Contractor shall thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction periods. Debris cleaned from the lines shall be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.

END OF SECTION

SECTION 40 63 00 – SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

PART 1 - GENERAL

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

A. As specified in Section 26 00 00, Electrical Work. The provisions of these related sections apply to this section and work described in this section shall comply with them.

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

A. This item of work shall include the furnishing of all labor, materials, tools and equipment necessary for the installation of the telemetering and supervisory control system. The system shall consist of a Remote Terminal Unit (hereinafter indicated as RTU), Touch screen panel, and Communication Circuits.

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

C. System Overview – These specifications are for a distributed SCADA system for a water system. This system shall require but not limited to the following work:

1. Providing one (1) RTU at the well pump system site, including but not limited to the following major equipment:

a. RTU

b. UPS

c. 5-Port Ethernet Hub

d. 10” HMI Operator Panel

e. One (1) Power Supply

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

a. The system shall be used for transmitting alarms, status and telemetry, calculated data, diagnostic and error logging information.

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

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

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

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

1.3 SUBMITTALS: Submittals shall be made for approval and resubmitted until approval is received for the following:

Provide required copies of submittal information to the Engineer for distribution after review.

Furnish submittal information on the following items:

A. Catalog Cuts: Submit for approval catalog cuts of following equipment

1. SCADA system components and equipment.

2. Conductors and Wiring.

3. Wiring and functional or block diagrams.

4. Manufacturer's recommendations for installation.

5. Logic diagrams and ladder diagrams.

6. Manufacturer's recommended list of spare parts for a one-year period of operation.

B. Electrical Installation Drawings: At least 10 days prior to any testing the Contractor shall submit one hard copy set and one electronic set of approved complete electrical installation drawings. The installation drawings shall include the manufacturer's wiring diagrams for the SCADA system and any built-to-order equipment.

C. As-Built Drawings: Upon completion of the final inspection and testing, the Contractor shall provide one hard copy set and one electronic set of as-built installation drawings and manufacturer's wiring diagrams for the SCADA system and any built-to-order equipment.

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

PART 2 - PRODUCTS

2.1 GENERAL: Unless otherwise indicated, provide all first quality, new materials, free from any defects, in first class condition, and suitable for the space provided. Provide materials approved by UL wherever standards have been established by that agency. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

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

2.3 MATERIALS AND EQUIPMENT:

A. SCADA Cabinet: The Contractor's SCADA work shall include terminating all telemetry inputs and outputs to terminal blocks within the SCADA cabinet. Termination shall be maintained tight to top, front of the enclosure's left side. Terminal blocks shall be neatly aligned in a single column. The SCADA enclosure shall also include grounding strip, 120V AC power for connection to 24V DC power supply and UPS.

B. Remote Telemetry Unit:

1. Remote Telemetry Unit (RTU) shall be microprocessor based, solid-state construction utilizing second source semiconductors, unless otherwise specified. The RTU shall have a serial port and Ethernet port and be able to communicate using Ethernet/IP protocols. Each RTU shall be supplied with the number and types of I/O points as indicated elsewhere in the plans and specifications. Future expansion shall be possible by simply plugging in additional I/O modules to the rack-less I/O bus. Additional I/O modules shall connect next to each other without requiring a fixed size rack. RTU, I/O, touchscreen, and Ethernet switch components shall use 24VDC and shall be powered through a UPS backup with a minimum 60 minutes of backup time. Digital Outputs shall utilize transistor outputs and use auxiliary relays for controls, and Analog signals shall utilize 4-20maDC based signals. All downloading to the RTU controller and touchscreen shall be over Ethernet. All programming shall utilize ladder logic. Parts shall be off the shelf design and common throughout so as to minimize spare parts requirements. RTU shall be housed in the SCADA cabinet. Unit shall be Siemens Simatic S7-1200 or approved equal.

C. Operator Interface Touchscreen shall be installed in the front of the SCADA cabinet, or other suitable location as required. Touchscreen shall have a basic color screen. Touchscreens shall monitor and control local functions of the RTU. They shall communicate to the RTU using Ethernet communication, through a DIN rail mounted switch in the RTU panel. They shall be rated for NEMA 4X and shall display a minimum of 640x480 resolution. Touchscreens shall be "deployed" remotely over the Ethernet connection for centralized development and quality control. Unit shall be EZSeries EZD-T10C-SE or approved equal.

D. Instrumentation System Transmitter Power Supply: The power supply shall be mounted in the SCADA cabinet and deliver regulated 24-36 volts DC power at a maximum current recommended by the analog transmitter supplier. The unit shall operate on 117 volts AC

at 50-70 Hz. Load regulation shall be 150 mV maximum from no-load to full-load current. Line regulation shall be 150 mV from 105 to 135 volts AC.

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

F. Spare Parts:

1. One (1) Touch Panel

2. One (1) RTU

3. One (1) 8 Digital Input Module

4. One (1) Power Supply

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS:

A. Flush mount indicators, selector switches, pushbutton switches, and pilot lights in a logical arrangement.

1. Mount devices listed, shown, or required for a complete and operable system in accordance with device manufacturer's instructions, these specifications, and as recommended in NEMA PB1.1.

2. Ground control panel to safety ground of power source.

3. Analog signals must use shielded pairs cabling.

3.2 PROGRAMMING:

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

B. The RTU supplier and Contractor shall provide the complete programming and documentation for RTU to comply with the requirements set forth herein.

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

3.3 INTERCONNECTION:

A. All interconnecting cables where noise interference may occur shall be adequately shielded. It shall be the sole responsibility of the Contractor to prevent transients in the field wiring from being coupled into his equipment. The current carrying capacity of all conductors shall meet NEC requirements as a minimum.

B. Interconnecting cables between status and control units and analog equipment shall be terminated at both ends at terminal strips securely mounted on the equipment mounting frame.

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

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

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

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

D. The supplier of all equipment shall be an organization which is committed to the provision of ongoing support and development and can show a history which supports this position. In particular, the supplier must so state in writing that they have performed 5 similar projects with this proposed configuration. It must support and use industry standards and be committed to the use of open standards. The supplier must perform all work within the State of Hawaii.

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

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

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

3.8 MEASUREMENT AND PAYMENT: The electrical work shall be measured and paid for at the contract lump sum price bid.

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

which the item is a part.

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

END OF SECTION

SECTION 40 72 33 - RESERVOIR LEVEL TRANSMITTER

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION

This section of the specification describes the reservoir level recording system required. The reservoir level system will be a water level transmitter installed in an at-grade stilling well located near to the reservoir as shown on the plans. The transmitter is connected to a copper sensing line tapped into the stilling well. The reservoir transmitter system will be integrated with the pump system software installed with the Motor Control Center. The system will provide a reservoir level display and provide a separate time dependent reservoir water level data file which can be down loaded manually by the operator to a remoter computer. This system should provide reservoir level data in the proposed storage reservoir.

The following shall supplement Section 304 “Mechanical and Electrical”, in the Water System Standards, 2002.

