

State of Hawaii  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
DIVISION OF BOATING AND OCEAN RECREATION  
Honolulu, Hawaii

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Suzanne D. Case  
Chairperson

**CONTRACT SPECIFICATIONS AND PLANS**

Job No. B78CO74A  
Heeia Kea Small Boat Harbor Wastewater System Improvements  
Installation of Absorption Bed System  
Kaneohe, Oahu, Hawaii

May 2020

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Approved: \_\_\_\_\_



ED UNDERWOOD

Administrator

Division of Boating and Ocean Recreation

Approved: \_\_\_\_\_



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Engineering Branch Head

Division of Boating and Ocean Recreation

May 2020

CONTENTS

NOTICE TO BIDDERS .....	iii
INFORMATION AND INSTRUCTIONS TO BIDDERS .....	I-1
SPECIAL PROVISIONS.....	SP-1
TECHNICAL SPECIFICATIONS.....	S-1
PROPOSAL (Bound Separately))	
PLANS (Bound Separately)	
DEPARTMENT OF LAND AND NATURAL RESOURCES INTERIM GENERAL CONDITIONS, DATED OCTOBER 1994. (Bound separately)	
AG-008 103D General Conditions (Bound Separately)	

## **NOTICE TO BIDDERS**

(Chapter 103D, HRS)

COMPETITIVE BIDS for **Job No. B78CO74A Heeia Kea Small Boat Harbor Wastewater System Improvements Installation of Absorption Bed System, Kaneohe, Oahu, Hawaii** shall be submitted to the Department of Land and Natural Resources, Division of Boating and Ocean Recreation, Engineering Branch on the specified date and time through the State of Hawaii e-Procurement System (HIePRO). HIePRO is accessible through the State Procurement Office website at [www.spo.hawaii.gov](http://www.spo.hawaii.gov).

The Department of Land and Natural Resources Interim General Conditions, dated October 1994, as amended is available on request; and the General Conditions – AG008, latest revision shall be made a part of the specifications. Electronic copies of the General Conditions is available on the State Procurement Office website.

The purpose of this Invitation for Bids (IFB) is to award to a Contractor work that shall include, but not be limited to, construction of an absorption bed system for a new wastewater treatment plant at Heeia Kea Small Boat Harbor, Kaneohe, Oahu, Hawaii, and appurtenant work.

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

The estimated cost for this project is \$1,000,000.

All interested parties are encouraged to conduct a thorough site visit prior to bidding. A non-mandatory pre-bid conference will be held via teleconference on May 18, 2020 at 9:00 A.M. All interested bidders may call into (808) 587-0374 to participate in the pre-bid conference.

As a condition for award of the contract and final payment, the vendor shall provide proof of compliance with the requirements of 103D-310(c) HRS. Proof of compliance/documentation is obtained through Hawaii Compliance Express (HCE). Vendors shall register in Hawaii Compliance Express (HCE), a program separate from HIePRO. The annual subscription fee to utilize the HCE service is currently \$12.00. Allow 2 weeks to obtain complete compliance status after initial registration. It is highly recommended that vendors subscribe to HCE prior to responding to a solicitation. The vendor is responsible for maintaining compliance. If the vendor does not maintain timely compliance in HCE, an offer otherwise deemed responsive and responsible may not be awarded.

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

The Engineering Branch Head is responsible for administering and overseeing the Contract, including monitoring and assessing contractor performance.

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

Should there be any questions, please use the question and answer section of the HIePRO solicitation.

# INFORMATION AND INSTRUCTIONS TO BIDDERS

## CONTENTS

		<u>Page</u>
A	Project Location and Scope of Work .....	I-2
B	Sealed Proposals .....	I-2
C	General Conditions .....	I-2
D	Proposal Form .....	I-2
E	Omissions or Erasures .....	I-2
F	Notice of Intent to Bid and Questionnaire .....	I-2
G	Bid Security .....	I-2
H	Contractor's License Required .....	I-2
I	Irregular Bids .....	I-3
J	Withdrawal of Bids .....	I-3
K	Successful Bidder to File Performance and Payment Bonds .....	I-3
L	Number of Executed Original Counterparts of Contract Documents .....	I-3
M	Change Orders .....	I-3
N	Wages and Hours .....	I-3
O	Permits .....	I-3
P	Property Damage .....	I-4
Q	Time .....	I-4
R	Bidder's Responsibility to Provide Proper Superintendence .....	I-4
S	Liquidated Damages .....	I-4
T	Hiring of Local Labor .....	I-4
U	Water and Electricity .....	I-4
V	Public Convenience and Safety .....	I-5
W	Work to be Done Without Direct Payment.....	I-5
X	As-Built Drawings .....	I-5
Y	Asbestos Containing Materials .....	I-5
Z	Worker Safety .....	I-5
AA	Toilet Facilities .....	I-5
BB	Signs .....	I-5
CC	Field Office for Department .....	I-6
DD	Quantities .....	I-6
EE	Other Health Measures .....	I-6
FF	Hawaii Business Requirement .....	I-6
GG	Compliance With §3-122-112 HAR .....	I-6

## 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. SEALED PROPOSALS: **Not applicable. See 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 Land and Natural Resources (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 standard questionnaire. When required, 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. **No bid security is required for bids less than \$50,000.**
- 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. This project will require a Class "A" Contractor's License.

- 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. **Performance and payment bonds are not required for bids less than \$50,000.**
- 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. **For contracts less than \$50,000, the State reserves the right to contract the work under a purchase order.**
- 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 Land and Natural Resources 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. This project will require a valid Contractor's license Class "A".

- 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 LOCAL LABOR: The Contractor shall hire local labor whenever practicable.



- 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 by the Contractor at the end of the project in both hard copy and 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. **The contractor shall provide a project sign at the site. Location to be verified by the Engineer.**

- CC. FIELD OFFICE AREA FOR DEPARTMENT: 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).
- 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 the contractor shall be in compliance with the following requirements:
- 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.

## **COMPLIANCE, DOCUMENTATION AND HAWAII COMPLIANCE EXPRESS**

As a condition for award of the contract and as proof of compliance with the following requirements of 103D-310(c) HRS:

Vendors are required to be compliant with all appropriate state and federal statutes. Proof of compliance (compliance documentation) is required. See the HiePRO Buyer FAQ on the State Procurement website for more information.

Proof of compliance/documentation is obtained through Hawaii Compliance Express (HCE). Vendors shall register in Hawaii Compliance Express (HCE), a program separate from HiePRO. The annual subscription fee to utilize the HCE service is currently \$12.00.

Allow 2 weeks to obtain complete compliance status after initial registration. It is highly recommended that vendors subscribe to HCE prior to responding to a solicitation.

The vendor is responsible for maintaining compliance. If the vendor does not maintain timely compliance in HCE, an offer otherwise deemed responsive and responsible may not be awarded.

**Vendors are required to be compliant with all of the requirements of 103D-310(c) HRS at the specified response due date (bid opening). The proof of compliance/documentation will be verified through the Hawaii Compliance Express. Failure to be fully compliant at the specified response date shall deem the vendor’s bid to be non-responsive and vendor’s bid will be rejected.**

## 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.hawaii.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 replacing the last paragraph with the following:

In the event the Notice to Proceed is not issued within three hundred and sixty-five (365) days after the date of bid opening, the Contractor may submit a claim for increased labor and materials costs (but not overhead costs) that will be incurred after 365 days after the date of bid opening plus the contract time allowed for performance of the work. Such claims shall be accompanied with the necessary documentation to justify the claim. No payments will be made for escalation costs that are not fully justified as determined by the State.

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 Chairperson, Department of Land and Natural Resources, 1151 Punchbowl Street, 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.

The notice of award, if any, resulting from this solicitation shall be posted on the HIePRO website.

**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** - Contractor shall not commence any work until it obtains, at its own expense, all required herein 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 laws of the State to issue such insurance in the State of Hawaii. Coverage by a “Non-Admitted” carrier is permissible provided the carrier has a AM Best’s Rating of “A-VII” or better.
2. 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.
3. Certificate(s) of Insurance acceptable to the Department shall be filed with the Engineer prior to commencement of the work. Certificates shall identify if the insurance company is a “captive” insurance company or a “Non-Admitted” carrier to the State of Hawaii. The Best’s Rating must be stated for the “Non-Admitted” carrier. Certificates shall contain a provision that coverages afforded under the policies will not be canceled or changed until at least thirty (30) 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.

4. 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.
5. 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.
6. 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.
7. If the Contractor is self-insured, it shall furnish, upon the request and the satisfaction of the Engineer, any documentation to demonstrate the ability to self-insure itself. The Engineer, from time to time, can conduct an audit to determine the ability of the Contractor to be self-insured. Failure to comply with the Engineer's request will be considered a material breach of the contract, and at the discretion of the Engineer, may be sufficient grounds to terminate the contract, suspend any work or withhold future payments.
8. It is the responsibility of the Contractor to notify the Department of any changes to its insurance policies or if the Contractor receives a notice of cancellation of any of its insurance policies. The Contractor will immediately provide written notice to the Department should the insurance policies evidenced on its Certificate of Insurance form be cancelled, limited in scope, or not renewed upon expiration.
9. In addition, the Contractor's insurance policies shall contain the following clauses:
  - (a) The State of Hawaii is added as an additional insured with respect to operations performed for the State of Hawaii.
  - (b) It is agreed that any insurance maintained by the State of Hawaii will apply in excess of, and not contribute with, insurance provided by this policy.
- 10. 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 worker's compensation insurance for all persons whom they employ or may employ in carrying out the work under this contract. 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. The Contractor shall obtain General Liability insurance with a limit of not less than \$1,000,000 per occurrence and \$2,000,000 aggregate. The commercial general liability insurance shall include the State as an additional insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies.
- (c) Comprehensive Automobile Liability. The Contractor shall obtain Auto Liability insurance covering all owned, non-owned and hired autos with a combined single Limit of not less than \$1,000,000 per accident for bodily injury and property damage. The State shall be named as additional insured. The required limit of insurance may be provided by a single policy or with a combination of primary and excess policies.

Furthermore, the Contractor's commercial general liability insurance and automobile liability insurance 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 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.

- (d) 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.

## TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS	SECTION NO.
<b><i>DIVISION 1 - GENERAL REQUIREMENTS</i></b>	
General Specifications	01019
Submittals	01300
Mobilization and Demobilization	01505
Barricades	01530
Pollution Control	01567
Project Sign	01581
<del>Field Office</del>	<del>Item CC ITB</del>
<span style="border: 1px solid black; padding: 2px;">N.I.C.</span>	
<b><i>DIVISION 2 - SITEWORK</i></b>	
Contractor's Qualifications	02000
Demolition	02050
Site Preparation	02100
Trenching, Backfilling, and Compacting	02225
Effluent Disposal System	02226
Aggregate Base Course	02230
Asphaltic Concrete	02512
<b><i>DIVISION 3 - CONCRETE</i></b>	
<del>Cast-in-Place Concrete</del>	<del>03300</del>
<span style="border: 1px solid black; padding: 2px;">N.I.C.</span>	
<del><b><i>DIVISION 11 - EQUIPMENT</i></b></del>	
<del>Package Sewage Pump Station</del>	<del>11300</del>
<del>Moving Bed Bio Reactor Package Plant System</del>	<del>11400</del>
<del>Ultraviolet Disinfection System</del>	<del>11500</del>
<b><i>DIVISION 16 - ELECTRICAL</i></b>	
Electrical General Requirements	16050
Standby Diesel Generator Set	16234
Underground Electrical Work	16302
Interior Wiring Systems	16402
Automatic Transfer & Bypass-Isolation Switch	16410
Exterior Lighting	16520
<b><i>APPENDIX</i></b>	
Engineering Report for Heeia Kea Small Boat Harbor Wastewater System Improvements	

***DIVISION 1***  
***GENERAL REQUIREMENTS***

## SECTION 01019

### 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 GENERAL

- A. Examination of Premises: The Contractor shall contact the Engineer and obtain permission before visiting the site.
- B. 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.
- C. Notices: The Contractor shall notify the Engineer and give at least three (3) working days notice before starting any work.
- D. Disruption of Utility Services: All work related to the temporary disconnection of electrical system shall be pre-arranged with the Engineer so that any disruption of such services will be kept to a minimum. In the event temporary power hook-up is required, the Contractor shall provide the necessary services.
- E. Parking Policy for Contractor
  - 1. The Contractor and its employees will not be allowed to park in zones assigned for permit parking.
  - 2. Areas to be used by the Contractor shall be identified by the Harbor Master and arranged by Contractor through contact with the Engineer in advance of the project start up.
- F. Toilet Accommodations: The Contractor may use the existing toilet facilities if so designated by the Engineer; however, it is the Contractor's responsibility to keep same clean and in a sanitary condition at all times.
- G. 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.

- H. Use of Power-Driven Equipment: The Contractor is cautioned to take all necessary safety precautions to protect personnel, and the public whenever power driven equipment is used.
- I. 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.
- J. Clean Up Premises: 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.
- K. 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.
- L. 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.
- M. 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.
- N. 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.

O. Required Submittals

1. Required submittals as specified in the Technical Sections of these specifications include one or more of the following: Shop drawings; manufacturer supporting installation drawings; technical data; schedules of materials; guarantees; operating and maintenance manuals; and as-built drawings.
2. The Contractor shall make a comprehensive list of the required submittals, by Specification Section, and submit this list to the Engineer within 15 days after notice to proceed.
3. As-Built Drawings: When as-built drawings are required for submittal, the following shall apply:
  - a. 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.
  - b. All deviations from alignments, elevations and dimensions which are stipulated on the plans shall be recorded in red on the as-built drawings.
  - c. The following procedure shall be followed:
    - 1) Immediately after these changes are constructed in place, the Contractor shall record them on the field office plans.
    - 2) Within two weeks after final inspection of the project, the Contractor shall transfer the changes marked on the field office plans onto a clean copy of plans using a red pencil. Any deletions shall be so noted and redrawn as necessary. The Contractor shall stamp or mark the tracings "AS-BUILT", and also sign and date each drawing so marked.
    - 3) The Contractor shall submit the as-built drawings together with the marked-up field office plans to the Engineer.
    - 4) Any as-built drawing which the Engineer determines does not accurately record the deviation shall be corrected by the State, and the Contractor shall be charged for the services.

END OF SECTION

## SECTION 01300

### SUBMITTALS

#### PART 1 - GENERAL

##### 1.1 SUBMITTALS

A. Shop drawings shall be required for:

1. Division 2 Absorption Bed Installation/Phasing Plan Related to Dewatering
2. Division 3 – Equipment pad and foundation reinforcing, concrete mix design, epoxy anchor product data.
3. Division 11 – Packaged Sewage Pump Station Moving Bed Bioreactor Packaged Plant System Ultraviolet Disinfection System
4. Division 16 - Electrical Work.
5. Any others as called for in the plans, specifications or by the Engineer.

B. Other required submittals shall include:

1. Manufacturer's Data.
2. Certificates of Warranty.
3. Operation and Maintenance Manuals.
4. Sheeting and Shoring Plans
5. Any others as called for in the plans, specifications, or by the Engineer.

##### 1.2 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 have a rubber stamp made up in the following format:

CONTRACTOR NAME

PROJECT: \_\_\_\_\_

\_\_\_\_\_

JOB NO: \_\_\_\_\_

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, it can be matched up again. The back of this tag will be used by the Engineer 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, including dimensioned plumbing shop drawings, shall be required and shall be reviewed by the Engineer, prior to any ordering of materials and equipment.
- E. Unless otherwise noted, the Contractor shall submit to the Engineer for his review eight copies of all shop drawings, piping layout, and/or catalog cuts for fabricated items and manufactured items (including mechanical and electrical equipment) required for the construction. Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty regular working days for examining the drawings.
- F. The drawing shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.

- G. Unless otherwise approved by the Engineer, shop drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the drawings or other approved means that the Contractor has checked the shop drawings and that the work or equipment shown is in accordance with contract requirements and has been checked for dimensions and relationship with work of all other trades involved. All deviations from the plans and specifications shall be listed. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the contract documents and will be returned to the Contractor for resubmission in the proper form.
- H. When the shop drawings have been reviewed by the Engineer, two sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit eight copies of the drawings, unless otherwise directed by the Engineer. No changes shall be made by the Contractor to the resubmitted shop drawings other than those changes indicated by the Engineer. The re-submittal shall be so indicated on the shop drawing.
- I. The review of such drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of the dimensions, fabrication details, and space requirements or for deviations from the contract drawings and specifications, unless the Contractor has called attention to such deviations, in writing, by a letter accompanying the drawings and the Engineer approved the change or deviations, in writing, at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.
- J. The approval of the above drawings, lists, prints, specifications, or other data shall in no way release the Contractor from his responsibility for the proper fulfillment of the requirements of this contract nor for fulfilling the purpose of the installation nor from his liability to replace the same should it prove defective or fail to meet the specified requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01505

### MOBILIZATION AND DEMOBILIZATION

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

A. Description: This section covers the requirements for mobilization and demobilization.

1.2 MOBILIZATION: Mobilization shall consist of the transporting, assembling, constructing, installing, and making ready for use at the job site, all the equipment, machinery, structures, utilities, materials, labor, and incidentals necessary to do the work covered by this contract.

1.3 DEMOBILIZATION: Demobilization shall consist of the dismantling and removal of the above-mentioned equipment, machinery, structures, utilities, materials, and incidentals, and the cleaning up of the site.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

3.1 GUIDELINES: If the Contractor utilizes private lands other than the sites provided by the Department for mobilization purposes, the provisions of this section shall apply, and the mobilization and demobilization work on said private lands shall be in accordance with the agreement between the Contractor and the land owner.

Any and all additional mobilization or demobilization costs in excess of the maximum amounts specified in the Proposal shall be included in the appropriate unit prices bid in the Proposal. The Contractor shall not receive any compensation for mobilization and demobilization in addition to those specified in the Proposal.

All equipment, machinery, buildings, utilities and incidentals mobilized and demobilized under this section shall remain the property of the Contractor.

END OF SECTION

## SECTION 01530

### BARRICADES

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

- A. Description. This work shall consist of furnishing, installing and maintaining barricades in accordance with the requirements of the contract.

Barricade application shall be provided for in the latest edition of the FHWA publication, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and as amended.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Lumber: Lumber for rails, frames and braces shall be dry, sound, undamaged, well seasoned, and free from any defect which may impair their strength and durability.
- B. Hardware: Nails shall be galvanized wire nails. As many and as large a size as is practicable shall be used.
- C. Paints: Paints shall be exterior enamel paint of the best grade or first line as made by approved manufacturers.
- D. Sheet Reflecting Material: Sheet reflecting material shall conform to the applicable requirements of Subsection 712.20(C) of the "Standard Specifications for Road and Bridge Construction".
- E. Alternate Designs: Alternate barricade designs such as plastic molded barricades may be used subject to the Engineer's approval. The Contractor shall submit shop drawings or catalog cuts for approval.

#### PART 3- SUBMITTALS

- 3.1 Submit Barricade plan showing materials and location of materials that will be used for barricade requirements.

#### PART 4 - EXECUTION

##### 3.1 CONSTRUCTION REQUIREMENTS

- A. General: Barricades shall be constructed in a first class, workmanlike manner in accordance with details shown on the plans and as specified herein.

Barricades shall be in good condition and approved by the Engineer for use within the project limits. Barricade application and installation shall be as shown on the plans and as directed by the Engineer in accordance with the guidelines provided in the latest edition of the FHWA publication, Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and any amendments or revisions thereof as may be made from time to time.

Sand bags or other approved weights shall be provided where required or as directed by the Engineer. Sand bags or other approved weights shall not be placed on any striped barricade rail.

Steady burn and/or flashing lamps shall be required on selected barricades used during hours of darkness. Locations shall be as shown on the plans and as directed by the Engineer. Lamps shall be attached on the barricade ends closest to the traveled way and shall be visible to the motorist.

Barricades furnished and paid for as provided for as provided herein may be used for temporary detours, construction phasing, or other temporary traffic control work.

Barricades furnished and paid for use in temporary detours or construction phasing may be used for permanent location called for on the plans.

Upon completion of the construction work, barricades shall be left in place, relocated, or removed and disposed of as shown on the plans or as directed by the Engineer. Barricades left in place, or relocated to new permanent locations shall become the property of the State. Barricades directed to be removed and disposed of shall become the property of the Contractor.

- B. Painting: Wooden rails, frames and braces shall be given a prime coat and 2 finish coats of new white exterior enamel paint. Rail faces to be reflectorized may be left unpainted unless otherwise specified or directed.
- C. Reflectorization: Reflectorization of barricade rails shall be done in a first class, workmanlike manner and the attachment of reflective sheeting shall be as shown on the plans, specified herein, or as directed and approved by the Engineer.

Both vertical faces of each barricade rail shall be reflectorized as shown on the plans.

Wooden rails shall be reflectorized with one of the following:

1. Reflective sheeting specified in Subsection 712.20(C)(4) of the "Standard Specifications for Road and Bridge Construction" and backed with a 26-gage galvanized steel sheet, or
2. a hardened aluminum backed reflective sheeting as specified in Subsection 712.20(C)(5) of the "Standard Specifications for Road and Bridge Construction."

D. Color: Rails, frames and braces shall be white.

The front and back faces of barricade rails shall have 6-inch wide alternative colored and white striped sloping downward toward the traveled way at an angle of 45 degrees with the vertical. The colored stripes shall be either orange or red in accordance with the following requirements:

1. Orange and white stripes shall be used in the following conditions:
  - a. Construction work.
  - b. Detours.
  - c. Maintenance work.
2. Red and white stripes shall be used in the following conditions:
  - a. On roadways with no outlet (i.e. dead-ends, cul-de-sacs).
  - b. Ramps or lanes closed for operational purposes.
  - c. Permanent or semi-permanent closure or termination of a roadway.

E. Maintenance: Barricades shall be kept in good condition throughout their usage during construction until the end of the contract.

F. The Contractor shall repair, repaint, clean or replace the barricades as required and as directed by the Engineer to maintain their effectiveness and appearance.

The Constructor shall immediately replace all lost, stolen or damaged barricades, lamps, sand bags and other approved weights.

Barricades used during construction phasing, temporary detours or other temporary traffic control work shall be cleaned and repaired as necessary, prior to being relocated to a permanent location shown on the plans or as directed.

No extra payment will be made for any repair work, repainting, or cleaning of barricades. The Engineer shall determine the suitable condition of each barricade and shall determine when each barricade shall be repaired, repainted or cleaned.

END OF SECTION

## SECTION 01567

### POLLUTION CONTROL

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

###### A. Rubbish Disposal

1. No burning of debris and/or waste materials shall be permitted on the project site.
2. No burying of debris and/or waste material except for materials which are specifically indicated elsewhere in these specifications as suitable for backfill shall be permitted on the project site.
3. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. During loading operations, debris and waste materials shall be watered down to allay dust.
4. No dry sweeping shall be permitted in cleaning rubbish and fines which can become airborne from floors or other paved areas. Vacuuming, wet mopping or wet or damp sweeping is permissible.
5. Enclosed chutes and/or containers shall be used for conveying debris from above to ground floor level.
6. Clean-up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean-up shall coincide with rubbish producing events.

###### B. Dust

1. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60 - Air Pollution Control.
2. The method of dust control and costs shall be the responsibility of the Contractor. Methods of dust control shall include the use of water, chemicals or asphalt over surfaces which may create airborne dust.
3. The Contractor shall be responsible for all damage claims in accordance with Section 7.16 - "Responsibility for Damage Claims" of the GENERAL CONDITIONS.

C. Noise

1. Noise shall be kept within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 - Community Noise Control for Oahu. The Contractor shall obtain and pay for the Community Noise Permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.
2. All internal combustion engine-powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.
3. Pile driving operations shall be confined to the period between 9:00 a.m. and 5:30 p.m., Monday through Friday. Pile driving will not be permitted on weekends and legal State and Federal holidays.
4. Starting-up of construction equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Engineer. Equipment exceeding allowable noise levels shall not be started-up prior to 7:00 a.m.

D. Erosion

1. During project construction activities the Contractor shall take proper care so as to preclude any damage to adjoining property from water and eroding soil.

E. Discharges Related to Construction Activities

1. No discharges related to construction activities shall enter State waters without an approved NPDES Permit issued by the State of Hawaii Department of Health Clean Water Branch.
2. The Contractor shall be responsible for processing a Site-Specific Best Management Plan (SSBMP) and receive approval 30 days in advanced of any discharge activity.
3. Waste water shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.

F. Others

1. The contractor work area shall be maintained in such a fashion that trucks and vehicles leaving the work area shall prevent any material from being carried onto the pavement.
2. Trucks hauling debris shall be covered as required by PUC Regulation. Trucks hauling fine materials shall be covered.
3. No dumping of waste concrete will be permitted at the job-site.



4. Except for rinsing of the hopper and delivery chute, and for wheel washing where required, concrete trucks shall not be cleaned on the job-site. Under no circumstances shall concrete wash down water be allowed to discharge into State waters or be allowed to percolate into the ground.
5. All vehicle fueling and maintenance shall be done in a designated area off-site from the project area.

G. Suspension of Work

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein shall be cause for suspension of the work creating such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.
2. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.
3. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall be done by force account as described in Subsection 4.2b -"Additional Work" of the GENERAL CONDITIONS and paid for in accordance with Subsection 8.4b - "Force - Account Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.18 - "Contract Time" of the GENERAL CONDITIONS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

## SECTION 01581

### PROJECT SIGN

#### PART 1 – GENERAL

##### 1.1 GENERAL REQUIREMENTS

- A. Furnish all labor, materials and equipment necessary to construct and install all project sign as specified hereinafter.

##### 1.2 SUBMITTALS

- A. Submit the following items for review. Work may not begin until these submittals have been reviewed and an adequate response per Section 01300 – Submittals has been provided.

- 1. Shop drawings

##### 1.3 LETTER STYLE

- A. Copy is centered and set in Adobe Type Futura Heavy. If this specific type is not available, Futura Demi Bold may be substituted. Copy should be set and spaced by a professional typesetter and enlarged photographically for photo stencil screen process.

##### 1.4 ARTWORK

- A. Constant elements of the sign layout - frame, outline, stripe, and official state information - may be duplicated following drawing measurements, or be reproduced and enlarged photographically using a layout template if provided. The “STATE OF HAWAII” masthead should be reproduced and enlarged as specified, using the artwork provided.

##### 1.5 TITLES

- A. The specific major work of the project under construction is emphasized by using 3-3/4” type, all capitals. Secondary information such as location or buildings uses 2-1/4” type, all capitals. Other related information of lesser importance uses letter heights as indicated on 01581-3, upper / lower case letters.

- B. Design should follow the example on page 01581-3.

#### PART 2 – PRODUCTS

##### 2.1 MATERIALS

###### A. LUMBER

- 1. Panel is 3/4” exterior grade high density overlaid plywood, with resin-bonded surfaces on both sides.

2. 4"x4" sign posts shall be Douglas Fir No. 1 or better.

## B. PAINTS AND INKS

1. Screen print inks are matte finish. Paints are satin finish, exterior grade. References to Ameritone Color Key Paint are for color match only.
2. Color:
  - a. 1BL10A Bohemian Blue
  - b. 2H16P Softly (White)
  - c. 2VR2A Hot Tango (Red)
  - d. 1M52E Tokay (Gray)

## C. CONCRETE

1. Concrete shall be class B with a 2,500 psi 28-day compressive strength.

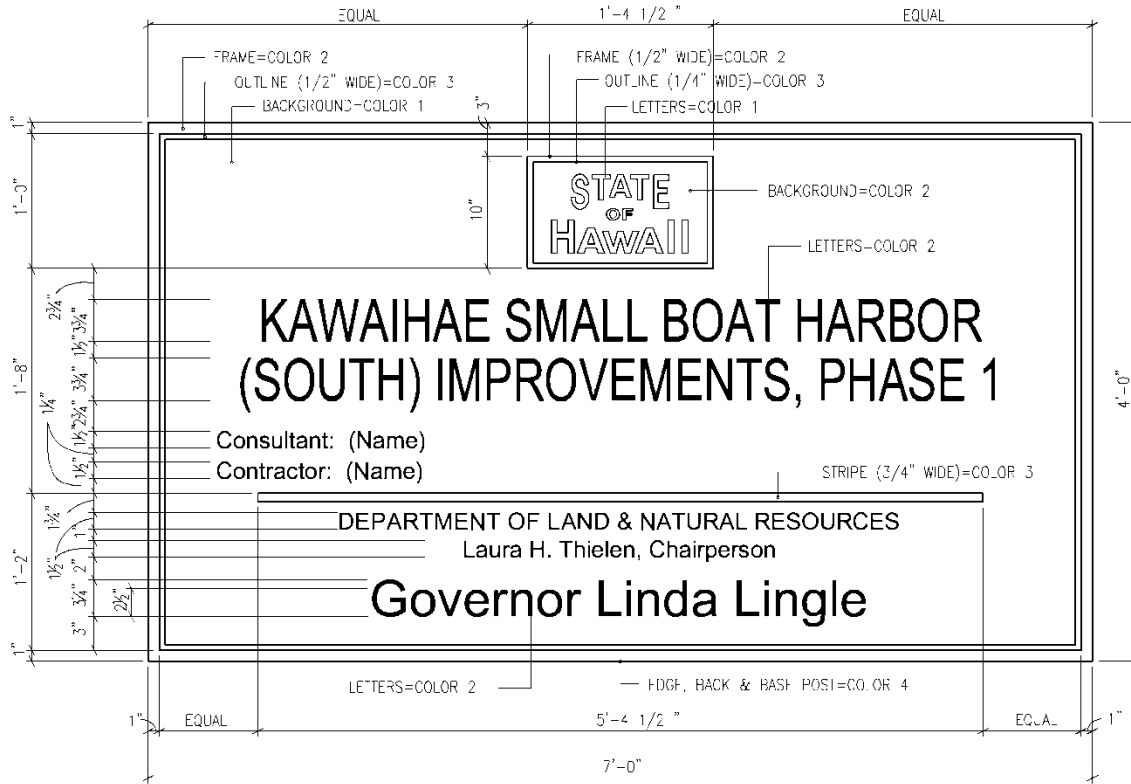
## PART 3 – EXECUTION

### 3.1 GENERAL

- A. The project sign shall be constructed with new materials as specified above.
- B. The Project sign shall be installed at the location indicated on the drawings or as designated by the Engineer. The project sign shall be erected upon commencement of work.

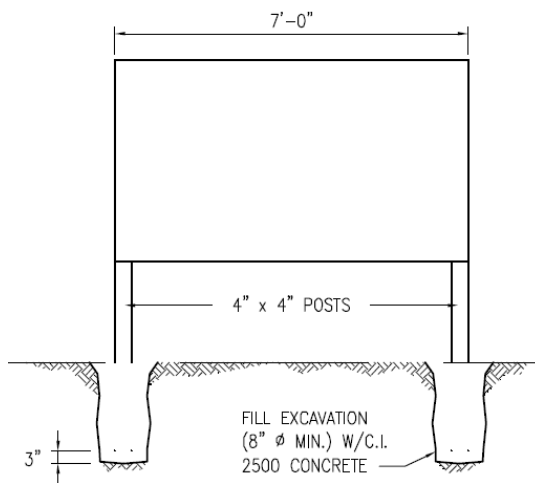
### 3.2 MEASUREMENTS AND PAYMENT

- A. The construction of the project sign, including all equipment, labor and material necessary to furnish and install the project sign will be paid for under the "Project Sign" proposal item.



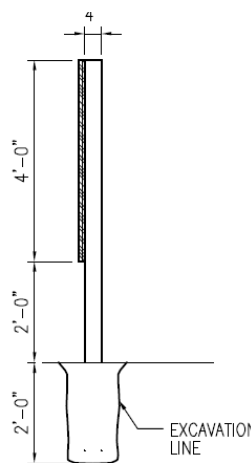
**SIGN DETAIL**

SCALE: NTS



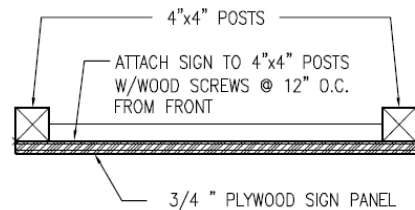
**FRONT ELEVATION**

SCALE: NTS



**SIDE ELEVATION**

SCALE: NTS



**PLAN**

SCALE: NTS

END OF SECTION

Project Sign  
01581-3

***DIVISION 2***  
***SITework***

SECTION 02000

CONTRACTOR'S QUALIFICATIONS

PART 1 – GENERAL

1.1 DESCRIPTION

Contractors or subcontractors and key personnel for the following work must demonstrate past successful experience that meet or exceed the requirements outlined in this section:

~~A. Wastewater Treatment Plant Construction including installation of UV Disinfection Equipment, pump stations and wastewater treatment plant construction as generally shown on the project drawings. N.I.C.~~

B. Effluent Disposal System generally matching that shown on the Project Drawings.

~~1.2 WASTEWATER TREATMENT PLANT CONSTRUCTION INCLUDING INSTALLATION OF UV DISINFECTION EQUIPMENT, PUMP STATIONS,~~

~~To ensure that the Wastewater treatment plant Construction Project Manager(s) and Superintendent(s) assigned to this project are experienced in work of this nature and have successfully completed projects of similar nature the Contractor shall provide within 15 calendar days of the Notice to Proceed.~~

~~A. Wastewater Treatment Plant Project Manager:~~

~~1. Minimum three successfully N.I.C. similar projects in the last 15 years as Wastewater Treatment Plant Project Manager.~~

~~B. Wastewater Treatment Plant Construction Superintendent:~~

~~1. Minimum three successfully completed projects in the last 15 years as Wastewater Treatment Plant Construction Superintendent.~~

1.3 EFFLUENT DISPOSAL SYSTEM INSTALLER

Ensure that the effluent disposal system installer is experienced in work of this nature and have successfully completed projects of similar conditions, the Contactor shall submit documentation of meeting the minimum requirements outlined below within 15 calendar days of the Notice to Proceed.