PART 2 - PRODUCTS

2.1 RESERVOIR LEVEL TRANSMITTER

The Contractor shall furnish and install a reservoir water level electronic gauge pressure transmitter to the sensing line from the proposed Reservoir stilling well to measure reservoir water levels. The gauge pressure transmitter shall be battery powered and the base station shall be powered by the pump control system with the following features:

1. Number Required: One (1)
2. Pressure Range: 0 - 30 psi (reservoir maximum operating height is 20 feet)
3. Accuracy: minimum ± 0.20% of span
4. Power Input: 24 volts DC
5. Standard Output Signal: 4-20 mA
6. Process Connection Material: 316L Stainless Steel
7. Process Connection: ½ inch NPT, with hex head block & SS bleed valve
8. Enclosure rating: NEMA 4X
9. Sensor Fill Fluid: Silicone
10. Display: LCD digital display, feet
11. Location: As shown on plan
12. Accutech GP10 Wireless Transmitter or approved equal

The water level electronic gauge pressure transmitter shall be specially designed transducer to meet the harsh environments encountered in industrial, municipal and pressure and/or depth measurements. The electronic sensor shall be enclosed in aluminum housing, isolated from the process liquid by a 316 SS diaphragm. The transmitter shall incorporate an isolated solid state piezo-resistive pressure transducer which provides excellent linearity, repeatability and low hysteresis. The transmitter shall be similar in all respects to the ACCUTECH I/A SERIES ELECTRONIC PRESSURE TRANSMITTER FOR GAUGE PRESSURE MEASUREMENT or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION AND TRAINING

Install reservoir level transmitter shall be supplied, installed and calibrated in accordance with manufacturer's requirements and recommended procedures. All appurtenances to install the transmitter shall be included as part of the work. The manufacturer’s certified technician shall perform the equipment calibration at the project site in the presence of owner’s operating personnel. The Contractor shall provide formal training for the transmitter and appurtenances by a factory certified technician to selected maintenance personnel to the satisfaction of Owner’s operational management. Training shall be provided with other equipment training required for this project.

3.2 WARRANTY

All materials and labor furnished for this item of work shall be guaranteed for one year from the date of final acceptance. The Contractor shall pay for any additional extended warranty to meet this requirement

END OF SECTION

DIVISION 43 20 00 - LIQUID HANDLING EQUIPMENT

SECTION 43 24 27 - DEEP WELL VERTICAL TURBINE LINE SHAFT PUMP

PART 1 - GENERAL

1.1 GENERAL PROVISIONS: The Contract, Special Provisions, Standard Specifications and other applicable provisions preceding these specifications, shall govern this section of work.

1.2 SCOPE OF WORK: The work to be completed under these Contract documents is the furnishing, installing, and pump testing of a water lubricated, deep well line shaft pump unit and appurtenances for Waiahole Ditch Well.

This work shall also be done in accordance with ANSI B58.1, “Vertical Turbine Pumps - Line Shaft and Submersible Types”, latest edition, and as supplemented and/or modified herein.

1.3 REFERENCE: The work under this section shall modify and supplement Division 300, Section 304.01.A, “Vertical Turbine Pumps” and Section 304.02.A, “Vertical Motors” as specified in the "Water System Standards", State of Hawaii, 2002, herein referred to as Standard Specifications.

All references to measurement and payment in the Standard Specifications shall be deleted. All references to "Manager" in the Standard Specifications shall be replaced by "Engineer and Manager".

1.4 MOBILIZATION AND DEMOBILIZATION: Mobilization shall consist of the transporting, assembling, constructing, installing and making ready for use at the well site all equipment, machinery, structures, utilities and incidentals necessary to do the work covered by this contract. Demobilization shall consist of the dismantling and removal from the project site all the above-mentioned equipment, machinery, structures, utilities and incidentals not incorporated in or a necessary part for the completed well.

When the project is completed, the Contractor shall clean up the well site and shall be responsible for all grading work required to leave the site in a neat and orderly condition to the satisfaction of the Owner. Payment for clean up work will not be paid for separately but shall be included in the contract unit price for Demobilization.

If the Contractor utilizes private lands other than the well site and access road for mobilization purposes, the provisions of this section shall still apply, and the mobilization and demobilization work on said private lands shall be in accordance with the agreement between the Contractor and the private landowners.

1.5 MEASUREMENT AND PAYMENT: Measurement for payment of the work under this section of the Specifications will be included in the lump sum price for the pump unit.

PART 2 - PRODUCTS

2.1 GENERAL: Conform to the requirements of the specifications referenced above.

2.2 DEEP WELL VERTICAL TURBINE LINE SHAFT PUMP UNIT:

2.2.1 Description: This section of the specifications covers the furnishing, installing and testing of one oil lubricated line shaft deep well vertical turbine pumping unit in Waiahole Ditch Well.

A. Design Conditions:

1. Waiahole Ditch Well

a.	Rated Capacity:	1400 GPM
b.	Proposed Well Casing Diameter:	16 inches
c.	Top of proposed concrete pump pad elev.:	616.0 feet
d.	Estimated static water level of well:	20 + (msl)
e.	Estimated drawdown with pump operating:	__ feet
f.	Proposed setting of pump intake:	(-)0.0 feet (msl)
g.	Maximum size pump (nominal):	14 inches
h.	Elevation of bottom of well perforated casing:	(-)130 feet (msl)

B. Deep Well Turbine Line Shaft Pumping Unit: Number required - One (1)

1. Pump Bowl Assembly:

a. Pump Rated Capacity and Head at 1770 rpm: 1400 gpm at 675 ft. head

b. Example of Pump Bowl Assembly Performance Characteristics Desired:

i. 0 gpm at 894 ft. head
ii. 900 gpm at 848 ft. head (pump efficiency not less than 75%)
iii. 1200 gpm at 760 ft. head (pump efficiency not less than 77%)
iv. 1400 gpm at 675 ft. head (pump efficiency not less than 79%)
v. 1600 gpm at 576 ft. head (pump efficiency not less than 75%)

c. Pump Used to Dimension Plans and Specify Pump Performance Characteristics: Goulds Model 13 CHC (9 stages)

2. Pump Motor:

a. Number Required: One (1)

b. Motor Characteristics:

i. Minimum horsepower rating: 350 HP
ii. Power: 480 volts, 3 phase, 60 hertz
iii. Minimum service factor: 1.15
iv. Minimum full load efficiency: 95%
v. Full Load current: 393 amps
vi. Maximum Speed: 1770 rpm