A. Effluent Disposal System Installer Supervisor:

1. Minimum three successfully completed similar projects in the last 15 years as an effluent disposal system installer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## SECTION 02050

### DEMOLITION

#### PART 1 - GENERAL

- 1.1 GENERAL REQUIREMENTS: The work includes demolition and removal as indicated in the plans or specified herein. Demolition specifically relates to dismantling the existing wastewater system consisting of all components shown on the As-Built Condition Inset as shown on the Site Plan of the Construction drawings. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of Government property. Remove rubbish and debris from the job site daily, unless otherwise directed. Store materials which cannot be removed daily in areas specified by the Engineer. The Contractor shall pay for all necessary permits and certificates that may be required in connection with this work.
- 1.2 SUBMITTALS: Submit proposed demolition and removal procedures to the Engineer for approval before work is started. Procedures shall provide for coordination with other work in progress and a detailed description of methods and equipment to be used for each operation, and sequence of operations. The new Wastewater Treatment Plant shall be fully functional and tested for functionality using a supplemental supply of water entering the new sewage pump station before final tie-in from the dockside force main and landside tie-in to the new sewage pump station are completed. The demolition and removal procedures shall clearly detail the phasing of tie-in work.
- 1.3 DUST CONTROL: Take appropriate action to check the spread of dust to the surrounding area and to avoid the creation of a nuisance in the surrounding area. Do not use water if it results in hazardous or objectionable conditions, such as flooding or pollution. Comply with all dust regulations imposed by local air pollution agencies.
- 1.4 PROTECTION
- A. Existing Improvements: Protect existing improvements that are to remain in place, that are to be reused, or that is to remain the property of the Engineer by temporary covers, shoring, bracing, and supports. Repair items damaged during performance of the work or replace with new to the satisfaction of the Engineer. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition, removal, and relocation work. Construction equipment and vehicles shall neither be permitted on, nor shall be stored on the existing work that is to remain in place.
- B. Trees: Protect trees within the project site which might be damaged during the demolition work.
- C. Public Safety: Where pedestrian and driver safety is endangered in the work or storage areas, use traffic barricades with flashing lights. Notify the Engineer prior to beginning any such work. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, and passageways, etc.

- D. Explosives: Use of explosives will not be permitted.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

### 3.1 EXISTING FACILITIES

- A. Demolish and remove portions of the existing wastewater treatment system as indicated on the plans in accordance with Department of Health procedures. These procedures require pumping tankage and all system elements containing sewage and disposing of the sewage by legal means. The top 3-feet of tankage shall be demolished and removed. The remainder of the tankage shall be filled with granular material up to 1-foot from grade. The remaining 1-foot shall be filled with topsoil (compacted to 85% based on modified proctor (ASTM D-1557). The surface shall be grassed and maintained until grass sprigs have taken root and started growing. Underground piping shall be removed or filled with CLSM (50 to 250 psi).
- B. The existence of active utility lines transversing the construction area other than those indicated is not definitely known. Should any be encountered, the Contractor shall not disconnect same without authorization of the Engineer, but shall inform the latter immediately of each discovery, and shall follow the Engineer's instructions.

#### 3.2.1 SAFETY

- A. Work shall be done in accordance with safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America.

### 3.3 DISPOSITION OF MATERIALS

- A. Title to Materials: Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Contractor upon receipt of notice to proceed. The Engineer will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site. Burning or burying of materials on the site will not be permitted.
- B. When removing the materials from the property, truck loads shall be trimmed and loaded as to prevent spillage.

### 3.4 CLEANUP

- A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage into ocean or adjacent areas. Cleanup spillage from ocean and adjacent areas. The Contractor shall leave the premises clean, neat, and orderly.
- B. Regulations: Comply with Federal, State, and Local hauling and disposal regulations.

END OF SECTION



## SECTION 02100

### SITE PREPARATION

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

The work to be performed under this section shall include clearing the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of the other work included in this contract. Site preparation shall also include all Best Management Practices (BMP) work associated with the Project Grading Plans as well as Project Erosion and Sediment Control (ESCP) Plans and Notes.

#### PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

##### 3.1 GENERAL

- A. Maintenance of Traffic: The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, etc.

When necessary, the Contractor shall provide and erect barriers, etc., with special attention to protection of personnel.

- B. Protection: Throughout the progress of the work protection shall be provided for all property and equipment, and temporary barricades shall be provided as necessary. Work shall be done in accordance with the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, and the State of Hawaii's Occupational Safety and Health Standards, Rules and Regulations.
- C. Fires: No burning of fires of any kind will be allowed.
- D. Reference Points: Bench marks, etc., shall be carefully maintained, but if disturbed or destroyed, shall be replaced as directed, at the Contractor's expense.
- E. Disposal: All materials resultant from operations under this Section shall become the property of the Contractor and shall be removed from the site. Loads of materials shall be trimmed to prevent droppings.
- F. The Project Plans contain Grading Plans as well as Erosion Control Plans that have been processed with the City and County of Honolulu for Agency approval. The Contractor shall process these plans for Grading Permit at the Frank F. Fasi Municipal Building Grading Permit Counter and shall comply with all requirements and conditions of the

The Project Plans related to Grading, Best Management Practices (BMP) and Erosion and Sediment Control (ESCP).

### 3.2 EXISTING UTILITY LINES

- A. The existence of active underground utility lines within the construction area is not definitely known other than those indicated in their approximate locations on the Drawings. Should any unknown line be encountered during excavation, the Contractor shall immediately notify the Engineer of such discovery. The Engineer shall then investigate and issue instructions for the preservation or disposition of the unknown line. Authorization for extra work shall be issued by the Engineer only as he deems necessary.

### 3.3 CLEAN UP OF PREMISES

- A. Clean up and remove all debris accumulated from building operations from time-to-time as directed. Upon completion of the construction work and before final acceptance of the contract work, remove all surplus materials, equipment, scaffoldings, etc., and leave entire job site raked clean and neat including replacement of all pavement markings disturbed to match pre-construction conditions to the satisfaction of the Engineer.

END OF SECTION

## SECTION 02225

### TRENCHING, BACKFILLING AND COMPACTING

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

This section covers the requirements for trenching, backfilling, and compacting.

- A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.
- B. Related Work:
  - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

##### 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Engineer.
- D. Compaction requirements are defined by American Society for Testing and Materials (ASTM) publication D-1557 "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-inch Drop."

##### 1.3 SUBMITTALS

- A. Shoring and sheeting plan: Describe materials of shoring system to be used. The shoring and Sheeting plans shall be prepared by the Contractor's Geotechnical and Structural professional Engineers. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in Hawaii. Indicate sequence and method of installation and removal. Should changes be required to the Contractor's Shoring and Sheeting Plan after acceptance these changes shall be made by the Contractor's Geotechnical and Structural professional Engineers at no additional cost to the State.

- B. Dewatering plan: Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicate. If dewatering is proposed the dewatering plan for trench work shall be made by the Contractors Geotechnical Engineer. Changes to the dewatering plan after approval shall be made by the Contractors Geotechnical professional Engineer at no additional cost to the State.

#### 1.4 PERMITS

- A. Obtain necessary permits required from applicable agencies. All permit fees will be considered incidental to the work and a separate payment shall not be made.

### PART 2 - PRODUCTS

#### 2.1 BACKFILL MATERIALS

- A. Select Material: Backfill from the bottom of the trench to one foot above the top of the pipe shall be select material. Sand, graded crushed rock (commonly known as "rock sand") or excavated granular or sandy material shall be used for select material provided that all rocks or lumps of material over one inch in its longest dimension have been removed. Select material shall be free from salt, ashes, refuse, organic material or other material which, in the opinion of the Engineer, is unsuitable.

All material to be used as select material backfill shall be approved by the Engineer. If in the opinion of the Engineer the excavated material does not meet the grading requirements of select material, the Contractor shall be required to screen the material prior to its use as select material backfill.

- B. Ordinary Material: Material used in the upper portion of the backfill from one foot above the top of the pipe to the surface of the ground or subgrade of the road shall not contain stone, rock or other material larger than six inches in its longest dimensions. No wood, vegetable matter or other material which, in the opinion of the Engineer, is unsuitable, shall be included in the backfill. No "adobe" or other materials determined to be deleterious by the Engineer shall be included in the backfill.
- C. The Contractor shall obtain the approval of the Engineer of all backfill material.

#### 2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

### PART 3 - EXECUTION

#### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed.

Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

### 3.2 FINISH ELEVATIONS AND LINES

- A. All material excavated from trenches shall be considered unclassified, whether consisting of earth, lava, soft rock, decomposed rock, solid rock, boulders, or coral. The trench shall be so dug that the pipe can be properly installed to the alignment and grade specified. Excavation shall commence at the point directed by the Engineer and shall be carried on in an orderly manner. No trench shall be opened more than 500 feet in advance of the installed pipe without the approval of the Engineer. No jumps or spaces will be permitted unless approved by the Engineer. Before proceeding with any excavation under asphaltic concrete and concrete pavements, the Contractor shall cut the edges of the excavation with a power saw to insure a neat cut along the pavement.
- B. Trench Widths:
  - 1. The widths of trenches for all pipes and appurtenances shall be as shown on the Drawings.
  - 2. Increases in widths over those shown due to sheeting, bracing, or other necessities of construction, may be made by the Contractor with the approval of the Engineer but no additional compensation will be allowed for such extra width.
  - 3. Bell holes shall be provided at each joint to permit the jointing of pipes to be made properly.
- C. Trench Depths:
  - 1. In general, trench depths for all pipes and appurtenances shall be as shown on the Drawings.
  - 2. Where necessary, the Engineer reserves the right to raise or lower the grades or to change alignments from those shown on the Drawings.
- D. Excavation Below Grades:
  - 1. Any part of the trench excavated below grade by the Contractor shall be corrected with select material, thoroughly compacted in place at no cost to the State.

### 3.3 PROCEDURES

- A. Utilities:
  - 1. All excavated areas shall be toned prior to excavation.
  - 2. Unless shown to be removed, protect lines shown on the drawings or otherwise made

known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the State.

3. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
  4. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the State.
  5. Expose existing utilities to confirm clearances as initial trenching work. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
  6. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
  2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
  3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.
- C. Blasting:
1. Blasting shall not be permitted.
- D. Dewatering:
1. Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from soil.
  2. Dispose water at an approved location by pumps, drains, and other approved methods.
  3. Dewatering related to the installation of the effluent disposal system shall comply with the requirements provided in SECTION 02226 EFFLUENT DISPOSAL SYSTEM.
- E. During the period of construction, the Contractor shall protect the public against mud, dust and similar nuisances and shall take steps to abate such nuisances.

- F. Convenient access to buildings along the line of work shall be maintained and temporary approaches shall be provided and kept in order. Temporary bridges for pedestrian traffic shall have handrails securely fastened to them. Handrails shall be free from any projecting nails, splinters, and rough edges.
- G. Storing of excavated material alongside the trench shall be done in such a manner as not to obstruct traffic. Whenever, in the opinion of the Engineer, proper storage of excavated material cannot be made alongside the pipe trench, the material shall be hauled away from the work site. If the excavated material meets the requirements for backfill material and proper storage cannot be made alongside the pipe trench, the material shall be stockpiled at convenient locations for later use in backfill.
- H. Surplus Material:
  - 1. Unless otherwise specified in the Plans or Specifications, or ordered by the Engineer, surplus excavated material shall become the Contractor's property and shall be removed from the work site and disposed of at no cost to the State.

#### 3.4 TRENCHING

- A. Comply with pertinent provisions of applicable "Soils Report" as provided for the project and the provisions of this Section.
- B. Provide sheeting and shoring necessary for protection of the Work, undermining of existing facilities and for the safety of personnel.
  - 1. Prior to backfilling, remove all sheeting.
  - 2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Engineer, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Engineer may permit portions of sheeting to be cut off and remain in the trench.
- C. Excavation:
  - 1. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conduit can be installed safely and backfill can be compacted properly into such tunnel.
  - 2. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects at no additional cost to the State, as directed by the Engineer.
  - 3. When the void is below the subgrade for the utility bedding, use select materials and compact to the relative density directed by the Engineer, but in no case to a relative

density less than 90%.

4. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the Engineer, but in no case to a relative density less than 80%.
5. Excavating for appurtenances:
  - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
  - b. Over depth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the State.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
2. Except where rock is encountered, do not excavate below the depth indicated or specified.
3. Where rock is encountered, excavate rock to a minimum over depth of 4" below the trench depth indicated or specified.

E. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.

F. Cover:

1. Provide a minimum cover over the top of the pipe as indicated on the drawings.
2. Where the minimum cover is not provided, jacket the pipes in concrete as indicated. Provide concrete with a minimum 28-day compressive strength of 2500 psi.

### 3.5 BEDDING

A. Provide bedding as indicated on the Drawings.

### 3.6 BACKFILLING

A. General

1. All backfill material shall be placed in the trench by hand or by approved mechanical methods. The compaction of backfill material shall be done by tamping with hand



tools or approved pneumatic tampers, by using vibratory compactors, by puddling if the backfill material can be suitably drained, or by any combination of the three. The method of compaction shall be approved by the Engineer and all compaction shall be done to the satisfaction of the Engineer.

2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no cost to the State, furnish material as specified in this section in the amount required to complete the backfill.
3. When backfill material is delivered by trucks, the material shall not be dumped directly into the trench but the fall of the material shall be broken at the edge of the trench. The backfill material shall then be deposited by hand or by approved mechanical methods.
4. Ensure that no damage is done to structures or their protective coatings.

B. Backfilling Around Pipe:

1. Select material shall be used to backfill the trench from its bottom to one foot above the pipe. Prior to the laying of the pipe, the select material cushion shall be deposited in the trench and shall be leveled off, compacted, and shaped to obtain a smooth compacted bed providing firm uniform bearing along the laying length of the pipe.
2. After the pipe is installed, but prior to testing the line, select material shall be deposited in the trench evenly on both sides and along the full length of the pipe in 6-inch maximum loose lifts. If necessary, additional select material can be deposited over the center of each length of pipe to prevent undue movement during testing of the line. Ensure that initially placed material is tamped firmly under pipe haunches. The bell holes at the pipe joints shall not be backfilled at this time.
3. The pipeline shall then be tested. After the pipeline has passed the test, the Contractor shall backfill the bell holes with select material. The select material, which had been previously deposited over the pipe in the trench, shall be leveled and compacted.

C. Backfilling to Grade:

1. From an elevation one foot above the top of the pipe to grade, the backfill material shall be placed in layers not to exceed 12 inches in loose lifts each lift shall be compacted to a relative density not less than 90%.
2. If the trench section is flooded, no further backfill shall be placed for two (2) days. After this period, the backfill shall again be thoroughly compacted to a relative density of not less than 90% by a method and with equipment approved by the Engineer.
3. The Contractor shall reconstruct the base course and pavement of roadway damaged by the construction of the pipeline as covered elsewhere in these Detailed Specifications.
4. Other improvements such as driveways, sidewalks, curbs, gutters, stonewalls, fences

and other structures damaged during construction shall be replaced or repaired to their original condition or better as approved by the Engineer.

### 3.10 FIELD QUALITY CONTROL

- A. The Engineer will inspect and approve open cuts and trenches before installation of pipeline or structures, and will make the following tests:
  - 1. Assure that trenches are not backfilled until all tests have been completed;
  - 2. Check bedding for proper layer thickness and compaction;
  - 3. Verify that test results conform to the specified requirements, and that sufficient tests are performed;
  - 4. Assure that defective work is removed and properly replaced.

END OF SECTION

## SECTION 02226

### EFFLUENT DISPOSAL SYSTEM

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

This section covers the effluent disposal system for the new packaged wastewater system. The system consists of two absorption beds approximately 100 feet long by 50-feet wide.

- A. Work included: Excavation and backfill, placement of Infiltrator trenches, installation of an inspection port at each absorption bed, installation of distribution boxes and paving including sub-base, base course and Asphaltic Concrete (AC) paving for final grade over the absorption beds located in the Heeia Kea Small Boat Harbor parking lot.
- B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections of Division 2 identified in various paragraphs below.

##### 1.2 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. This particularly pertains to dewatering.
- B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.
- C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Engineer.
- D. Compaction requirements are defined by American Society for Testing and Materials (ASTM) publication D-1557 "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-inch Drop."

##### 1.3 SUBMITTALS

- A. Shoring and sheeting plan for trench and absorption bed installation: Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by the Contractor's Geotechnical and Structural professional engineers registered in Hawaii. Indicate sequence and method of installation and removal. Changes to the Sheeting and Shoring Plan after approval shall be made by the Contractor's Geotechnical and Structural professional Engineers at no additional cost to the State.

- B. Dewatering plan: The absorption beds shall be partially installed into the water table. It is intended that the absorption beds be installed in phases and active installation be dewatered by use of cofferdams (or equal) to isolate the work area and dewatering be accomplished by pumping to inactive areas of the absorption bed area. Dewatering from active areas of absorption bed installation into a completed absorption bed is also allowed as long as excessive solids are not discharged into a completed absorption bed. This may require a zone of intermediate settling before discharge into a completed absorption bed. The Contractor shall prepare and submit its proposed absorption bed installation/phasing plan for Engineer approval showing active construction work areas and areas that will be used for dewatering. Once approved the Contractor can commence absorption bed installation per contract drawings, Should the phasing plan not effectively provide adequate dewatering areas per installation phase the Contractor shall modify the phasing plan until effective by the Contractor's Geotechnical and Structural professional Engineers and no additional cost to the State.

The project has not anticipated nor pursued the need for an NPDES Permit for Dewatering or contemplated Industrial Wastewater Discharge permit to the City sewer. Should the Contractor want to pursue either of these options he is free to do so at his sole discretion and expense.