3. Discharge Column Assembly:

   a. Discharge Column Pipe: The pipe needed shall conform to the following specifications:

      i. Column Pipe: ASTM A53, Grade B, Steel Pipe
      ii. Nominal Diameter: 10 inches
      iii. Wall Thickness: 0.365 inches (Schedule 40)
      iv. Pipe Thread: Short, Round Thread, 8 thread/inch
      v. Thread Specification: API Spec. 5CT
      vi. Pipe Grade and Thread: ASTM A53, Grade A, Schedule 40 with NPT threads

   b. Column Pipe Coupling: The couplings shall conform to the following specifications:

      i. Pipe Size: 10 inches
      ii. Pipe Grade and Thread: Same as pipe
      iii. Thread Specification: API Spec. 5CT and 5B

   c. Column Line Shaft and Couplings:

      i. Line Shaft Diameter: 1 15/16 inches
      ii. Line Shaft Material: ASTM A582, Type 416 stainless steel
      iii. Shaft Coupling Material: ASTM A852, Type 416 stainless steel

   d. Line Shaft Enclosing Tube:

      i. Tube Size: 3 inches
      ii. Tube Material: ASTM A53, Grade B, Steel Pipe
      iii. Tube Wall Thickness: 0.300 (Schedule 80)

4. Discharge Head Assembly:

   a. Number Required: One (1) for each pump unit.

   b. Size and Class of Discharge Flange: 10-inch, 150 lbs. ANSI B16.1

   c. Size of Discharge Column to Discharge Head Flange: 10" x 10"

5. Pumping Unit Efficiency Test Requirement:

   Pumping Unit Test Requirements for Waiahole Ditch Well: Minimum guaranteed field efficiency at rated capacity and head: 68%. (See Section 3.12 for the definition of field efficiency.)

2.2.2 Deep Well Line Shaft Pumps: The pump unit shall be of the multi-stage turbine type as manufactured by Byron Jackson Pump, Inc.; Johnston Pump Co.; Layne and Bowler, Inc.; Weir Floway, Inc.; Peerless Pump; Goulds Pump, or approved equal.

Each pumping unit shall consist of a vertical electric motor, a pump bowl assembly, a discharge column assembly, and a discharge head assembly. The motor shall be described in Section 3.01.03.

The pumping units supplied shall conform with these specifications and the "American National Standard for Vertical Turbine Pumps - Line Shaft and Submersible Types," ANSI B58.1 as last revised. These specifications shall serve as a complement to ANSI B58.1 and where contradictions occur, these specifications shall govern. These specifications indicate minimum material quality required. The pump unit shall have also been classified by U.L. Laboratories as complying to ANSI/NSF Standard 61.

A. Pump Bowl Assembly: The pump bowl assembly shall consist of the pump bowl, impellers, shaft, suction case and strainer.

The pump manufacturer shall provide enough clearance in the pump bowls to allow for any distortion of the pump shaft under any operating condition without the impeller making contact with the bowl.

Downthrust and upthrust loads shall be absorbed by thrust bearings in the motor.

1. Pump Bowls: The pump bowls shall be of close-grained cast iron, free from blow holes, and holes and other defects. The bowls shall conform to minimum strength according to ASTM Designation A48, or Class 30 or better as required with a minimum tensile strength of 30,000 pounds per square inch and shall be higher strength materials as needed for the upper pump bowl units. Pump manufacturer to provide calculations and pump material specifications with the shop drawings for review and approval. The bowls shall be capable of withstanding a hydrostatic pressure equal to twice the pressure at rated capacity or 1-1/2 times the pressure at shut-off head, whichever is greater. Each bowl shall be accurately machined and fitted to close dimensions and fitted with bronze, ASTM B 505, sleeve-type bearings on each side of the impellers.

2. Impellers: The impellers shall be of the fully enclosed type and shall be of zincless bronze ASTM B548, of heavy construction and free from blow holes, porosity and other defects. The impeller shall be finished all over, accurately fitted and perfectly balanced, both statically and dynamically, (hydraulic "balanced thrust" impellers shall not be permitted). Passages shall be smooth to assure efficient operation and to prevent air or sand locking. The impeller shall be locked securely with taper collets of ASTM A582, Grade 416 stainless steel or shall be double keyed.

3. Impeller Shaft: The impeller shaft shall support the impellers and shall be of turned, ground and polished 416 stainless steel, ASTM A-582, or higher strength material. The shaft shall be supported by suitable non-corrosive bearings made of bronze, ASTM B505 alloy C83600, both sides of each impeller with positive means for water lubricating each bearing. The size of the shaft to be determined by the pump manufacturer to shall be capable of transmitting the total thrust and torque loads of the unit in either direction. Pump manufacturer to provide calculations for the pump shaft with the shop drawings for review and approval.

Sand collars, locked securely to the shaft, shall be bronze, ASTM B505, alloy C83600 to prevent dirt, sand or other foreign particles from entering the shaft bearings.

4. Suction Case. The suction case shall connect the strainer to the pump bowls and house the bearing which supports the bottom portion of the impeller shaft. The suction case shall be of cast iron conforming to ASTM A 48, Class 30, properly designed to guide water from the well to the first impeller with minimum friction loss.

5. Strainer. The strainer shall be of the cone type. The strainer shall be directly attached to the lower end of the suction case or attached to the suction case by means of a short length of suction piping with suitable couplings. The suction piping shall not exceed one foot in length and shall be of identical size and construction as the discharge column piping.

   The strainer shall be of stainless steel, ASTM A276, Type 316L. The net inlet area of the strainer shall not be less than 3 times the suction case area. The maximum opening shall not be more than 75 percent of the minimum opening of the water passage through the bowl or impeller. A half-inch neoprene washer shall be inserted for vibration control.

B. Discharge Column Assembly: The discharge column assembly shall consist of the discharge column pipe, column couplings, line shaft, line shaft couplings and sounding tubes.

1. Discharge Column Pipe: The column pipe shall be 10-inch minimum inside diameter, 40.48 pounds per foot steel pipe conforming to ASTM A 53, Grade B, coated with zinc inside and outside by the hot-dip process with no less than 1.8 ounces per square foot. Each section of column shall have 8 threads per inch, 3/16 inch taper with ends accurately machined to form a butt joint to insure an accurately assembled column length and perfect alignment. The pipe shall be furnished in interchangeable sections of not more than 20 feet in length.

2. Discharge Column Couplings: The pipe shall be furnished to interchangeable sections 20 feet nominal length with lathe cut threads and shall be fastened with threaded-sleeve type couplings. The joint connection shall insure proper alignment

3. Shaft Enclosing Tube: The shaft enclosing tube shall be of ASTM A53, Grade B, Schedule 80, extra strong steel pipe, in interchangeable sections not more than 5 feet length, accurately machined and threaded. The ends of the tube shall be square with the axis. The maximum angle error of the thread axis relative to the bore axis shall be 0.001" per inch of thread length. The shaft enclosing tube shall be stabilized in the column pipe by steel cored rubber centering spiders, located at 20-foot intervals.

4. Line Shaft Bearing: The combination line shaft bearings and shaft enclosing tube couplings shall be of continuous cast bronze alloy conforming to ASTM B-584, alloy C83600, spaced not more than 5 feet apart and threaded left-hand to prevent unscrewing during pump operation. The maximum angle error of the thread axis to the bore axis shall be within 0.001" per inch of thread length. The concentricity of the bore to the threads shall be within 0.005" total indicator reading. Each bearing must contain a sediment trap to prelude dirt and rust from being washed down

through other bearings and oil grooves which will readily allow the oil to flow through and lubricate the bearings below.