#### 1.4 PERMITS

- A. A Grading Plan has been approved by the City and County of Honolulu. The Contractor shall be required to process the approved Grading Plan(s) for Grading Permit. The Contractor shall obtain any other necessary permits required from applicable agencies. All permit fees will be considered incidental to the work and a separate payment shall not be made.

### PART 2 - PRODUCTS

#### 2.1 BACKFILL MATERIALS

- A. Absorption Bed Fill from Bottom of Bed to bottom of compacted untreated base course: Backfill shall be washed crushed stone 1-1/2" to 2" nominal size.
- B. Aggregate Base Course:  
See Specification Section 02230.
- C. Asphaltic Concrete Pavement:  
See Specification Section 02225.
- D. The Contractor shall obtain the approval of the Engineer of all backfill material and pavement section materials.
- E. Infiltrator Trenches:  
Infiltrator trenches shall be Infiltrator® Water Technologies High Capacity Infiltrator Chamber H-20, ISO 9001 Certified, IAMPO approved and UPC approved. or engineer approved equal.

- F. Distribution Chambers:  
Distribution Chambers (Boxes) shall be Jensen Precast Model D-30 Commercial Distribution boxes with design load for H-20 loading and conforming to ASTM C-478. The cover for the distribution boxes shall be Jensen precast traffic cast iron frame and cover with gasket for slab construction. Distribution chamber substitutions shall be approved by the Engineer.
- G. Distribution Pipe and Fittings:  
Distribution piping from Wastewater Treatment Plant to distribution boxes and to infiltrator trenches shall be PVC, C900, Class 150. Fittings shall be HARCO PVC fittings for PVC pipe. Fittings shall meet DR-18 requirements of AWWA C-900. Substitution of pipe and fittings shall be approved by the Engineer.
- H. Inspection Manholes:  
The Inspection manholes are for periodic visual inspection of absorption bed water quality and observance of water level. The inspection manholes shall be as shown on the plans and as manufactured by Walker Industries (Maui) or Engineered approved equal.
- I. Reinforced Concrete Jacket:  
Shall be as shown in the City and County of Honolulu Wastewater System Design Standards dated July 2017 (Standard Detail S-03). The Standard Detail S-03 is attached to the end of this specification section as Attachment 1.

## 2.2 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

## PART 3 - EXECUTION

### 3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. All existing materials including asphaltic concrete (AC) pavement and sands with in the absorption bed systems shall be removed from the site and disposed of in conformance with all Federal, State and City regulatory requirements.

### 3.2 FINISH ELEVATIONS AND LINES

- A. All material excavated from absorption bed area shall be considered sand in nature. The excavation shall be so dug that the infiltrator trenches and inspection manholes can be properly installed to the alignment and grade specified. Excavation shall commence based on the Absorption Bed Installation/Phasing Plan and shall be carried on in an orderly manner. Should the Installation/Phasing Plan not produce the required dewatering needs the

Installation/Phasing Plan shall be modified at no additional expense. Before proceeding with any excavation under asphaltic concrete and concrete pavements, the Contractor shall cut the edges of the excavation with a power saw to insure a neat cut along the pavement. The Contractor shall follow the approved sheeting and shoring plan developed by the Contractor's Geotechnical and Structural Professional Engineers sheeting/shoring plan as required in Paragraph 1.3A to maintain the integrity of the neat cut line and supporting, base and sub-bases below. If the integrity of the neat cut edge and material below become compromised, the Contractor shall correct as required by the Contractor's corrective plan prepared by the Contractor's Geotechnical and Structural professional Engineers at no additional cost to the State.

B. Absorption Bed Widths:

1. The widths of the Absorption Beds for all infiltrator trenches and appurtenances shall be as shown on the Drawings.
2. Increases in widths over those shown due to sheeting, bracing, or other necessities of construction, may be made by the Contractor with the approval of the Engineer but no additional compensation will be allowed for such extra width.

C. Absorption Bed Depths:

1. In general, the absorption bed depths for all infiltrator trenches and appurtenances shall be as shown on the Drawings.
2. Where necessary, the Engineer reserves the right to raise or lower the grades or to change alignments from those shown on the Drawings.

D. Excavation Below Grades:

1. Any part of the absorption bed excavated below grade by the Contractor shall be corrected with allowed backfill material, thoroughly compacted in place at no cost to the State.

### 3.3 PROCEDURES

A. Utilities:

1. All excavated areas shall be toned prior to excavation.
2. Unless shown to be removed, protect lines shown on the drawings or otherwise made known to the Contractor prior to absorption bed installation. If damaged, repair or replace at no additional cost to the State.
3. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted and inform the Engineer so a corrective action can be taken.

4. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the State.
  5. Expose existing utilities to confirm clearances as initial absorption bed installation work. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
  6. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- B. Protection of persons and property:
1. Barricade the absorption bed area from the commencement of absorption bed work until completion of the absorption bed system.
  2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
  3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.
- C. Blasting:
1. Blasting shall not be permitted.
- D. Dewatering:
1. Dewatering shall be in accordance with the Contractor prepared Absorption Bed Installation/Phasing Plan. Should the initial phase require adjustments, the adjustments shall be made and the revised Absorption Bed Installation/Phasing Plan shall be submitted to the Engineer for approval. Revised Absorption Bed Installation/Phasing plans shall be prepared by the Contractor's Geotechnical and Structural professional Engineers at no additional cost to the State.
- E. During the period of construction, the Contractor shall protect the public against mud, dust and similar nuisances and shall take steps to abate such nuisances.
- F. Convenient access to buildings along the line of work shall be maintained and temporary approaches shall be provided and kept in order. Temporary bridges for pedestrian traffic shall have handrails securely fastened to them. Handrails shall be free from any projecting nails, splinters, and rough edges.
- G. Storing of excavated material shall be done inside the limits of the absorption in an inactive work zone.

H. Surplus Material:

1. Unless otherwise specified in the Plans or Specifications, or ordered by the Engineer, surplus excavated material shall become the Contractor's property and shall be removed from the work site and disposed of at no additional cost to the State.

3.4 ABSORPTION FIELD INSTALLATION

A. Comply with pertinent provisions of applicable "Soils Report" as provided for the project and the provisions of this Section.

B. Provide sheeting and shoring necessary for protection of the Work, undermining of existing facilities and for the safety of personnel.

1. Prior to backfilling, remove all sheeting.

C. Excavation:

1. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects at no additional cost to the State, as directed by the Engineer.
2. When the void is below the subgrade for the infiltrator trenches, use allowed backfill materials and compact to the relative density directed by the Engineer, but in no case to a relative density less than 90%.
3. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the Engineer, but in no case to a relative density less than 80%.

D. Depressions:

1. Except where rock is encountered, do not excavate below the depth indicated or specified.
2. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified and backfill with allowed backfill materials

E. Cover:

1. Provide a minimum cover over the top of the absorption bed as indicated on the drawings.



### 3.5 BEDDING

- A. Provide backfill and untreated aggregate base course and asphaltic concrete (AC) pavements indicated on the Drawings.

### 3.6 BACKFILLING

#### A. General

1. All backfill material shall be placed in the absorption bed by hand or by approved mechanical methods. The compaction of backfill material shall be done by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling if the backfill material can be suitably drained, or by any combination of the three. The method of compaction shall be approved by the Engineer and all compaction shall be done to the satisfaction of the Engineer.
2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no additional cost to the State, furnish allowed fill materials as specified in this section in the amount required to complete the backfill.
3. When backfill material is delivered by trucks, the material shall not be dumped directly into the absorption bed but the fall of the material shall be broken at the edge of the absorption bed. The backfill material shall then be deposited by hand or by approved mechanical methods.
4. Ensure that no damage is done to structures or their protective coatings.

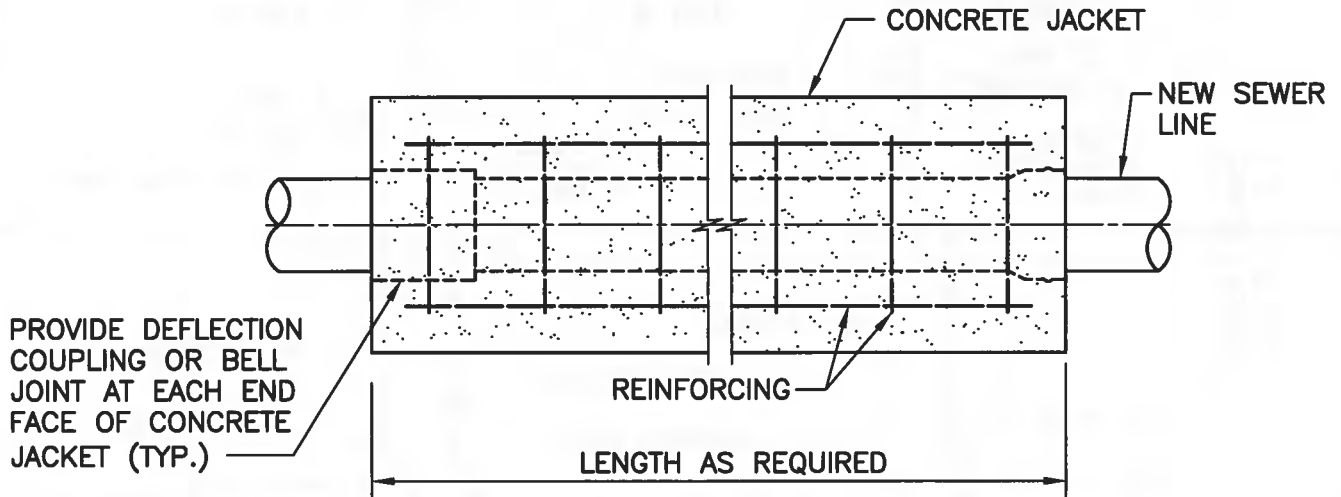
#### C. Backfilling to Grade:

1. Backfilling of the absorption bed shall be as shown on the plans. From an elevation above the top of the infiltrator trenches to grade, the backfill material shall be placed in layers not to exceed 8 inches in loose lifts each lift shall be compacted to a relative density as indicated on the plans.

### 3.10 FIELD QUALITY CONTROL

- A. The Engineer will inspect and approve open cuts and trenches before installation of pipeline or structures, and will make the following tests:
  1. Check absorption bed subgrade for level compliance.
  2. Verify that test results conform to the specified requirements, and that sufficient tests are performed;
  3. Assure that defective work is removed and properly replaced.

END OF SECTION



4 - #4 ON 8" PIPES,  
 4 - #5 ON 10" AND 12" PIPES,  
 LARGER THAN 12", A SPECIAL  
 DETAIL MUST BE SUBMITTED FOR  
 APPROVAL

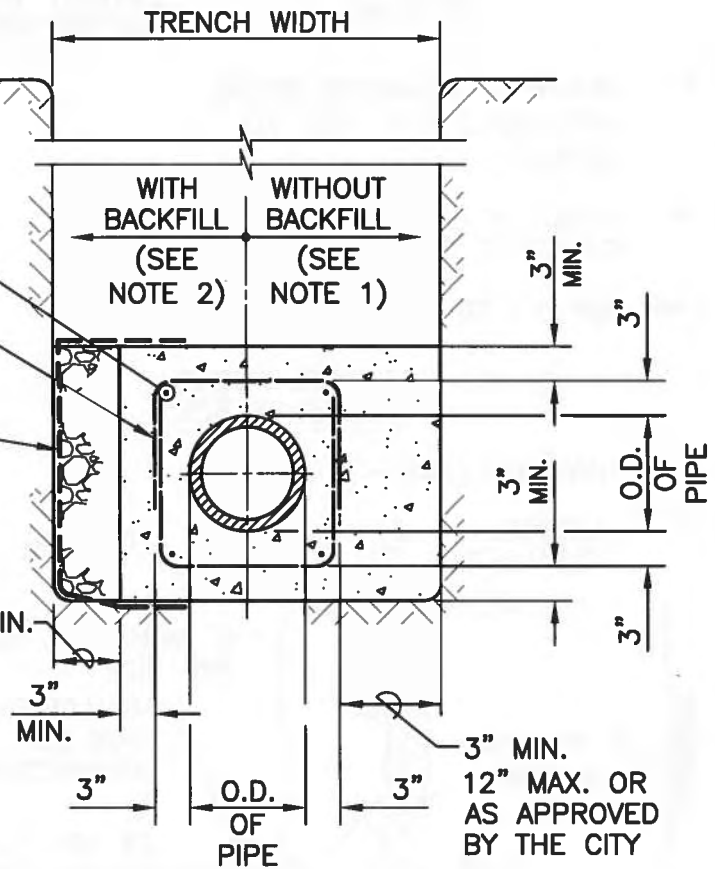
#3 HOOPS, 10" O.C.,  
 LAPPED 12", AT ENDS

FILTER FABRIC,  
 MIN. 6" OVERLAP  
 AT CONCRETE

**NOTES:**

1. CONCRETE JACKET MAY EXTEND TO TRENCH WALL FOR NARROW TRENCH. TRENCH WALL SHALL BE CUT VERTICAL AND NEAT.
2. FORMS SHALL BE USED FOR CONSTRUCTION OF CONCRETE JACKET IN WIDE TRENCH WITH CRUSHED ROCK BEDDING BACKFILL. FORMS SHALL BE REMOVED.
3. FOR EXISTING PVC PIPES, PROVIDE SANDED SURFACE 2' IN LENGTH AT EACH END PRIOR TO INSTALLING CONCRETE JACKET PER STANDARD SPECIFICATIONS. DEFLECTION COUPLING OR BELL NOT REQUIRED AT ENDS.

**PLAN**



**SECTION**



DATE: 7/2017

CITY AND COUNTY OF HONOLULU	STANDARD DETAILS	REINFORCED CONCRETE JACKET FOR PIPES 12-INCH AND SMALLER	S-03
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## SECTION 02230

### AGGREGATE BASE COURSE

#### PART 1 - GENERAL

##### 1.1 GENERAL REQUIREMENTS

- A. Description. This work shall consist of furnishing and placing one or more courses of aggregate base on a prepared surface in accordance with the requirements of the contract.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

Materials shall meet the requirements specified in the following Subsections of Division 700 Materials of the "Standard Specifications for Road and Bridge Construction."

Aggregate	703.06
Water	712.01

#### PART 3 - EXECUTION

##### 3.1 CONSTRUCTION REQUIREMENTS

- A. Placing
1. The base material shall be placed on the prepared surface without segregation. Segregated materials shall be remixed until a uniform distribution is obtained. The material shall not be dumped in piles on the prepared surface.
  2. Depositing and spreading shall commence at that part of the work farthest from the point of loading the material and shall progress continuously without breaks, unless otherwise directed by the Engineer.
  3. If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed on 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.
  4. If the contractor uses a vibratory roller weighing 9 tons or more, the lift thickness may be increased to 7 inches.
  5. Spreading of binder material over the surface of the compacted base will not be permitted. Additional material if required shall be incorporated uniformly throughout the thickness of the compacted material by scarifying and blading. The combined material shall meet all quality requirements as specified.

B. Shaping and compacting

1. The Contractor shall perform such shaping work as necessary and such that the finished base shall conform to the required grade and cross-section. The finished base where not controlled by adjacent structures or features shall not vary more than 0.04 foot above or below the theoretical grade.
2. Compaction of each layer shall continue until a density of not less than 95 percent of the maximum density, determined in accordance with the requirements of Subsection 106.09 - Special Test Methods, of the "Standard Specifications for Road and Bridge Construction, has been achieved. Field density determination will be made in accordance with Hawaii Test Method HWY-TC 1. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the quantity necessary for proper consolidation.
3. Should high or low spots develop during rolling operations, such spots shall be smoothed out by blading with a self-propelled and pneumatic-tired motor grader having a wheel base not less than 15 feet long and a blade not less than 10 feet long.
4. Each layer shall be compacted initially by rolling with three-wheel rollers followed by intermediate rolling with pneumatic-tired rollers. Final rolling shall be done with three-wheel rollers.

- C. Equipment. Three-wheel rollers and pneumatic-tired rollers shall conform to the requirements specified in Subsection 401.03(B)(4) - Rollers.

END OF SECTION

SECTION 02512

ASPHALTIC CONCRETE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

Asphaltic concrete shall consist of a mixture of mineral aggregate and bituminous material, mixed at a central plant in the proportions hereinafter specified and spread and compacted on a prepared base or existing road surface.

The pavement may consist of a surface course mixture and leveling or base course mixture, as hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS

All materials shall meet the requirements specified in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 1985, with the following subsections of Division 700 - Materials.

Bituminous Material (Asphalt Cement, Grades AR 40 or 80)	702.01
Asphalt Paint (Emulsified Asphalt)	702.04
Aggregate	703.09
Filler	703.15
Blending Sand	703.22
Hydrated Lime	712.03

Leveling or base course mixture shall be Mix No. 2, surface wearing course mixture shall be as State Mix No. 5 for parking lots.

- A. Grading and Composition Requirements: Materials composing the asphalt concrete shall be combined to meet the requirements set forth in Table 1. The grading composition limits specified are based on materials of uniform specific gravity. Correction of grading limits shall be made to compensate for any variations in specific gravity of the individual sizes.