5. Line Shaft. The line shaft shall connect the head shaft to the impeller shaft. The line shaft shall be ground and polished No. 416 stainless steel conforming to ASTM A582, of the size called for in these specifications. The line shaft shall be furnished in interchangeable sections of not more than 20 feet in length. To insure accurate alignment of the shafts, they shall be factory certified straight within 0.005 inch total indicator reading for a 10-foot section; the butting faces shall be machined square to the axis of the shaft; the maximum permissible error in the axial alignment of the threaded axis with the axis of the shaft shall be 0.002 inch in 6 inches.

6. Line Shaft Coupling. The individual sections of the line shaft shall be connected with ASTM A582, Type 416, stainless steel couplings. The coupling shall be designed with a safety factor of 1-1/2 times the shaft safety factor and shall be threaded to tighten during pump operation without distortion or vibration.

7. Sounding Tubes. Two sounding tubes for measuring water levels in the well shall be furnished and installed by the pump contractor together with sufficient stainless steel straps (minimum width 3/4-inch) and rubber cushions to fasten the tubes to the discharge pipe column at intervals not exceeding 10 feet. Tubes shall be 1-1/4 inch polyvinyl chloride pipe, schedule 80 with threaded connections (solvent welding male/female adapters will not be acceptable). The tube shall be accurately measured as to depth of setting when installed. The lower end of the tube is to be set at the top of the bowl assembly. All joints shall be sealed with teflon tape or an approved equal.

C. Discharge Head Assembly: The discharge head assembly shall consist of a head base plate, surface discharge head and head shaft.

1. Head Base Plate. A base plate, of sufficient area and thickness to support the weight of the entire pumping unit, shall be furnished for mounting the surface discharge head. The base plate shall be fabricated steel construction, free from detrimental defects and conform to ASTM A-283, Grade D or cast iron, ASTM A48, Class 30, free from blow holes, sand holes and all other detrimental defects. The base plate shall be accurately machined, drilled and rabbetted to fit the discharge head and shall be properly fitted as a permanent part of the concrete pump foundation to prevent the entrance of water into the well. The opening of the base plate shall be of sufficient size to allow the installation of the pump bowl assembly, the discharge column assembly, the well level recorder pressure sensor assembly, and the DLNR monitoring sounding tube assembly. The base plate shall be made to mount directly onto the sanitary ring set on the well casing extension (increaser) with suitable sealing gasket.

2. Surface Discharge Head. The surface discharge head shall support the driver, the discharge column assembly and the pump bowl assembly and shall discharge water from the discharge column assembly. The discharge head shall be accurately machined, of fabricated steel construction, free from detrimental defects and conform to ASTM A-283, Grade D or cast iron ASTM A48, Class 30, free from blow holes, sand holes and all other detrimental defects. The discharge head shall incorporate a discharge elbow having an above ground, ANSI B16.1, Class 125, flanged outlet.

The discharge head shall have following NPT stubs or taps between the space between the well casing the pump discharge column to allow passage the following:

a. Two (2) 1-1/4" N.P.T. taps for the well sounding tubes for level recorder pressure sensor assembly and DLNR monitoring tube assembly.
b. One (1) ¾ or 1" NPT for the Well Vent.

One (1) ¾" NPT for the discharge head drain.

The discharge head shall be provided with the manufacturer's single cartridge mechanical seal suitable to this oil lubrication pump application. The mechanical seal and seal adaptor plate shall be constructed of 316 stainless steel or better material. The pump supplier shall provide complete shop drawings for the mechanical seal and include the necessary oil-lube water piping and fittings to properly install the seal to the pump pre-lube system. Stainless steel removable screens shall be provided at the coupling guard openings. The single cartridge mechanical seal shall be Chesterton, Model 155 seal or approved equal.

The discharge head shall be provided with the manufacturer's standard oil lubricated stuffing box assembly with a solenoid operated sight drip feed, 120 volts AC, and separate manual by-pass operated sight drip feed system with necessary copper tubing to an external oil reservoir.

3. Head Shaft. The head shaft shall connect the line shaft to the driver. The head shaft shall be of ASTM A582, Type 416 stainless steel which shall not exceed 10 feet in length. A suitable method shall be provided, on the top of the head shaft, to allow impeller adjustment by means of an adjusting nut. The nut shall be provided with a positive locking device. Straightness and machining tolerances shall be given under the "Line Shaft" section of these specifications.

4. Oil Lubrication System Reservoir. The oil lubrication system for the pump shall be provided with a 55-gallon steel reservoir, in lieu of the standard size reservoir normally provided with the oil lubricated pumps. An oil filter shall be installed on the feed line from the reservoir to the pump unit. The tank shall be mounted on its own stand and bolted to the pump pad adjacent to the discharge head. Mounting height shall be such that it allows gravity feed to the oil lubrication system on the discharge head.

The contractor shall submit five (5) copies of shop drawings showing the installation to the oil lubrication system on the discharge head and include the oil reservoir supports and braces. Shop drawing must be approved before the ordering of any materials. The Contractor shall coordinate this work with the pump contractor to insure proper installation of the oil reservoir.

2.2.3 Pump Motor: The pump motor shall be a weather protected Type I enclosure and be of the proper size to drive the pump continuously over the complete head range without the load exceeding the motor capacity. The motor shall be a cast iron normal torque, low starting current, drip proof, vertical, hollow shaft, squirrel cage induction motor with NEMA weather protected Type I enclosure and shall conform to the standards of the National Electrical Manufacturers Association and the American Institute of Electrical Engineers. The motor shall be General Electric, Westinghouse or approved equal. The motor shall be designed for reduced voltage auto transformer starting.

The motor shall have a horsepower rating and service factor as specified and shall be designed to operate at an ambient temperature of 40º C. with a temperature rise of not more than 80º C. at the rated horsepower of the motor.

Motor windings shall be encapsulated or sealed with epoxy according to NEMA standards by an insulation system such as Custom Polyseal or approved equal. The motor shall have an efficiency of not less than that specified when operated at the rated horsepower of the motor.

Corrosion-resistant screens over air inlet and air outlet openings shall be furnished with the motor. Each motor shall be furnished with 115 volt space heaters which shall operate only when the motor is not running.

The bearing in the motor shall be oil lubricated. The motor thrust bearings shall have ample capacity to carry the thrust loads of the pump thrust and weights of the pump shaft and pump rotating element with pump operating at shutoff head conditions. The thrust bearing shall be of such size that the average life rating is based on five years of continuous operation. It shall also have ample capacity to permit the pump to operate for 10-minute periods with the discharge valve closed. High capacity motor thrust bearing shall be provided with cooling system from pump discharge piping. The Pump Contractor shall coordinate with the site contractor to connect the motor water cooling and drain system to comply with motor manufacturer requirements.