<u>Compacted Thickness Individual Layers</u>	<u>Base and Leveling Course</u>	<u>Roadway Mixes</u>		
		<u>(Std.)</u>	<u>(Dense Grade)</u>	<u>Resurfacing Mix</u>
Minimum	1-1/2"	1-1/4"	1-1/4"	3/4"
Maximum	2-1/2"	2-1/2"	2-1/2"	1-1/2"

**TABLE 1 - GRADING AND COMPOSITION REQUIREMENTS**

<u>MIX NO.</u>	2	3	4	5
<u>SIEVE SIZE</u>	<u>COMBINED AGGREGATE Total Percent Passing by Weight</u>			
1-1/4"	100	-	-	-
1"	85-100	100	-	-
3/4"	-	90-100	100	-
1/2"	60-85	70-90	85-100	100
3/8"	-	-	72-88	80-100
No. 4	36-55	40-57	48-66	55-75
No. 8	26-41	30-47	32-48	35-52
No. 16	17-32	20-36	21-37	22-38
No. 30	12-25	16-28	15-27	14-26
No. 50	8-18	10-22	9-21	8-20
No. 100	5-14	8-17	6-16	6-15
No. 200	1- 8	4-10	4-10	4-10
<u>Percentage by weight of Asphaltic Cement to be Added</u>	4.5-6.5	5.0-7.0	6.0-8.0	5.0-7.0

The grading within the above tolerances shall be to the percentage of aggregate passing the sieves during any day's run will conform to the following limitations:

Passing No. 4 and larger sieves	7% above or below
Passing No. 8 and No. 100 sieves	4% above or below
Passing No. 200 sieves	2% above or below
Bituminous Binder	0.4% above or below
Temperature of Mixture on Delivery	20°F above or below

## PART 3- EXECUTION

### 3.1 DETAILS

- A. **Mixing:** The asphaltic cement shall be heated in a kettle of approved type, and maintained at a temperature between 275NF and 300NF. The heat must be so applied that there can be no burning of any portion of the asphaltic cement. No live steam shall be injected into the cement. The mineral aggregate shall be heated in an approved appliance to a temperature of not less than 275NF nor more than 320NF.

After heating to the required temperature, the required amount of asphalt cement shall be added to the heated aggregate. This mass shall be introduced into the mixer within 25NF of each other's temperature.

- B. **Prime Coat:** All surfaces on or against which asphalt concrete is to be placed shall first be given an asphaltic cement prime or tack coat as specified in Section 02513, "Prime Coat," of these specifications.

Before applying the prime and tack coat, the Contractor shall prepare the existing surfaces by power brooming to remove all loose particles, dust, sand, and other foreign materials.

- C. **Asphaltic Concrete Interlayer Fabric Membrane:** Immediately after installation of the prime coat and prior to installation of the asphaltic concrete wearing surface the interlayer fabric membrane is to be installed in accordance with Section 02517.

- D. **Laying Wearing Surface:** In advance of placing asphalt concrete over an existing base, surfacing, or pavement, and after the base, surfacing, or pavement has been prepared as herein specified, and if ordered by the Engineer or shown on the plans, a leveling course mixture shall be spread to level irregularities, dips, depressions, sags, and excessive crown, and to provide a smooth base of uniform grade and cross-section in order that the surface course will be of uniform thickness. The above specified material shall not be placed more than one day in advance of placing the surface course. No additional compensation will be allowed for placing leveling course mixture as specified above and full compensation for all work incidental to such operations shall be considered as included in the contract prices or price paid for the asphalt concrete mixture used.

The mixture as prepared above shall be brought to the work in suitable vehicles at a temperature of not less than 250NF. Tarpaulins shall be provided and used upon all loads. The wearing surface shall be spread with self-propelled mechanical spreading and finishing equipment, provided with a screed or strike-off assembly capable of distributing not less than the full width of a traffic lane. The screed shall be adjustable to the required crown and elevation. Screeding includes any cutting, crowding or other action which is effective on the mixture without tearing, shoving, or gouging, and which produces a finished surface of an even texture. The equipment shall be provided with rolling, tamping, or other suitable compacting devices, and shall be operated with a forward speed of not more than 20 feet per minute.

If the spreading and finishing equipment leaves ridges, indentations, or other marks in the surface that cannot be eliminated by rolling or prevented by adjustment in operation, its use shall be discontinued and other acceptable equipment shall be furnished by the Contractor.

If more than one course is to be laid in any area, not more than 24 hours shall elapse between the spreading and finishing of any two successive courses in that area. The self-propelled mechanical spreading and finishing machine shall be capable of propelling the vehicle being unloaded in uniform manner and, if necessary, the load of the haul vehicle shall be so limited that satisfactory spreading will be obtained. While being unloaded, the vehicle shall be firmly attached to the machine and the brakes on the vehicle shall not be depended upon to obtain contact between the vehicle and the machine.

Before placing asphalt concrete wearing surface adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face in a neat line. The location of the proposed joint shall be tested with a 10-foot straight-edge and cut back such that when the straight-edge is laid on the finished surface parallel with the center line of the street, the surface shall in no place vary from the lower edge of the straight-edge more than 1/8 inch.

Before placing asphalt concrete adjacent to any existing asphalt concrete, the face of the existing asphalt concrete shall be trimmed to a vertical face in a neat line.

Where asphalt concrete wearing surface is placed adjacent to a Portland cement concrete gutter, the asphalt concrete wearing surface shall be so laid that its surface, after compaction, will approximately be 1/4-inch above the surface of the adjacent concrete. The edge of the asphalt concrete wearing surface shall then be smoothed and sealed over a width of approximately 3 inches with hot hand-irons having a self-contained heating unit.

At locations where the width of asphalt concrete mixture to be spread is too narrow to permit the use of self-propelled mechanical spreading and finishing equipment, or where the surfacing is to extend to a featheredge and the use of such a machine is not practicable, the mixture may be spread by hand-raking. Where hand-raking is permitted, the mixture shall be finally shaped and smoothed by means of a wooden float 8 feet long, one-inch thick and 4 inches wide. The float shall be rigidly ribbed, and to insure a true and flat surface on the underside, adjusting screws shall be placed between the rib and float at not more than 24-inch centers. The float shall be operated by means of a long handle, from the side of the area being paved or surfaced, and parallel with the center line of the pavement or surfacing. High spots and irregularities that are transverse to the path of traffic shall be cut down and the material redistributed over the area. The maximum depth of wearing surface which may be spread and rolled in one course shall not exceed a compacted thickness of 2 inches. Where such thickness exceeds 2 inches, it shall be spread and rolled in courses each not to exceed a compacted thickness of 1-1/2 inches unless otherwise specified in these specifications.

Wearing surface mixture shall not be spread from hauling vehicles. No wearing surface shall be spread when the atmospheric temperature is below 50°F or during other unsuitable weather, or when the base is wet.



- E. Rolling: Immediately after the wearing surface has been laid as specified above, it shall be compressed with power rollers, smooth running, and in first-class mechanical condition. Initial rolling or tamping shall be performed when the temperature of the mixture is between 220NF and 245NF.

After the first pass of the roller, any low or grainy spots shall be broken up with a hot rake and more material worked in to insure a surface of uniform texture and maximum density. Rolling equipment shall be self-propelled. Initial rolling of asphalt concrete mixtures shall be performed by means of a three-wheeled roller weighing not less than 12 tons and with a compression on the rear wheels of not less than 325 pounds per linear inch of tire width, or in lieu thereof, by means of a three-axle tandem roller weighing not less than 12 tons. For production not exceeding 150 tons per hour, not less than one of the above specified rollers shall be used for initial rolling. For productions in excess of 150 tons per hour, one additional roller of a type designated by the Engineer will be required for each additional 100 tons or fraction thereof of asphalt concrete mixture placed.

Three-axle-tandem type rollers shall be so constructed that the rolls, when locked in position for all treads to be in one plane, are held with a rigidity which will permit the following test under full load. With the weight of the roller supported on the central roll, the tread of the central roll shall not be more than 1/8-inch above the plane tangent to the treads of the end rolls. With the weight of the roller supported on the end rolls, the tread of the central roll shall not be more than 1/4-inch below the plane tangent to the treads of the end rolls.

In general, three-axle tandem roller shall not be used in rolling over a crown or on warped surfaces when the axle is in a locked position.

Finishing rolling of asphalt concrete mixtures shall be performed by means of a tandem roller weighing not less than 10 tons.

Rolling shall continue until the compressed pavement or surfacing has a relative specific gravity of not less than 95 percent of the specific gravity of the combined mixture without voids.

- F. Smoothness: The finished surface of the pavement shall be true to grade and cross-section, free from depressions, or grainy spots, and shall show a uniform distribution of aggregate.

When a straight-edge, 10 feet long, is laid on the finished surface parallel to the center line of the pavement, the surface shall in no place vary from the lower edge of the straight-edge more than 3/16 of an inch.

No traffic shall be permitted on any course of asphalt concrete until it has cooled and set, except such traffic as may be necessary for construction purposes.

END OF SECTION

Asphaltic Concrete  
02512-5

***DIVISION 3***  
***CONCRETE***

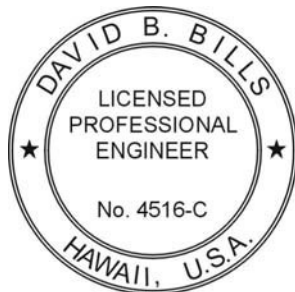
# ***APPENDIX***

**ENGINEERING REPORT**  
**FOR**  
**HEEIA KEA SMALL BOAT HARBOR**  
**WASTEWATER SYSTEM IMPROVEMENTS**  
**KANEOHE, OAHU, HAWAII**  
**TMK: 4-6-006:064**

**May 2018**  
**September 2018 (Revised)**

Prepared for:  
State of Hawaii  
Department of Land and Natural Resources  
Division of Boating and Ocean Recreation 4  
Sand Island Access Road  
Honolulu, Hawaii 96819

Prepared by:  
Bills Engineering Inc.  
1124 Fort Street Mall, Suite 200  
Honolulu, Hawai'i 96813-2715



THIS WORK WAS PREPARED  
BY ME OR UNDER MY SUPERVISION.

A handwritten signature in black ink that reads "David B. Bills".

SIGNATURE  
Expiration Date: 4-30-20

DAVID Y. IGE  
GOVERNOR OF HAWAII



BRUCE S. ANDERSON, Ph.D.  
DIRECTOR OF HEALTH

STATE OF HAWAII  
DEPARTMENT OF HEALTH  
P. O. BOX 3378  
HONOLULU, HI 96801-3378

In reply, please refer to:  
File:

245b ATC

September 28, 2018

Mr. David Bills, P.E.  
1124 Fort Street Mall, Suite 200  
Honolulu, HI 96813-2715  
Email: [dbills@BillsEngineering.com](mailto:dbills@BillsEngineering.com)

Dear Mr. Bills:

Subject: Heeia Kea Small Boat Harbor  
Wastewater Treatment Plant (WWTP)  
46-509 Kamehameha Hwy  
Kaneohe, HI 96744  
TMK: (1) 4-6-006:069  
File No. 245-B

The Department of Health (Department) acknowledges receipt of your revised application submittal. The Department has reviewed the submittal and determined that the subject project complies with applicable provisions of the Hawaii Administrative Rules (HAR), Chapter 11-62, Wastewater Systems. Therefore, the proposed project is approved for construction.

An inspection of the completed project is required to verify the information provided in the submittals. Please notify our office at least three weeks in advance to schedule a final inspection of the completed project.

Should you have any questions, please contact Shawn Sakoda at 586-4294.

Sincerely,

SINA PRUDER, P.E., CHIEF  
Wastewater Branch

STS:sp

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## **TABLE OF CONTENTS**

### **Index**

	<u>Page</u>
1. Introduction.....	1
2. Project Description .....	1
3. Wastewater Flow Projections .....	2
4. Wastewater Collection, Treatment and Effluent Disposal Systems Overview.....	2
5. Wastewater Treatment Facilities.....	4
6. Sludge Disposal Plan .....	6
7. Standby Power .....	8

### **Figures**

Figure 1	Location Map
Figure 2	Tax Map
Figure 3	Heeia Kea Small Boat Harbor Aerial Photo
Figure 4	Wastewater Facility Site Plan
Figure 5	Collection System, Treatment System and Effluent Disposal System Flow Chart
Figure 6	Hydraulic Loading and Removal Rates Diagram

### **Tables**

Table 1	Heeia Kea Wastewater Treatment Plant Equipment List
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### **Appendices**

Appendix A	Owner and Operator Information and Owner Certification
Appendix B	Existing Pump Station Records
Appendix C	World Water Works System WWTP Description, Equipment Description and Flow Chart
Appendix D	Flygt Pre-fabricated Lift Station
Appendix E	Trojan UV Disinfection System
Appendix F	Geotechnical Investigation Report by Lawrence Shinsato including Absorption Bed Sizing
Appendix G	Certifications by Engineer
Appendix H	MagFlux® Effluent Flow Meter
Appendix I	Floor Plans for Buildings at the Heeia Kea Small Boat Harbor

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**ENGINEERING REPORT**  
**FOR**  
**HEEIA KEA SMALL BOAT HARBOR**  
**WASTEWATER SYSTEM IMPROVEMENTS**

**1. INTRODUCTION**

It is intended to improve the wastewater treatment and disposal facilities for the Heeia Kea Small Boat Harbor. This Engineering Report has been prepared to address State of Hawai'i Department of Health requirements as contained in Hawai'i Administrative Rules (HAR), Title 11, Department of Health, Chapter 62, Wastewater Systems as to all the design, construction and operation requirements of the facilities.

**2. PROJECT DESCRIPTION**

The Heeia Kea Small Boat Harbor is a State of Hawaii owned and operated boating facility located adjacent to Kamehameha Highway in Kaneohe, Oahu (TMK:4-6-006:064). See Figure 1 - Location Map and Figure 2 - TMK. Owner and operator information is contained in Appendix A.

The facility consists of boat slips, ramp, dock and public restrooms. An aerial view of the project is shown on Figure 3 – Aerial Photo.

The scope of work as shown on Figure 4 – Wastewater Facility Site Plan will include:

1. There are two existing Wastewater treatment plans currently serving the Heeia Kea Small Boat Harbor. They are obsolete and functioning poorly. Both treatment plants will be demolished and removed by pumping all liquid from the systems and crushing the structures to 3 foot below grade. The crushed structures will then be filled with granular backfill to 6-inch below grade. A double layer of Mirafi® cloth will be placed over the granular material and the top 6-inches will fill with native topsoil material and re-grassed. The new WWTP and facilities have been laid out so demolition and abandonment of the existing facilities will be done at the end of the project and after the new WWTP and disposal system are completely operational.
2. Installation of a new duplex pump station at Kamehameha Highway picking up flow from both dockside 4-inch force main and landside existing gravity sewer serving the landside restroom facilities.
3. Installation of a new World Water Works MBBR package waste water treatment plant (WWTP) along Kamehameha Highway, including continuous flow monitoring, solids screening, flow equalization chamber 2-MMMR chambers, clarifier and permanent standby power for landside SPS and WWTP.
4. Construction of discharge leach fields. There are two identical leaching fields to provide 100 percent effluent disposal redundancy. Demolition and backfill of existing flow equalization basins, aeration chambers, and seepage pits as described in Item 1 above.

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### 3. **WASTEWATER FLOW PROJECTIONS**

Wastewater flows generated by the Heeia Kea Small Boat Harbor will be designed for 5,000 GPD system. A flow meter was installed during the preliminary stages of design (October 22, 2017 through February 22, 2018) to collect accurate flow data for sizing. The measured flow was actually less than 5,000 GPD but 5,000 GPD has been selected as the WWTP design flow are estimated to be 5,000 gallons per day (GPD), as provided by DLNR-DOBAR. The temporary flow meter records documenting the existing flows are attached in Appendix B. There are no plans for Harbor expansion and no provisions have been allocated for future flow increases.

### 4. **WASTEWATER COLLECTION, TREATMENT AND EFFLUENT DISPOSAL SYSTEMS OVERVIEW**

#### **4.1 Introduction**

The Heeia Kea Small Boat Harbor has three main elements that are integral with respect to proper sewage handling and reuse management. These are the collection system, wastewater treatment system and disposal system. Figure 5 provides a flow chart of the relationship of the three items related to the Heeia Kea Small Boat Harbor.

An overview of the three elements is provided here and the basis of design follows later in this report for the treatment system.

#### **4.2 Collection System Overview**

Sewage from the landside and dockside wastewater facilities are collected by gravity flow into a small dockside sewage pumping station (SPS). The SPS is connected to a force main leading to the wastewater treatment plant located near Kamehameha Highway. The dockside SPS consists of a fiberglass shell with buoyancy collar, two pumps (one duty and standby with an alternator). The pump station is being provided standby power from a generator located inside the fenced area of the new WWTP. The control panel for the pump station will also be located inside the fenced area of the new WWTP for security/vandalism purposes. The pump station and control panel are within 65-feet of each other. The pump control panel will be equipped with an auto-dialer for emergency purposes and allow operator and harbor Master notification. The pump station is shown in Appendix D.

The pump station pumps are sized to deliver wastewater to the WWTP equalization basin at a flow rate of 7 gallons per minute (10,000 GPD). Should both pumps have to operate at a peak flow period the flow rate would be 14 gpm (20,000 GPD). This is considered more than adequate (peak flow factor of 4 to the WWTP equalization basin. Catalogue cuts of the SPS have been placed in Appendix C.

#### **4.3 Treatment System Overview**

The new treatment system for the Heeia Kea Small Boat Harbor wastewater treatment facilities is a World Water Works Moving Bed Biofilm Reactor (MBBR) packaged treatment plant with hydraulic screen, equalization basin, 2-MBBR units, clarifier and sludge storage. The system details are provided in Appendix C. Appendix C also provides an operation flow chart. The clarifier element was specifically chosen over the



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dissolve air flotation (DAF) option. The WWTP is designed to provide effluent quality of less than 20 mg/l Total Suspended Solids, less than 20mg/l BOD and less than 5 mg/l fats oils and greases as outlined in Appendix C. The WWTP is primarily made from 316 stainless steel. Appendix C also has a layout of the WWTP unit and its major elements. Primary power to the WWTP comes from HECO and the WWTP also has an auto-transfer switch to activate power from the standby generator located inside the new WWTP fenced enclosure. A one-line wiring diagram has also been included in Appendix C.

Other ancillary electrical features are two area lights within the fenced area. In addition, if an internet line can be brought to the WWTP, it will be set up to allow off-site trouble shooting help be the Manufacturer and its local representative (Hawaii Engineering Inc).

The WWTP influent screen receiving all flow from the new sewage pump station is mounted at the top of the WWTP with the liquid component dropping into the WWTP equalization basin and solids falling via downspout into a trash bin for removal as required by the operator. The screen is rated for 75 gpm which is substantially above the system needs, but that is the smallest screen size available.

The WWTP has been provided with an equalization basin to ensure flow through the plant starting with the MBBR units and all units following does not exceed the design flow rate for the system (5,000 GPD). The calculations and assumptions used to size the equalization basin are contained in Appendix C page 9b.

The WWTP sludge storage has been design to accommodate 4,200 gallons of sludge. This is estimated to provide a 20-day day storage at full 5,000 GPD operation. It is fully anticipated the sludge removal frequency will be less frequent than design due to the fact the 5,000 GPD flow is conservative based on the flow records. Sludge storage computations are contained in Section 6 of this report.

The Owner (State of Hawaii Department of Land and Natural Resources Division of Boating and Ocean Recreation has specifically requested that disinfection not be included in the new WWTP. This is primarily based on the fact that the existing two WWTP systems do not have chlorination and have been discharging considerably worse quality effluent into the environment for substantial amount of years with no observed or reported negative impacts. However, if disinfection is required by the Department of Health the Owner would prefer a chlorination system and not an Ultra-violet disinfection system.

The WWTP is being equipped with a Trojan Ultraviolet Lamp Disinfection System with redundant elements. The UV system is contained in Appendix E. A complete equipment list is provided in Table 1.

The WWTP has been set with a distance of 16-feet from the property line. The land outside the property is also owned by DLNR-DOBAR and the setback from the outer limits of the adjacent DLNR-DOBAR lot are a minimum of 30 feet.

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#### **4.4 Effluent Flow Meter**

The WWTP is being equipped with a MagFlux® Electronic Flow Meter that can track the WWTP flow instantaneously and continuously. The effluent flow meter is shown in Appendix H.

#### **4.5 Disposal System Overview**

The disposal system will consist of two large leaching fields. Flow will alternate between leaching fields on a regular basis by means of valving inside the WWTP fenced enclosure. Once again, the valving is being placed inside the fence enclosure for security and vandalism reasons. The effluent line from the clarifier will have a tap and valve to allow easily accessible effluent sampling.

The size of each leaching field is approximately 5,250 square feet (4,267 effective square feet), and the effective square footage is based on almost the slowest percolation rate determined by the project Geotechnical Engineer (11.0 inches/minute). This sizing is conservative considering the percolation rates in the Geotechnical Report are substantially faster and the leaching field sizing is based on 5,000 GPD which conservative based on the actual flow data. The complete Geotechnical Report is contained in Appendix D.

The leaching fields will be equipped with a monitoring manhole in the middle of each field. The monitoring manhole will be price cesspool ring with a 24-inch riser to grade and 24-inch traffic bearing sewer manhole cover. This will allow for inspection of water level and quality.

Installation of the leaching fields will be done in phases to ensure no discharges to waters of the United States requiring extensive permitting including permitting with the Army Corps of Engineers and State of Hawaii, Department of Health, Clean Water Branch. The method that will be used to ensure no discharge will be “back of trench” techniques where cofferdams are created inside the leaching field and effluents pumped behind the cofferdam in the active leaching field installation zone. Construction will detail a “suggested” installation phasing plan, but the Contractor may modify. However, under no circumstance will be allowed unless the proper permits are obtained.

### **5. WASTEWATER TREATMENT FACILITIES**

#### **5.1 Design Flow**

The design flow has been described in Section 3 above and the actual flow data is in Appendix B.

#### **5.2 Treatment Plant and Individual Components**

Figure 4 shows the layout for the Heeia Kea Small Boat Harbor Wastewater Treatment Facilities and Appendix C shows a Flow Chart and hydraulic profile. Appendix C identifies each element of the system and provides the specific product data, design criteria and design parameters utilized in the wastewater treatment system design.

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### **5.3 Operational Plan**

The Operation of the WWTP is described in Appendix C. Appendix C describes all process controls for the wastewater treatment facilities. It is intended to be a guide to demonstrate the effectiveness of coordinated design effort in developing a treatment system specifically for the Heeia Kea Small Boat Harbor.

### **5.4 Operation and Maintenance**

The Operation and Maintenance Manual is provided separately. There is also a supplement to the manual regarding Department of Health requirements as cited in Chapter 11-62.

### **5.5 Wastewater Treatment Facility – Construction Plans**

After approval of this Engineering Report construction plans will be prepared, processed for agency approval by all required agencies. Following approval, the Heeia Kea Small Boat Harbor improvements will be put out to competitive bid and will be constructed by the selected contractor.

Owner: State of Hawaii, Department of Land and Natural Resources  
Division of Boating and Ocean Recreation  
4 Sand Island Access Road, Honolulu, Hawaii 96819  
Contact: Finn D. McCall  
[finn.d.mccall@hawaii.gov](mailto:finn.d.mccall@hawaii.gov)  
(808) 587-3250

Contractor: To be determined

Design Engineer: Bills Engineering, Inc. (Process Elements)  
Contact: David Bills  
[dbills@billsengineering.com](mailto:dbills@billsengineering.com)  
(808) 792-2022

MK Engineers, Ltd. (Electrical Design)  
Contact: Mitchell Nagata  
[mitchell@mkhawaii.com](mailto:mitchell@mkhawaii.com)  
(808) 484-5366

Tanimura & Associates, Inc. (Structural Engineer)  
Contact: Adrian Lee  
[alee@tanimuraeng.com](mailto:alee@tanimuraeng.com)  
(808) 536-7692

Operator: State of Hawaii, Department of Land and Natural Resources  
Division of Boating and Ocean Recreation  
4 Sand Island Access Road, Honolulu, Hawaii 96819  
Contact: Wade Thode (Contract Operator)  
[wadethode@yahoo.com](mailto:wadethode@yahoo.com)  
(808) 721-4866  
Contact: Ernie C. Choy (Harbor Agent)  
[ernie.c.choy@hawaii.gov](mailto:ernie.c.choy@hawaii.gov)  
(808) 233-3603

---

The construction plans will be used by the Contractor for construction of the wastewater treatment facilities.

The wastewater facilities will be fully tested to ensure proper operation prior to start-up. Representatives from the Department of Health will be notified for start-up testing.

## **6.0 SLUDGE DISPOSAL PLAN**

### **6.1 Overview**

The wastewater treatment plant clarifier generates sludge which is transferred to the sludge holding tank. The solids from the clarifier section will be pumped from the clarifier to the sludge storage portion of the wastewater treatment plant. The sludge holding tank (4189 gallon capacity) is capable of providing 20 days storage without decanting for percentage Total Solids of 0.65%. Should the percentage solids drop below 0.65% decanting can extend the storage past the 20 day minimum requirement. Calculations of storage at various percentage solids are presented below.

The sludge holding tank will be equipped with overflow interconnecting piping back to the equalization basin to prevent overflows from the sludge holding tank compartment of the wastewater treatment plant.

### **6.2 Sludge Storage Design Calculations**

The following shows design storage capacities for clarifier solids transfer at 0.50%, 0.65%, 0.75% and 1.00% solids concentrations:

#### **0.50% Solids:**

280 mg/l Total Suspended Solids (TSS) Removed  
11.6 lb/day solids @ 5,000 gpd Design Flow  
278 gpd at 0.50% concentration (Transfer to Sludge Holding Tank)  
4189 gallons storage available  
15 days storage (Decanting Required)

#### **0.65% Solids:**

280 mg/l Total Suspended Solids (TSS) Removed  
11.6 lb/day solids @ 5,000 gpd Design Flow  
232 gpd at 0.60% concentration (Transfer to Sludge Holding Tank)  
4189 gallons storage available  
20 days storage (Decanting Optional)

#### **0.75% Solids:**

280 mg/l Total Suspended Solids (TSS) Removed  
11.6 lb/day solids @ 5,000 gpd Design Flow  
185 gpd at 0.75% concentration (Transfer to Sludge Holding Tank)  
4189 gallons storage available  
22.6 days storage (Decanting Optional)

---

### **1.00% Solids:**

280 mg/l Total Suspended Solids (TSS)

11.6 lb/day solids @ 5,000 gpd Design Flow

139 gpd at 1.00% concentration (Transfer to Sludge Holding Tank)

4189 gallons storage available

30.1 days storage (Decanting Optional)

### **6.3 Decanting Equipment and Process**

Decanting will be required for solids transfer under 0.6% solids to achieve 20 days required storage. Decanting is optional for solids transfer over 0.6% solids. Decanting will simply extend the amount of storage days available before removal of solids to an off-site facility.

The decanting equipment/process provided with the wastewater treatment plan is as follows:

- a. Blowers/Mixers for the Sludge Tank are shut off.
- b. One to two hours of settling time recommended after Blower/Mixer shut off. (NOTE: With remote access controls provided it is possible that Blower Mixer shut off could be triggered remotely prior to the operator arriving on-site to commence the decanting process)
- c. The WWTP system is equipped with a floating decant pump for the sludge tank.
- d. After 1 to 2 hours settling the operator would turn on the decant pump and allow it to pump back to the Equalization Tank until the pump reached the settled sludge blanket. This can be observed by watching the pump go down and when it reaches the sludge layer and decanting can stop. Another option for the operator is to watch the water being pumped back to the Equalization Tank and stopping the decant pump when the water turns from clean to dirty.
- e. Once the decanting was completed; the air would be turned back on until the next decant cycle.
- f. For clarifier transfer solids under 0.6%, this decanting most likely would take place once per week; but could be as infrequently once every two weeks or even more frequently if desired. (NOTE: This should be a very quick process especially if the blowers are shut off remotely prior to the operators arrival to allow for setting in advance. Additionally, the volumes of water that will be required to be removed should be very minimal).
- g. For clarifier transfer solids greater than 0.6% the decanting process can be used to extend the available storage.
- h. The decanting process can be done as many times as required/necessary until the sludge will no longer settle and then it would need to be pumped out and removed.

---

#### **6.4 *Ultimate Disposal of sludge from the sludge Holding Tank***

The existing Heeia Kea Small Boat Harbor currently disposes of its existing sludge at the Kailua Wastewater Treatment Plant. Sludge is hauled by on a contract basis:

ABC Plumbing  
Contact: Randy Miguel  
Phone: (808) 887-0766  
Email: [sweetwatertoo@yahoo.com](mailto:sweetwatertoo@yahoo.com)

The same process will occur for the new Heeia Kea Wastewater Treatment plant.

#### **7.0 *Standby Power***

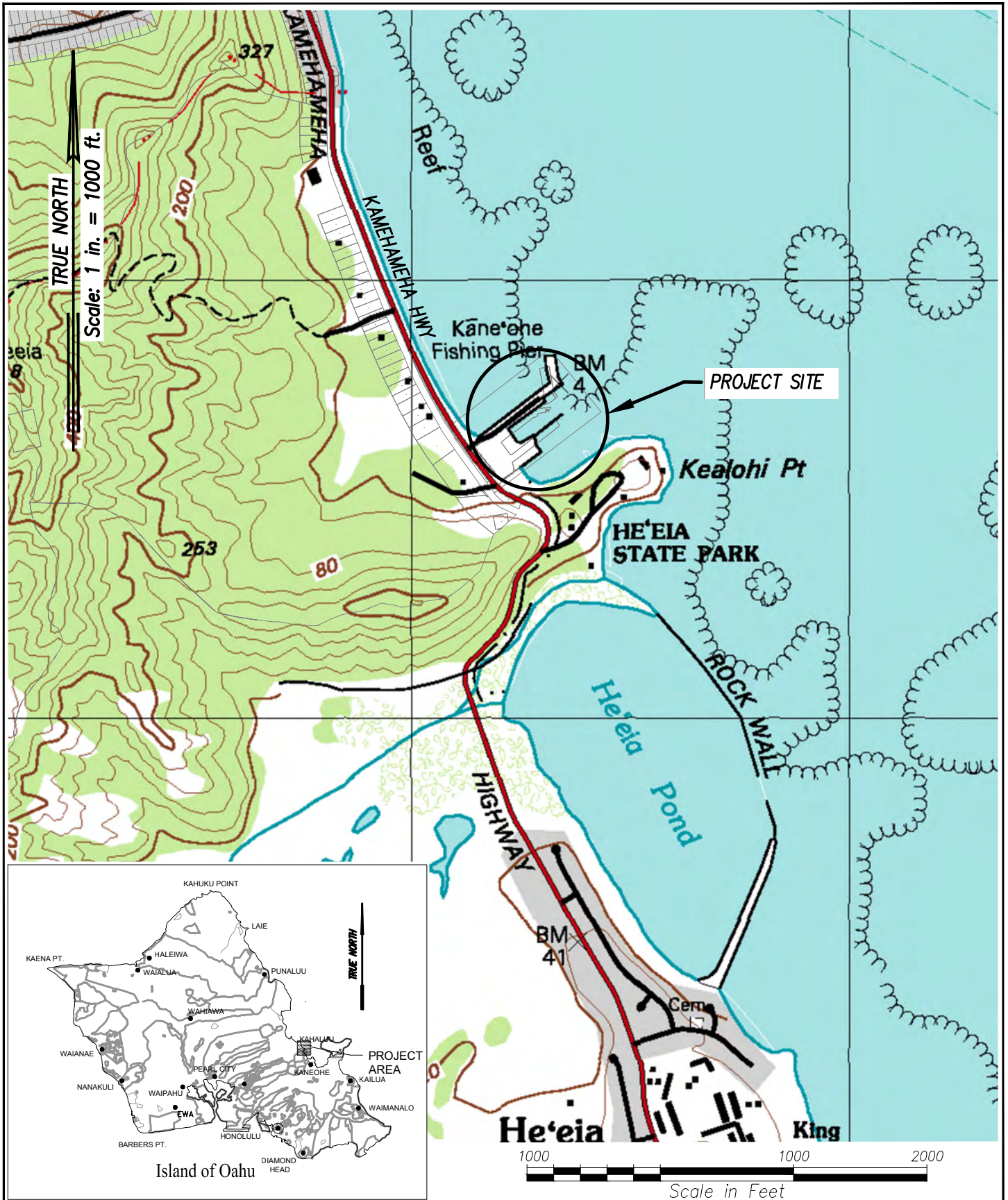
The WWTP is equipped with a standby generator. The standby generator is capable of providing standby power to all elements of the facility. This includes the sewage pump station delivering flow to the WWTP, and all elements requiring power including the UV system.