PART 3 - EXECUTION

3.1 SUBSTITUTION OF SPECIFIED PUMP: If a specified pump model has been used to dimension plans and specify pump performance characteristics, a substitute pump can be used only if the following conditions are met:

A. All changes in dimensions resulting from the substitution of the specified pump shall be the responsibility of the Contractor and such changes must be approved by the Engineer.

B. The substitute pump must have performance characteristics equal to or better than the specified pump. Specific performance characteristics that shall be compared are the required horsepower, efficiency and head-capacity curve.

C. The Engineer must approve the substitution before the substitute pump is ordered.

3.2 PRELIMINARY SUBMITTALS: The Contractor shall submit six copies of the following to the Engineer and the OWNER for review and approval prior to ordering of the pump unit:

A. Preliminary Pump Characteristic Curves: (Overall Characteristics) The preliminary pump characteristic curves shall show the head, efficiency and brake horsepower vs. capacity of the pump to be furnished.

B. Pumping Unit Specifications: The Contractor shall submit complete specifications for the pump and motor he proposes to furnish. All pumping unit material shall be specified.

C. Thrust Load Curves: The Contractor shall supply with his proposal a curve showing the thrust load from shutoff head to the pump rated head. The rating of the thrust bearing being furnished with the motor shall be shown as part of the data on the curve.

D. Bowl Assembly Data. Bowl Assembly data shall contain thrust factor, available lateral end clearances, all required clearances and computations of relative shaft stretch at shut off head and at other point specified.

E. Data Sheets. The Contractor shall complete a copy of the attached pump and motor data sheets and submit them with the submittals.

3.3 FACTORY LABORATORY PUMP TEST: The Contractor shall submit six (6) factory certified copies of the performance curves and test data sheets of a factory laboratory running test conducted for each bowl assembly furnished and witnessed by an independent engineering firm. The curves and data sheets must be approved by the Engineer and Owner before the pump is shipped. The running test shall be conducted in accordance with the latest edition of ANSI B 58.1 to show that the specified conditions can be met by the bowl assemblies furnished. The performance curve shall show the head-capacity, efficiency-capacity and required brake horsepower capacity curves for each bowl assembly.

The required pump test acceptance grade meet or exceeds ANSI/HI 14.6. Corresponding tolerance band shall be Grade 1U.

The Contractor shall make the necessary changes and replacements to obtain the required performance characteristics before the pumping unit including pump motor, leaves the factory. All costs for such changes and replacements will be paid for by the Contractor. The cost for all laboratory tests shall be paid for by the Contractor.

3.4 CERTIFICATION OF DISCHARGE COLUMN PIPE: The Contractor shall submit to the Owner's Representative, before the pump is installed, a certificate verifying the following:

A. The thickness of the discharge column pipe furnished is as specified.

B. The pipe supplied conforms to ASTM A53, Grade B, as specified.

C. The pipe has been coated with zinc inside and outside by the hot-dip process.

3.5 CERTIFICATION OF LINE SHAFT AND LINE SHAFT COUPLING MATERIAL: Before the pumping units are installed, the Contractor shall submit to the Owner's Representative certificates verifying that the line shaft and line shaft couplings are made from Type 416 stainless steel material. The Contractor shall submit a certificate verifying the line shaft alignment to be straight within 0.005 inch total indicator reading for a 10-foot section.

3.6 LAYOUT DRAWINGS: Five sets of pump and piping layout drawings shall be submitted for approval to the Owner's Representative prior to construction. All dimensions of pump, column, fittings and appurtenances shall be shown.

3.7 CHECKING OF EXISTING WELL: Checking of the existing well shall be done by a well driller holding a current C-57 Well Drilling Specialty License from the State of Hawaii. The well driller shall check the existing well for silting, caving-in and foreign materials before installing the pumping unit. The testing procedure must be approved by the Owner's Representative prior to starting. A written report stating the results of the test shall be submitted to the Owner's Representative after completion of testing.

3.8 INSTALLATION OF VERTICAL TURBINE PUMP: Installation of the vertical turbine pump shall be done by a pump installer holding a current C-57a Pump Specialty License from the State of Hawaii, under the direction of the supplier of the equipment. The equipment shall be installed only in the presence of the Owner's Representative.

The pump installer shall have a minimum of five years experience in the installation, testing, maintenance and repair of vertical turbine deep well pumping units of similar capacity, head, setting and horsepower as the pumping units specified. The pump installer shall also have nearby plant facilities and equipment to immediately repair the pumping units, should an emergency arise.

3.9 PUMP COLUMN WARRANTY: The Contractor shall guarantee the pump column assembly covered by these specifications against any defective material and workmanship for one year from the date of column assembly's actual installation, testing, and acceptance by the Owner. Contractor's obligation under this warranty shall be to replace and correct all defective parts at no cost to the Owner, including removal and reinstallation of the necessary parts in the pump column assembly. The cost to remove and subsequently re-install the pump unit in the well is specifically included should the pump failure be caused by defective pump column assembly installation or material failure.

3.10 INSTALLATION INSTRUCTIONS AND MAINTENANCE MANUAL: The pump manufacturer shall also provide at least 5 copies of the instructions for the installation of the pumping units and proper maintenance. The manual shall include drawings of the pump describing its individual components and its material list.

3.11 CHLORINATION: After the pump has been acceptably installed and tested the Contractor shall chlorinate and flush the well, pump, and piping by injecting a chlorine solution in accordance with AWWA A100. The chlorination, testing and flushing procedure shall be repeated as required by the Owner. The chlorination, testing and flushing procedures shall be submitted to and approved by the Owner prior to action. A copy of all disinfection test results shall be submitted to the Owner for approval.

The Contractor shall be responsible for proper disposal of chlorinated water to safeguard public health and the environment in accordance with Department of Health regulations.

3.12 TEST OF PUMPING UNIT: After installation of all machinery and other equipment in the well, a complete operating test of the pumping unit and other equipment shall be made over a minimum period of eight (8) hours.

Before the operating test is run, the Owner's Representative shall test a bacteriological sample from the well. The Contractor shall allow the Owner's Representative 48 hours to determine the results of this test. If the sample shows presence of coliforms, the Contractor shall chlorinate and flush the well, pump, and piping by injecting a chlorine solution approved by the Owner's Representative. The testing, chlorination and flushing procedure shall be repeated as required by the Owner.

Throughout the operating test, the pumping unit shall run smoothly without vibration or heating of the bearings. If, during or as a result of this test, any structural or mechanical defect or weakness develops, or if the equipment fails to deliver its required conditions, the Owner's Representative reserves the right to reject any part or all of the equipment and demand reconstruction or replacement to meet the requirements of these specifications.

After the operating test has been completed to the satisfaction of the Owner's Representative, a field pump efficiency test shall be performed on the installed pump unit. This efficiency test shall be made in accordance with ANSI B58.1, latest edition. The capacity of each pumping unit shall be tested under the head-capacity conditions specified.

The Pump Contractor shall furnish all testing instruments, water pressure gages, calibrated voltmeter, power analyzer, water level sounder, and all other equipment required for the pump efficiency test, which are not available in the permanent pump control equipment.

The overall pumping unit efficiency is defined as and will be determined by dividing the water horsepower at the measuring devices near the discharge elbow or pipe by electrical input horsepower at outlet of the motor control center.

Water horsepower shall be computed by the following formula:

$$whp = \frac{H \times Q}{3{,}960}$$

where: H = Distance in feet from the well's dynamic water level to the center of the discharge flange of the pump plus the discharge pressure in feet measured at sampling cock between the discharge head and main line check valve plus the velocity head in feet ($V^2/2g$).

Q = Discharge in gallons per minute.

Electrical input horsepower shall be computed by the following formula:

$$P = \frac{1.732 \times I \times E \times P.F.}{746}$$

where: I = amperes (Meter Reading)
E = volts (Meter Reading)
P.F. = Power Factor (To be provided by the Manufacturer's Motor Specification)

The quantity of water delivered shall be based on readings of the flow meter. No special calibration will be made. Tests shall be made with electric current normally furnished by the Hawaiian Electric Co., Inc. or Owner-furnished generator. No adjustment of the electrical power will be allowed. Should the test for efficiency for the pumping unit result in an overall efficiency of less than that specified at the guaranteed capacity and head point, the Contractor shall make the changes and replacements necessary to obtain this required overall efficiency, and the cost of all such changes and replacements, and of any additional test required, shall be paid by the Contractor.

During the period between the first test and the final acceptance of the pumping unit by the Owner, the units shall be left in place and in good working condition for use by the Owner in order to provide service, if required and at no additional cost to the Owner.

If the pumping is capable of pumping the rated capacity under normal operating conditions, the efficiency test may be waived at the option of the Owner.

PUMP DATA SHEET

Manufacturer:
Pump No.
Operating Pump Speed: RPM
Number of Stages:
Diameter: Inches
Thrust Constant (K):
Shaft Diameter: Inches
Shaft Enclosing Tube: Inches
Discharge Column: Inches
Suction Size: Inches
Discharge Head Model No.
Impeller Weight (Each): Lbs.
Total Length of Pump: Feet Inches
(Top of Pump Bowl to Bottom of Suction Strainer)
Total Weight of Pump: Lbs.
(Including column, shaft, and tubing; excluding discharge head)
Pump Laboratory Efficiencies:
At Design Conditions: Field Head Range to Feet
Minimum Capacity: GPM
Minimum Bowl Efficiency: Percent
Minimum Overall Efficiency: Percent
At Maximum Overall Efficiency:
Efficiency: Percent
Capacity: GPM
Total Dynamic Head: Feet
Operating Horsepower: (Submit Calculations)
At Design Head Range: H.P.
At Shut-Off Head: Feet H.P.
At Zero Head @ Discharge Head: H.P.
Total Downthrust: (Submit Calculations)
At Design Head Range: Lbs.
At Shut-Off Head: Lbs.
Shaft Stretch: (Submit Calculations)
At Design Head Range: Inch
At Shut-Off Head: Inch
Maximum Lateral Allowed:

MOTOR DATA SHEET

Manufacturer:
Vertical or Horizontal, Solid or Hollow Shaft:
Coupling:
Type:
Type of Enclosure:
Nameplate Horsepower: H.P.
RPM at Full Load: RPM
Phase: Phase
Frequency: Hertz
Voltage: Volts
Full Load Amperes: Amps
Locked Rotor Current: Amps
Power Factor - 100% Load:
- 75% Load:
- 50% Load:
Efficiency - 100% Load: Percent
- 75% Load: Percent
- 50% Load: Percent
NEMA Code Letter:
Frame Designation:
Weight: Lbs.
Length: Feet Inches
Service Factor:
Nameplate Temperature Rise Degree C/Ambient Temperature Degree C:
Insulation Class and Added Process:
Thrust Bearing:
Sleeve or Ball:
Type of Lubrication:
Capacity - Up Lbs.
- Down Lbs.
Space Heaters: No. Volts Watts
Guards - Material:

SECTION 43 24 28 - PUMP DISCHARGE UNIT AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION: The work under this section of the specifications includes all labor, materials, equipment and services necessary to install the pump discharge unit and appurtenances for Waikoloa Well No. 8.

A pump discharge valve unit includes a pump control valve, a pump discharge check valve, a pump vacuum release check valve, flow meter, well level sensor, well concrete pump pad, well column increaser, and all necessary piping and appurtenances, shall be furnished for pumping unit as shown on the plans.

The Contractor shall be responsible for coordinating with the deep well pump unit contractor and electrical contractor to insure proper installation of the pump discharge unit.

1.2 REFERENCE: The work under this section is specified in the following applicable sections of the Water System Standards, State of Hawaii, 2002,

Section 202	-	Ductile Iron Pipe, Fittings and Appurtenances
Section 205	-	Valves and Appurtenances
Section 207	-	Cast Iron Manhole Covers, Frames, Rungs, Eyebolts, Meter Box and Valve Box Covers and Frame and Standpipe
Section 302	-	Water Mains and Appurtenances

and in the following sections of the Standard Specifications for Public Works Construction, September 1986,

Section 39	-	Portland Cement Concrete
Section 40	-	Concrete Structures
Section 43	-	Concrete Blocks, Cradles and Jackets
Section 48	-	Reinforcing Steel

all of which shall herein be referred to as Standard Specifications.

All references to measurement and payment in the Standard Specifications shall be deleted.

All references to "Engineer" in the Standard Specifications shall be replaced by "Owner's Representative".

PART 2 - PRODUCTS

A. Pump Control Valve:

1. Number Required: One (1) Rubber Seated Butterfly Valve with Electric Valve Actuator

2. Size of valve: 8 inches

3. Minimum pressure rating of valve: 150 psi

4. Minimum differential pressure valve shall be capable of operating against: 50 psi

5. Class of flanges valve shall be mounted between: ANSI B16.42, Class 150 psi

B. Pump Discharge Check Valve:

1. Number Required: One (1)

2. Size of valve: 8 inches

3. Minimum pressure rating of valve: 150 psi

4. Class of valve flange: 150 lb., ANSI B16.42

C. Pump Vacuum Release Check Valve:

1. Number Required: One (1)

2. Size of valve: 8 inches

3. Minimum pressure rating of valve: 150 psi

4. Class of valve flange: 150 lb., ANSI B16.42

2.1 PLAN OF OPERATION OF PUMP DISCHARGE VALVE UNIT: The pump discharge valve unit shall be designed to (1) release air in the pump discharge column on starting up, and (2) break the vacuum in the pump discharge column as the water drops back when shutting down.