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## **Figures**

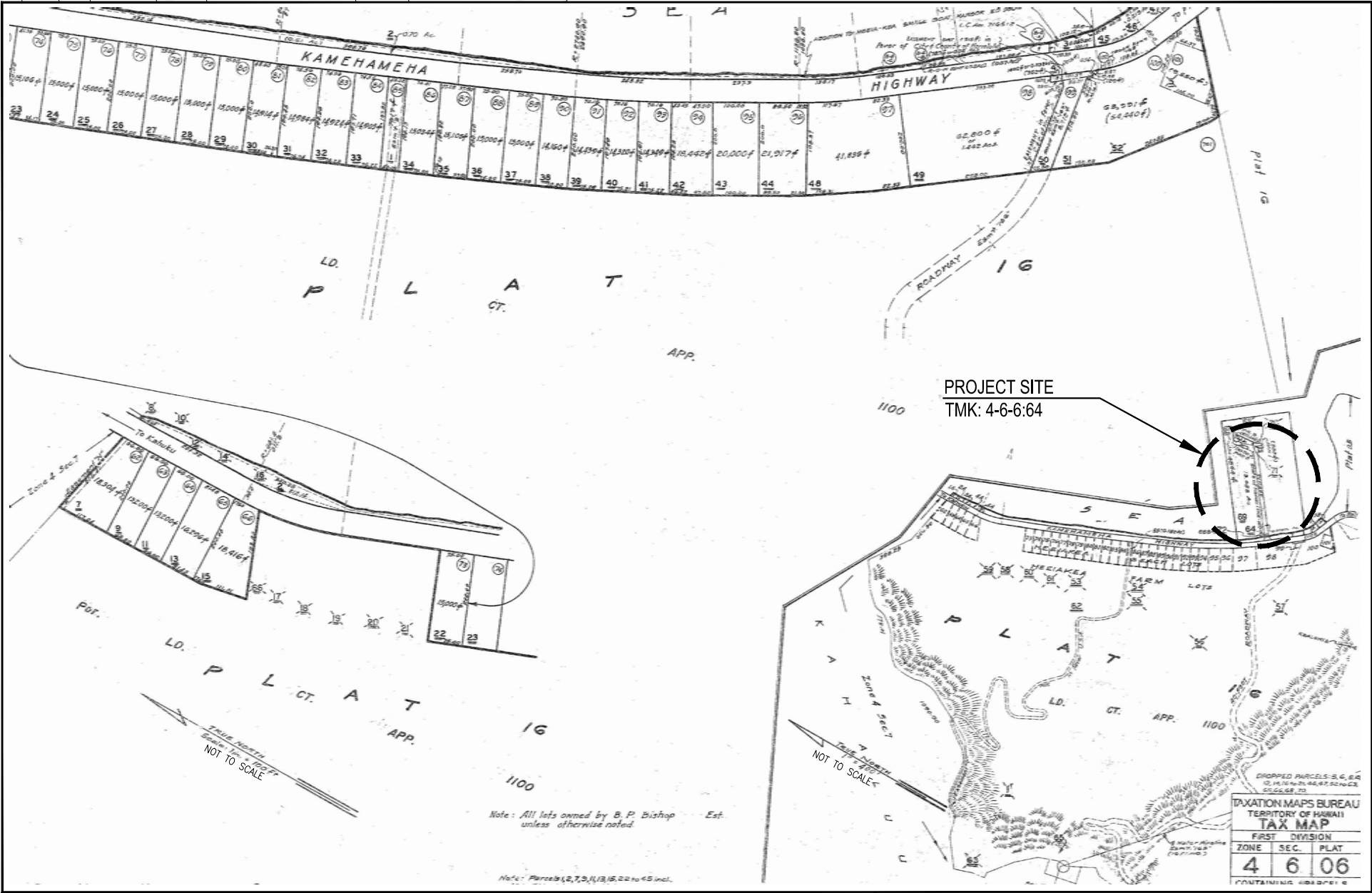
- Figure 1      Location Map
- Figure 2      Tax Map
- Figure 3      Heeia Kea Small Boat Harbor Aerial Photo
- Figure 4      Wastewater Facility Site Plan
- Figure 5      Collection System, Treatment System and Effluent Disposal System Flow Chart
- Figure 6      Hydraulics Loading and Removal Rates Diagram

Wed, 07 Jun 2017 - 11:52am  
 C:\Users\buhr\Documents\H\_PROJ\562-00\_HEEIA\_KEA\_WWTP\EXHIBITS\562-00\_HEEIA\_KEA\_LOCATION.dwg



<b>JOB NO.</b> 562-00	<b>Bills Engineering Inc.</b> Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HEEIA KEA SMALL BOAT HARBOR WASTEWATER SYSTEM IMPROVEMENTS KANE'ONE, OAHU, HAWAII TMK: (1) 4-6-6:64	<b>FIGURE</b>  <b>1</b>
<b>SCALE:</b> AS NOTED			
<b>DATE:</b> JUN 2017			





**2**

**FIGURE**

**JOB NO:**  
562-00

**SCALE:**  
AS NOTED

**DATE:**  
JUN 2017

**Bills Engineering Inc.**  
 Civil/Environmental Engineering  
 1124 Fort Street Mall, Suite 200  
 Honolulu, HI 96813

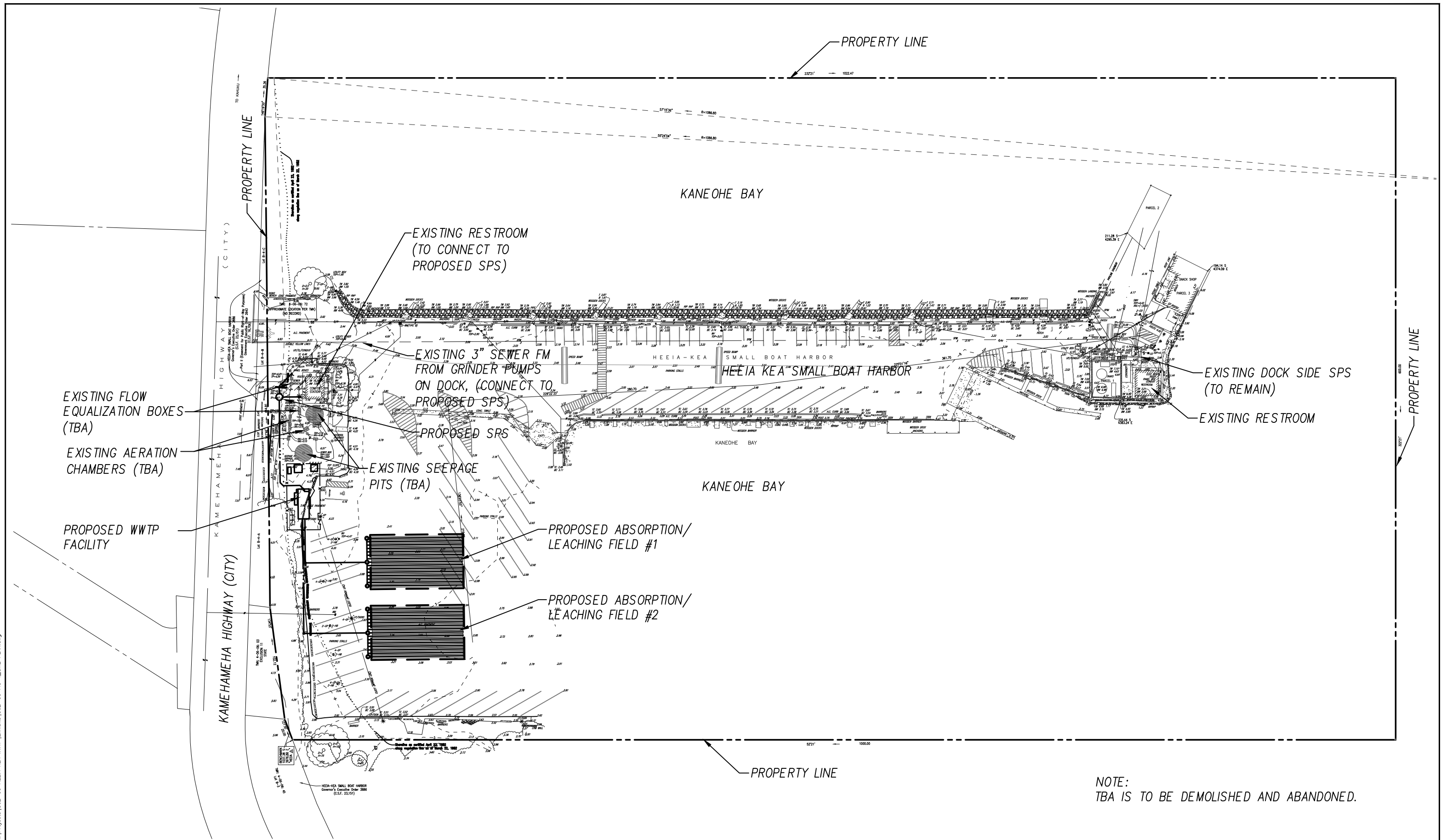
HEEIA KEA SMALL BOAT HARBOR  
 WASTEWATER SYSTEM IMPROVEMENTS  
 KANEOHE, OAHU, HAWAII  
 TMK: (1) 4-6-6:64

**TAX MAP**



3	FIGURE	JOB NO: 562-00	<b>Bills Engineering Inc.</b> Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HEEIA KEA SMALL BOAT HARBOR WASTEWATER SYSTEM IMPROVEMENTS KANEHOE, OAHU, HAWAII TMK: (1) 4-6-6:64
		SCALE: AS NOTED		
		DATE: JUN 2017		AERIAL PHOTO

Mon, 23 Apr 2018 - 8:45am  
 N:\Projects\562-00 HEEIA KEA WWTP\Exhibits\562-00 FIG 4 SITE PLAN.dwg



NOTE:  
TBA IS TO BE DEMOLISHED AND ABANDONED.



JOB NO: 562-00	<b>Bills Engineering Inc.</b> Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HEEIA KEA SMALL BOAT HARBOR WASTEWATER SYSTEM IMPROVEMENTS KANEOHE, OAHU, HAWAII TMK: (1) 4-6-6:64	FIGURE
SCALE: AS NOTED			4
DATE: APR 2018		WASTEWATER FACILITY SITE PLAN	

**SEWER COLLECTION SYSTEM  
DOCK SIDE PUMP AND  
LANDSIDE RETROOM  
(0.005 MGD)**



**HEEIA KEA SMALL BOAT HARBOR  
WASTEWATER TREATMENT PLANT  
(WORLD WATER WORKS  
PACKAGED MBBR WWTP)  
(0.005 MGD)**



**HEEIA KEA SMALL BOAT HARBOR  
LEACHING FIELDS  
(TWO FIELDS TO PROVIDE  
100% BACK-UP)  
(0.005 MGD)**

Mon, 23 Apr 2018 - 7:56am  
N:\Projects\562-00 HEEIA KEA WWTP\Exhibits\562-00 HEEIA KEA\_FLOW CHART.dwg

JOB NO. 562-00	<b>Bills Engineering Inc.</b> Civil/Environmental Engineering 1124 Fort Street Mall, Suite 200 Honolulu, HI 96813	HEEIA KEA SMALL BOAT HARBOR WASTEWATER SYSTEM IMPROVEMENTS KANEEOHE, OAHU, HAWAII TMK: (1) 4-6-6:64	<b>FIGURE</b>  <b>5</b>
SCALE: AS NOTED		FLOW CHART	
DATE: APRIL 2018			

# NOT FOR CONSTRUCTION

1. WWW SCOPE DEFINED BY RED DOTTED LINES
2. CUSTOMER PIPING SHALL BE INDEPENDENTLY SUPPORTED

MAIN
SECONDARY
FLEX
AIR
CHEMICAL
ELECTRICAL

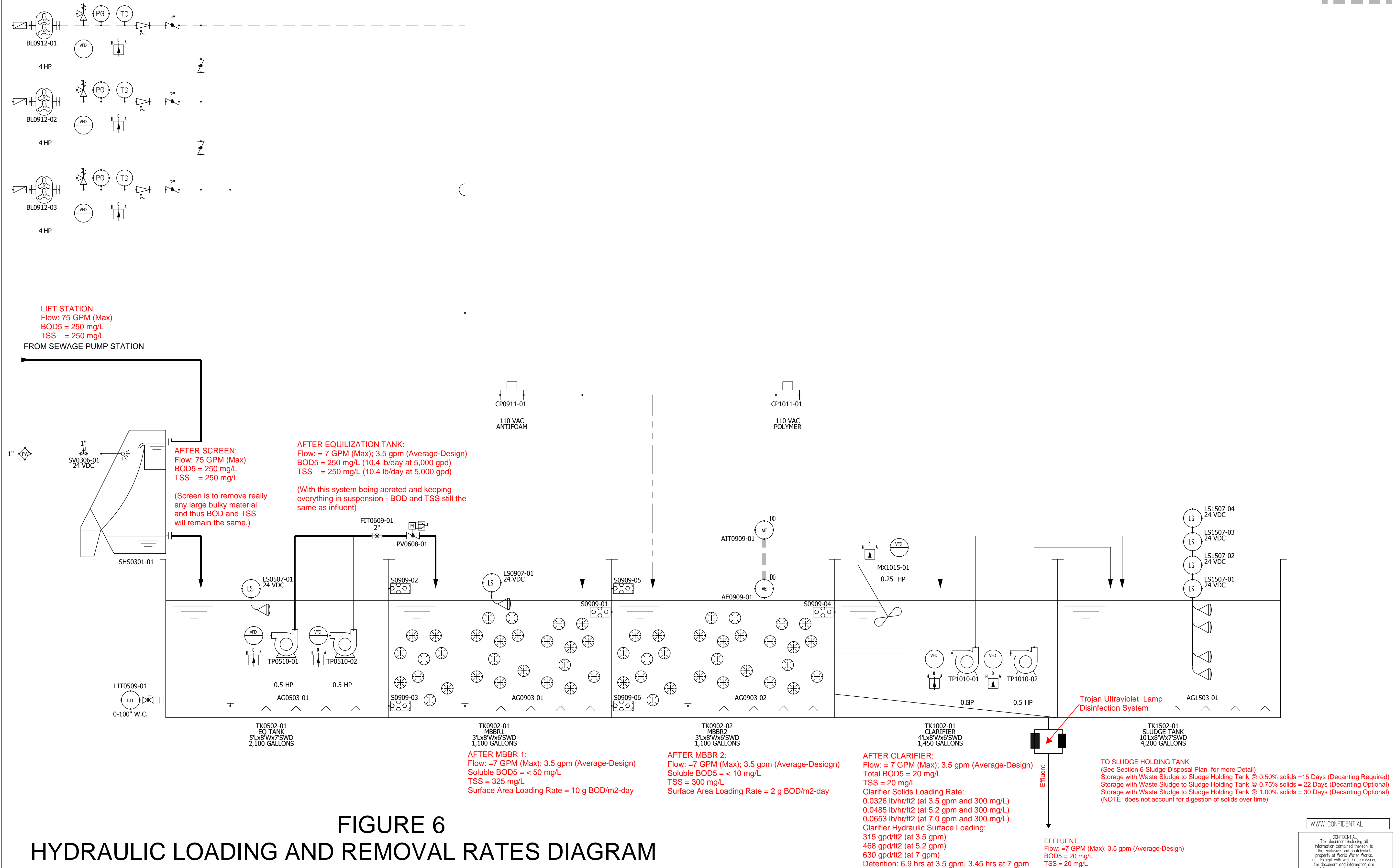
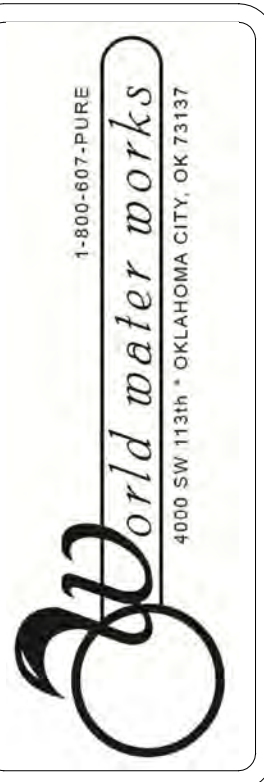


FIGURE 6

HYDRAULIC LOADING AND REMOVAL RATES DIAGRAM

BY	JT
DESCRIPTION	PRELIMINARY
DATE	2/18/2018
REV	0



CLIENT:	HEEIA KEA HARBOR
LOCATION:	KANEHOE, HI
FILE NAME:	Heeia Kea Harbor-KanehoeHT-MBBR Package Plant
DESCRIPTION:	PACKAGE PLANT

P.O.#	
DRAWN BY:	JT
CHECKED BY:	GP
DATE:	2/17/2018
SCALE:	N/A
JOB #	
DRAWING #	0604
SHEET:	4
OF	4 SHEETS

WWW CONFIDENTIAL

CONFIDENTIAL  
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## **Tables**

Table 1	Heeia Kea Wastewater Treatment Plant Equipment List
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**TABLE I**

**HEEIA KEA WASTEWATER TREATMENT PLANT EQUIPMENT LIST**

ITEM	MAKE AND MODEL	MANUFACTURER	LOCAL REPRESENTATIVE
Lift station and Control Panel	TOP 5 PRE-FAB, 2" SST/PVC	FLYGT Xylem Inc. 1 International Drive Rye Brook, NY 10573 United States 1-914-323-5700	Mack McPherson Hawaii Engineering Services, Inc. Ph: (808) 841-0033; Fax: (808) 841-2534 Email: <a href="mailto:mack@hiengineering.com">mack@hiengineering.com</a> Website: <a href="http://www.hiengineering.com">www.hiengineering.com</a>
Side Hill Screen	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	World Water Works, Inc.   Clean Water and Energy from Wastewater 4000 SW 113th Street, Oklahoma City, OK 73173   1-800-607-PURE   <a href="http://www.worldwaterworks.com">www.worldwaterworks.com</a>	Mack McPherson Hawaii Engineering Services, Inc. Ph: (808) 841-0033; Fax: (808) 841-2534 Email: <a href="mailto:mack@hiengineering.com">mack@hiengineering.com</a> Website: <a href="http://www.hiengineering.com">www.hiengineering.com</a>
Equalization Basin	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
MBBR Units	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above

Clarifier	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
Sludge Holding Tank	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
Effluent Flow Meter	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP and specifically shown in Appendix H	Same as Above	Same as Above
WWTP MBBR Control Panel	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
Internet Interface for Remote Monitoring and Control	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
Auto-dialer	Part of Ideal MBBR™ Moving Bed Biofilm Reactor WWTP	Same as Above	Same as Above
Disinfection System	STANDARD TROJANUVFIT AL 20 SYSTEM	Trojan UV 3020 Gore Road London, Ontario Canada, N5V 4T7 Office: +1 (519) 457-3400; Office: +1 (888) 220-6118	Mack McPherson Hawaii Engineering Services, Inc. Ph: (808) 841-0033; Fax: (808) 841-2534 Email: <a href="mailto:mack@hiengineering.com">mack@hiengineering.com</a> Website: <a href="http://www.hiengineering.com">www.hiengineering.com</a>
Standby Generator	Caterpillar Model: D40-2LC Power: 40 eKW / 50KVA Voltage: 208/120	501 Southwest Jefferson Avenue, Peoria, IL, 61630 888-614-4328	No Local Representative Mainland: Critical Power Products & Services. LLC 4140 W. Grange Ave Post Falls, ID 83854 USA Toll Free: (877) 959-2757 Phone: (509) 228-0178