The pump control valve shall be full open with the pumping unit stopped. After the pump is started, the electric valve actuator (a part of the pump control valve) shall be energized by the sequence timer (timer adjustable from 0 to 10 minutes), which will close the control valve. Prior to the valve closure, the air and the initial inrush of water from the pump column shall be expelled through the pump control valve. As the pump control valve moves from its open position to closed position, it allows the pump discharge check valve to open. Time delay relays (timer adjustable from 0 to 5 minutes) shall be provided to shut down the pumping unit should either the pump control valve or the pump discharge check valve fail to allow water flow after pump control valve shuts.

When the pump is to be shut off, the pump control valve is actuated into its full open position, upon which the pump is shut down. Should the water, on falling back into the well, create a vacuum in the pump discharge column, the vacuum release check valve opens and breaks the vacuum. Time delay relays shall be provided to shut down the pumping unit should the shutting down sequence take longer than 0 to 5 minutes.

2.2 PUMP CONTROL VALVE AND APPURTENANCES: This section of the specifications covers the pump control valve which consists of a rubber seated butterfly valve and an electric valve actuator.

A. Rubber Seated Butterfly Valve: The flanged, rubber seated butterfly valve and handwheel operator shall conform in all respects with AWWA C504-74, Class 150B, unless otherwise stated in these specifications. The valve shall be Allis-Chalmers, American Valve & Hydrant, Clow, Mueller, Dezurik, or approved equal.

The valve shall be designed for a minimum operating pressure of 150 psi. The rubber seat shall be of new natural or synthetic rubber and shall be of a design which permits their replacement at the site of installation.
The manufacturer's name and catalog number shall be molded or stamped on the valve where it can be easily seen after the valve is installed.

B. Electric Valve Actuator: The electric valve actuator shall open and close the rubber seated butterfly valve for the pump control system on the deep well pump.

1. Description: The electric valve actuator shall consist of a high torque reversible motor, self-locking reduction gearing, end of stroke limit switches, mechanical torque sensing switch, a declutchable handwheel device, end of stroke adjustable mechanical stops, all as a self-contained unit.

2. Actuator Sizing: The actuator shall be sized and selected against valve operating torque values and safety factors stated by the valve manufacturer. The sizing shall be based on the maximum torque encountered during the stroke of the valve when operating under maximum working pressure rating conditions.

3. Actuator Output: The output of the actuator shall be of a hollow bored design supplied with a bushing adapter suitable for removal and machining by the valve manufacturer, in order to insure proper fit with the valve stem.

4. Enclosure: The actuator enclosure shall be of cast aluminum construction designed to meet NEMA IV, watertight requirements.

5. Electric Motor: The motor shall be reversible and be of the induction-type designed for 120 volts or 230 volts, 1 phase, 60 HZ supply. Motor insulation shall be Class "F" and be protected by means of thermal switches imbedded in the motor windings. Motor bearings shall be of the permanently sealed type.

6. Reduction Gearing: The actuator shall be a double reduction unit consisting of self-locking worm gear drives suitable for maintaining valve position in the event of electric power failure. The worm shall be hardened alloy steel and the worm gear shall be of alloy bronze. All power gearing shall be grease lubricated.

7. Limit Switches: The actuator shall be equipped with four gear train limit switches with 16 contacts, a total minimum of three sets of normally open and three sets of normally closed contacts at each end of travel. Switches shall be S.P.D.T., snap action type, totally enclosed and rated for 120 VAC service. Verify the amount of limit switches that will be used by the pump control system.

8. Torque Switch: The actuator shall be equipped with a double acting torque switch which is to be responsive to loads encountered in either the opening or closing direction. The torque switch shall operate during the complete valve

cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be wired to shut off the actuator motor in the event excessive loads are encountered during travel.

9. Handwheel Operation: A handwheel shall be provided for manual operation. The handwheel shall not rotate during motor operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operation and shall remain in motor operation until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically but not electrically.

10. Position Indication: The actuator shall be supplied with local visual indication of valve position.

11. The electric valve actuator shall be AUMA Electric Actuator, SG series or approved equal. The Contractor shall submit calculations for sizing/selection of actuator unit for this application with shop drawings.

2.3 PUMP DISCHARGE CHECK VALVE: The pump discharge check valve shall be flanged, center guided check valve, Combination Pump Valve, APCO, Valmatic, Metraflex, or approved equal. The valve body shall be semi-steel or cast iron with bronze trim, stainless steel spring and bronze bushed center guides. The valve shall be installed on the discharge line of each pump.

2.4 PUMP VACUUM RELEASE CHECK VALVE AND APPURTENANCES: The pump vacuum release check valve shall be a flanged, soft seated, center guided check valve, Combination Pump Valve, APCO, Valmatic, Metraflex, or approved equal. The valve body shall be semi-steel or cast iron with bronze bushed center guides. The valve shall be provided with a resilient seat to provide "bubbletight" sealing.

The Contractor shall provide the necessary appurtenances to install well air vent screen as detailed in the plans, well air vent relief line to discharge head, and be responsible to make the connections to the pump unit. The Contractor shall be responsible to coordinate the connection with the pump unit supplier.

2.5 TURBINE METER AND FLOW TRANSMITTER:

A. Description: This section of the specifications includes the furnishing and installation of one turbine meter with high speed pickup register, cast iron strainer, and flow rate indicator/totalizer.

1. Number required: One (1)

2. Meter and strainer size: 8 inches

3. Class of meter and strainer flange: USAS B 16.1, 150 lb.

4. Register: 1,000 gallons (per sweep-hand revolution)

5. Totalization: 1,000,000,000 gallons (6-wheel odometer)

6. Location: As Shown on Plans

7. Neptune Model No.: HP Turbine

B. Turbine Meter: The turbine meter shall be Neptune High Performance (HP) meter with magnetic drive or approved equal. The meter has a two-piece bronze case with internal molded straightening vanes as part of the inlet hub.

The meter is rated at 100%± 1.5 accuracy over its normal operating range of 35 to 4000 gpm. Maximum operating pressure is 150 psi.

Strainer shall be HP Neptune made with a lead free, high copper alloy and AWWA approved strainer with a stainless-steel screen installed immediately upstream of the meter.

C. Flow Transmitter: The meter shall be equipped with a Flow Transmitter, manufactured for Neptune HP meters, which utilizes solid state electronic circuitry to develop a high-frequency pulse and a 4-20mA signal that is proportional to flowrate through the meter. The flow transmitter shall be Neptune Model Tricon-E.

The transmitter shall provide a 4-20 mA analog signal output proportional to flow rate; 600 ohms maximum impedance. The transmitter unit shall be tested with the meter and calibrated prior to field installation. The Contractor shall also confirm the unit output and power requirements with the SCADA system and provide the necessary appurtenances for meter installation.

2.6 WELL WATER LEVEL SENSOR INSTALLATION:

A. Well Level Sensor: The Contractor shall furnish and install a submersible water level sensor into one of the sounding tubes to measure well water level. The sensor shall be directly powered by the well water level system and also provide the same water level information to the SCADA system. The pump contractor shall coordinate this installation with the Site Contractor to insure proper installation of the Well level sensor to the SCADA system.

1. Number Required: One (1)

2. Pressure Range: 0 - 30 psi

3. Accuracy: + 1.0% of span

4. Input: 15/45 volts DC

5. Output: 4-20 mA

6. Body: 316 stainless steel

7. Sensor Fill Fluid: Silicone 200

8. Sensor Diameter: 0.690 inches

9. Cable Length: TBD feet.

The submersible water level sensors shall be specially designed transducers to meet the harsh environments encountered in industrial, municipal and pressure and/or depth measurements. The electronic sensor shall be enclosed in a 316 SS housing, isolated from the process liquid by a 316 SS diaphragm. These sensors incorporate an isolated solid state piezo-resistive pressure transducer which provides excellent linearity, repeatability and low hysteresis. The cable for the sensor shall be 20 GA polyethylene jacket, insulated and shielded cable unspliced for the full length from the well to the well level recorder. The Contractor shall install the well sensor cable without kinks to ensure the air breather passage is not closed. The sensor shall be similar or better in all respects to the Pressure Systems, Inc., KSPI Series 300 submersible level sensor or approved equal.

B. Well Level Transmitter Cable

1. At Well Pad.

Provide ducts and cable support connection according to the plans and details. The sensor cable and support steel cable (if applicable) shall not be kinked to insure the cable air breather in not closed. If stainless steel cable is utilized the contractor shall modify the cable support detail to accommodate the SS cable. Provide flexible long radius bends (minimum 3 inches) to the junction box on the pad. Leave a coil of cable in the junction box before pulling cable to control building.

2. Outside of Well.

The cable shall be installed between the well and SCADA system in a 1-inch minimum PVC electrical conduit pipe as shown on the plans. The contractor shall incorporate 6-inch minimum long radius bends to reduce cable kinks to the pad junction box and transition to the electrical junction box.

3. In the Well.

The sensor, sensor cable and support steel cable (if applicable) shall be suspended within a 1 ¼ inch PVC, Schedule 80 (ee plans) sounding tube which shall be strapped to the pump pipe column. The tubing and cable shall have sufficient counterweight to overcome any buoyant forces. The sensor shall terminate at the elevation (bottom of sounding tube) as shown on the plans. If a stainless support cable is utilized the sensor cable shall be taped at 20-foot minimum intervals to the support cable with electrical tape.

2.7 FLOW SWITCH:

A. General Description: This section of the specifications covers the furnishing and installing of the flow switch and appurtenant equipment.

1. Number required: One (1)

2. Pipe size: 8 inches (discharge line)

3. Vane area: 2.0 square inches

4. Location: As shown on plans

B. Flow Switch: The flow switch shall be a Flotect, 1-1/2 inch Model V4 vane operated, magnetically actuated flow switch as manufactured by W.E.Anderson, Inc., Kansas City. The flow switch shall operate on 120-volt, 60 Hertz power, and be provided with internal space heater.

2.8 PRESSURE SWITCH: The pressure switch shall have an adjustable operating range of 12 to 150 psig, overrange pressure of 350 psig and adjustable deadband of 6 to 30 psig. The switch unit shall be enclosed in an epoxy painted, steel watertight NEMA 4 enclosure. The pressure switch shall have copper alloy bellow with a 2-circuit contact block (SPDT) and external snubber. The pressure switch shall be similar in all respects to the Allan-Bradley Bulletin 836T-T253J pressure switch or approved equal.

2.9 PRESSURE GAGE: The diameter of the dial shall be 3-1/2 inches with a standard pressure range of 0 to 100 psi or as specified on the plans and a 1 percent full scale accuracy ASME Grade 1A. The gage shall be made with an all-welded stainless-steel construction. Gages shall be furnished with 1/4" NPT male bottom connections. Pressure snubbers shall be furnished with all gages and pressure instruments and shall be RAY or approved equal.

2.10 WELL CASING INCREASER: The Contractor shall be responsible for providing the well casing increaser shown on the plans. The increaser shall be installed before the well concrete pad is poured. It shall be made of the same material as the steel well casing or better material and welded to the elevation shown on the plans. The increaser upper diameter shall be coordinated with the Pump Contractor to insure it matches the access diameter on the pump discharge head (provided by Pump Contractor). The Contractor shall also coordinate the installation of the pump base plate (provided by Pump Contractor) for location on anchor bolts to be set into the well concrete pad.

2.11 ELECTRIC MOTOR THRUST BEARING COOLER: The Contractor shall provide all copper pipe, fittings and valves necessary to install the thrust bearing cooling lines as shown on the plans. The Contractor shall coordinate with the pump supplier the motor specifications and provide shop drawings for the cooling lines.

2.12 FLANGED PIPE AND FITTINGS:

A. Ductile Iron Flanged Pipe: Flanged pipe shall be of ductile iron manufactured in compliance with ANSI Specification A21.51.

1. The minimum class thickness for ductile iron flanged pipe shall be ANSI A21.51 Class 52 unless otherwise noted.

2. Flanges shall be of ductile iron. Threaded flanges shall be in accordance with ANSI A21.15, Class 125 or 250, as called for by the plans.

3. Flanged pipe shall have either integrally cast or threaded flanges but not a combination of both.

B. Cast Iron Flanged Fittings: Cast iron flanged fittings shall conform to ANSI A21.10 with flanges faced and drilled in accordance with ANSI B16.1-1975 Class 125, or Class 250 as called for by the plans.

C. Cement Mortar Lining: All flanged pipe and fittings shall be cement mortar lined in accordance with ANSI A21.4. Interior linings shall have ends tapered and sealed with a bituminous coat.

D. Gaskets: Gaskets for all flanged joints shall be 1/16" thick duct inserted rubber packing, Garlock No. 19, or approved equal. A 1/8" thick gasket may be used in place of the 1/16" gasket specified above. If the thicker gasket is to be used, it must be noted on the piping layout drawings submitted to the Owner's Representative for approval with the appropriate changes made in piping lengths. The design and materials of the substitute gasket must be approved by the Owner's Representative.

E. Steel Nuts and Bolts: Flange nuts and bolts shall be Silicon Bronze an accordance to ASTM B-98 or Type 302, 303, or 304 (ASTM A-276) stainless steel bolts and nuts.

F. Layout Drawings: Five (5) sets of piping layout drawings shall be submitted for approval to the Engineer prior to construction. All dimensions of valves, piping, fittings, and appurtenances shall be shown.

G. Approvals Required for Flanged Pipe and Fittings: The manufacturer and details of the flanged pipe and fittings must be approved by the Engineer before the piping layout drawings are submitted to the Engineer for approval.

2.13 GATE VALVE: The gate valve supplied by the Contractor shall be of the size indicated on the drawings. It shall be equipped with a handwheel, outside stem and yoke, and shall conform to the Department of Water Supply’s Water System Standards.

END OF SECTION