## **APPENDIX A**

### **Owner and Operator Information and Owner Certification**

**HEEIA KEA SMALL BOAT HARBOR  
WASTEWATER SYSTEM IMPROVEMENTS**

**KANEOHE, OAHU, HAWAII**

**TMK: 4-6-006:064**

**Owner and Operator Information**

<b>Owner:</b>	State of Hawaii Department of Land and Natural Resources Division of Boating and Ocean Recreation 4 Sand Island Access Road Honolulu, Hawaii 96819 Contact: Finn McCall Phone: (808) 587-3250
<b>Operator:</b>	State of Hawaii Department of Land and Natural Resources Division of Boating and Ocean Recreation 4 Sand Island Access Road Honolulu, Hawaii 96819  (Via Contract-Current Operator: Wade Thode) 92-7091 Elele Street Kapolei HI 96707 License # C-25978 Cell: 808-721-4866 Office: 808-672 6247
<b>Property Information:</b>	Heeia Kea Small Boat Harbor 46-499 Kamehameha Hwy Kaneohe, HI 96744 Contact: Harbor Agent IV: Ernest Choy Phone: (808) 233-3603

DAVID Y. IGE  
GOVERNOR OF HAWAII



SUZANNE D. CASE  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA  
FIRST DEPUTY

JEFFREY T. PEARSON  
DEPUTY DIRECTOR - WATER

EDWARD R. UNDERWOOD  
ADMINISTRATOR  
DIVISION OF BOATING AND OCEAN RECREATION

**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**  
**DIVISION OF BOATING AND OCEAN RECREATION**  
4 SAND ISLAND ACCESS ROAD  
HONOLULU, HAWAII 96819

BOR-E-010.19

July 24, 2018

Sina Pruder, Chief  
State of Hawaii  
Department of Health  
Wastewater Branch  
2827 Waimano Home Road, Room 207  
Pearl City, HI 96782

**Owner's Certification**  
**Heeia Kea Small Boat Harbor Wastewater Treatment System**  
**Kaneohe, Island of Oahu, Hawaii**

The Division of Boating and Ocean Recreation certifies as the owners of the subject wastewater treatment system located on TMK: (1) 4-6-006:064 that the treatment system shall be operated and maintained in accordance with all of the provisions of the operation and maintenance manual developed, and that all applicable effluent requirements will be met pursuant of HAR §11-62-23 (2). We also certify that the operation and maintenance manual shall be available to the operator of the treatment system and will in the event upon sale or transfer of ownership of the treatment system provide the construction drawings, equipment manuals, operational data collected, and the appropriate transfer documents and provisions binding the new owner to the operation and maintenance manual.

Should you have any questions, please call Mr. Finn McCall of our Engineering Branch at (808) 587-3250.

Sincerely,

A handwritten signature in blue ink, appearing to read "E. Underwood".

Edward R. Underwood  
Administrator



### Owner and Parcel Information

<b>Parcel Number</b>	460060020000	<b>Data current as of</b>	July 23, 2018
<b>Owner Name</b>	S OF H DLNR BOATING & OCEAN REC. DIV Fee Owner	<b>Project Name</b>	
<b>Location Address</b>	KAMEHAMEHA HWY	<b>Plat Map</b>	<a href="#">Plat Map PDF</a>
<b>Property Class</b>	RESIDENTIAL	<b>Parcel Map</b>	<a href="#">GIS Parcel Map</a>
<b>Land Area (approximate sq ft)</b>	30,491	<b>Legal Information</b>	
<b>Land Area (acres)</b>	0.7	LOT B-4-A MAP 14 LCAPP 1100 0.07 AC LOT B-4-B MAP 14 LCAPP 1100 0.02 AC SUBJ/E LOT B-4-C MAP 14 LCAPP 1100 0.61 AC	

**APPENDIX B**  
Existing Pump Station Records

## APPENDIX B

HEEIA KEA SMALL BOAT HARBOR

WASTEWATER FLOW

October 22, 2107 -

February 22, 2018

Date	Time	Total Flow in KGAL From Dock Through Temporary Flow Meter (Cumulative Daily Meter Readings)	Total in Gallons From Dock Through Temporary Flow Meter (Gallons/Day)	Total Flow to Landside Restrooms Based on Water Meter Reading Into Restroom (Gallons/Day)	Total Combined Flow From Dock and Restroom Water Meter (Gallons per Day)
10.21.2017	10.14.30	42			
10.22.2017	10.14.30	42.7	700	933	1633
10.23.2017	10.14.30	43.4	700	933	1633
10.24.2017	10.14.30	44.8	1400	933	2333
10.25.2017	10.14.30	46.5	1700	934	2634
10.26.2017	10.14.30	47.7	1200	934	2134
10.27.2017	10.14.30	48.8	1100	934	2034
10.28.2017	10.14.30	50	1200	934	2134
10.29.2017	10.14.30	50.8	800	937	1737
10.30.2017	10.14.30	51.4	600	937	1537
10.31.2017	10.14.30	52.6	1200	937	2137
11.01.2017	10.14.30	53.9	1300	937	2237
11.02.2017	10.14.30	55	1100	940	2040
11.03.2017	10.14.30	56.1	1100	940	2040
11.04.2017	10.14.30	57.5	1400	940	2340
11.05.2017	10.14.30	58.6	1100	942	2042
11.06.2017	10.14.30	59.3	700	942	1642
11.07.2017	10.14.30	60.5	1200	944	2144
11.08.2017	10.14.30	61.9	1400	944	2344
11.09.2017	10.14.30	63.4	1500	945	2445
11.10.2017	10.14.30	64.7	1300	945	2245
11.11.2017	10.14.30	65.8	1100	945	2045
11.12.2017	10.14.30	66.9	1100	945	2045
11.13.2017	10.14.30	67.6	700	945	1645
11.14.2017	10.14.30	69.1	1500	946	2446
11.15.2017	10.14.30	70.5	1400	956	2356
11.16.2017	10.14.30	71.7	1200	950	2150
11.17.2017	10.14.30	72.8	1100	950	2050
11.18.2017	10.14.30	74.1	1300	950	2250
11.19.2017	10.14.30	75	900	951	1851

HEEIA KEA SMALL BOAT HARBOR  
WASTEWATER FLOW

October 22, 2107 -  
February 22, 2018

Date	Time	Total Flow in KGAL From Dock Through Temporary Flow Meter (Cumulative Daily Meter Readings)	Total in Gallons From Dock Through Temporary Flow Meter (Gallons/Day)	Total Flow to Landside Restrooms Based on Water Meter Reading Into Restroom (Gallons/Day)	Total Combined Flow From Dock and Restroom Water Meter (Gallons per Day)
11.20.2017	10.14.30	75.7	700	951	1651
11.21.2017	10.14.30	76.7	1000	951	1951
11.22.2017	10.14.30	78.3	1600	951	2551
11.23.2017	10.14.30	79.4	1100	955	2055
11.24.2017	10.14.30	79.7	300	955	1255
11.25.2017	10.14.30	80.9	1200	955	2155
11.26.2017	10.14.30	81.7	800	945	1745
11.27.2017	10.14.30	82.2	500	945	1445
11.28.2017	10.14.30	83.4	1200	945	2145
11.29.2017	10.14.30	84.8	1400	945	2345
11.30.2017	10.14.30	85.6	800	957	1757
12.01.2017	10.14.30	86.6	1000	957	1957
12.02.2017	10.14.30	87.6	1000	957	1957
12.03.2017	10.14.30	88.2	600	958	1558
12.04.2017	10.14.30	88.7	500	958	1458
01.09.2018	11.37.30	0.8	450	867	1317
01.10.2018	11.37.30	1.5	700	867	1567
01.11.2018	11.37.30	2.3	800	867	1667
01.12.2018	11.37.30	3	700	867	1567
01.13.2018	11.37.30	4	1000	867	1867
01.14.2018	11.37.30	5.1	1100	867	1967
01.15.2018	11.37.30	5.4	300	867	1167
01.16.2018	11.37.30	6.2	800	850	1650
01.17.2018	11.37.30	7.4	1200	850	2050
01.18.2018	11.37.30	8.3	900	850	1750
01.19.2018	11.37.30	9.1	800	850	1650
01.20.2018	11.37.30	10.1	1000	850	1850
01.21.2018	11.37.30	10.6	500	850	1350
01.22.2018	11.37.30	11.4	800	850	1650
01.23.2018	11.37.30	12	600	850	1450

HEEIA KEA SMALL BOAT HARBOR  
WASTEWATER FLOW

October 22, 2107 -  
February 22, 2018

Date	Time	Total Flow in KGAL From Dock Through Temporary Flow Meter (Cumulative Daily Meter Readings)	Total in Gallons From Dock Through Temporary Flow Meter (Gallons/Day)	Total Flow to Landside Restrooms Based on Water Meter Reading Into Restroom (Gallons/Day)	Total Combined Flow From Dock and Restroom Water Meter (Gallons per Day)
01.24.2018	11.37.30	12.9	900	850	1750
01.25.2018	11.37.30	13.7	800	925	1725
01.26.2018	11.37.30	14.5	800	925	1725
01.27.2018	11.37.30	15.5	1000	925	1925
01.28.2018	11.37.30	16.3	800	925	1725
01.29.2018	11.37.30	17.3	1000	925	1925
01.30.2018	11.37.30	18	700	925	1625
01.31.2018	11.37.30	18.9	900	925	1825
02.01.2018	11.37.30	19.9	1000	925	1925
02.02.2018	11.37.30	20.9	1000	925	1925
02.03.2018	11.37.30	22	1100	875	1975
02.04.2018	11.37.30	22.9	900	875	1775
02.05.2018	11.37.30	23.5	600	875	1475
02.06.2018	11.37.30	24.7	1200	875	2075
02.07.2018	11.37.30	25.9	1200	875	2075
02.08.2018	11.37.30	26.9	1000	875	1875
02.09.2018	11.37.30	28.1	1200	875	2075
02.10.2018	11.37.30	29.4	1300	875	2175
02.11.2018	11.37.30	30.2	800	875	1675
02.12.2018	11.37.30	30.9	700	875	1575
02.13.2018	11.37.30	32.2	1300	875	2175
02.14.2018	11.37.30	33.2	1000	940	1940
02.15.2018	11.37.30	34.4	1200	940	2140
02.16.2018	11.37.30	35.6	1200	940	2140
02.17.2018	11.37.30	36.9	1300	940	2240
02.18.2018	11.37.30	38.1	1200	940	2140
02.19.2018	11.37.30	38.6	500	940	1440
02.20.2018	11.37.30	39.6	1000	940	1940
02.21.2018	11.37.30	40.9	1300	940	2240
02.22.2018	11.37.30	42	1100	940	2040



HEEIA KEA SMALL BOAT HARBOR  
WASTEWATER FLOW

October 22, 2107 -  
February 22, 2018

Date	Time	Total Flow in KGAL From Dock Through Temporary Flow Meter (Cumulative Daily Meter Readings)	Total in Gallons From Dock Through Temporary Flow Meter (Gallons/Day)	Total Flow to Landside Restrooms Based on Water Meter Reading Into Restroom (Gallons/Day)	Total Combined Flow From Dock and Restroom Water Meter (Gallons per Day)
				Average Daily Flow (Average)	1911
				Average Daily Flow (Median)	1940
				Monitoring Period (Flow Peak)	2634

## **APPENDIX C**

### World Water Works System WWTP Description, Equipment Description and Flow Chart



# World water works

Clean Water and Energy from Wastewater

**PROPOSAL**

**Hawaii Engineering Services-HonoluluHI-Heeia Kea WWTP-Package WWTP**

**REVISED: 08/20/18**

**PROJECT**

**New Wastewater Direct Discharge Treatment System**

**CLIENT**

**Heeia Kea WWTP**

**HI**

**CLIENT ENGINEER**

**David Bills**

**Bills Engineering**

**Honolulu, HI**

**WWW REPRESENTATIVE**

**Mack McPherson and Mike Elhoff**

**Hawaii Engineering - HI**

**PRESENTED BY**

**Greg Parks & Chandler Johnson**

**World Water Works, Inc.**

*Main Phone: 1-800-607-PURE*

*Direct Phone: (617) 899-1566*

*Email: CJohnson@worldwaterworks.com*

**August 20, 2018**

This document contains World Water Works' proprietary and confidential information has been disclosed for the purpose of consideration of purchase of the goods and services identified herein. This document and said confidential information shall NOT be distributed to any other company or entity except those listed on this cover page. By accepting and reviewing this proposal, you agree to these confidential terms.



DATE: August 20, 2018  
TO: **David Bills, Bills Engineering**  
FROM: Greg Parks, World Water Works, Inc. (WWW)  
CC: Chandler Johnson, WWW  
Mike Elhoff, Mack McPherson Hawaii Engineering Services, Inc.  
RE: WWW PROPOSAL: Heeia Kea WWTP- MBBR Package Plant

---

Dear Mike,

Thank you for the opportunity to allow World Water Works to provide the following Revised proposal for a MBBR Package Plant to treat the wastewater at the Heeia Kea WWTP to 20/20 (BOD/TSS) Effluent Discharge Limits. (Please note per meetings in Hawaii and subsequent emails; the actual discharge limits are expected to be 30/30; however, the client wanted to see 20/20. WWW has elected to design for 20/20 although lower values may be achievable depending upon the actual flows/loads.). WWW has significant experience providing MBBR/DAF Treatment Systems to include multiple installations in Hawaii. WWW's offering is designed to achieve the lowest life cycle costs and complete project satisfaction.

Please note the following highlights:

- WWW's PP Vessel Contains Equalization; MBBR Treatment (2-Stages), Clarification and Sludge Storage.
  - A clarifier section has been included as part of the package vessel instead of a DAF Unit.
- All SS Supplied by WWW is 316SS with the exception of the Sump Pumps.
- All chemical feed shelves and the PLC Control Panel will come with Sun Shades. All Panels and VFDs are Nema4X.

The document has been organized to provide:

- 1) OVERVIEW
- 2) DESIGN BASIS
- 3) SCOPE OF SUPPLY
- 4) PRICING & DELIVERY
- 5) CONTRACTUAL
- 6) ATTACHMENTS: EXAMPLE DRAWINGS

We encourage you to reach out to our references to understand how others have enjoyed the experience of working with World Water Works.



WWW has the technology, team and record of customer satisfaction to provide you the assurance of success and long-term value. WWW delivers:

- ✓ A passionate and technical team
- ✓ A track record of customer satisfaction
- ✓ Lasting technology that is capital and operationally cost effective
- ✓ The ability to achieve the desired goals consistently
- ✓ An industry leading warranty and performance guarantee

We look forward to partnering with you for lasting success! Let's schedule a time in the near future to review this proposal in detail and to move on to the next steps of this project.

Best Regards,

*Greg Parks*

World Water Works, Inc.



# World water works

Clean Water and Energy from Wastewater

## TABLE OF CONTENTS

OVERVIEW .....	5
1. COMPANY BACKGROUND – CELEBRATING 20 YEARS! .....	5
2. PROPOSAL HIGHLIGHTS .....	5
3. REFERENCES .....	5
DESIGN BASIS .....	6
4. DESIGN BASIS .....	6
5. TECHNOLOGY OVERVIEW .....	8
6. PROCESS DESCRIPTION .....	9
SCOPE OF SUPPLY .....	10
7. SCOPE DOCUMENT .....	10
8. UTILITIES (TO BE PROVIDED BY OTHERS) .....	16
9. DRAFTING ENGINEERING SERVICES .....	16
10. FACTORY TESTING – QUALITY CONTROL .....	17
11. FIELD SUPPORT, STARTUP & TRAINING SERVICES .....	17
PRICING AND DELIVERY .....	18
12. TIMELINE .....	18
13. SHIPPING .....	18
14. PAYMENT TERMS .....	18
15. PRICE .....	18
CONTRACTUAL INFORMATION .....	19
16. MECHANICAL WARRANTY & PERFORMANCE GUARANTEE.....	19
17. CUSTOMER TO SUPPLY (UNLESS OTHERWISE SPECIFIED IN THIS DOCUMENT) .....	19
18. TERMS AND CONDITIONS.....	19

## OVERVIEW

### 1. COMPANY BACKGROUND – Celebrating 20 Years!

**World Water Works (WWW)** was founded in 1998 and is headquartered in Oklahoma City, OK with offices throughout the US and India. Our core competency continues to be designing, manufacturing, integrating and delivering the highest quality water, process and wastewater technology in the field. To learn more about WWW's history and our passionate team, please visit [www.worldwaterworks.com/company](http://www.worldwaterworks.com/company).



### 2. PROPOSAL HIGHLIGHTS

- ✓ Full Performance Guarantee
- ✓ Award Winning Technology
- ✓ Flexible Design
- ✓ Low Life Cycle Costs
- ✓ 10 Year Vessel Warranty
- ✓ MADE IN THE USA!
- ✓ Passionate Customer Centric Team
- ✓ Experience



### 3. REFERENCES

WWW recognizes that our success has absolutely everything to do with our customers' satisfaction. Our commitment to that simple concept has resulted in customers who feel passionately about us, some of which can be found by going to the following link: [www.worldwaterworks.com/resources/testimonials](http://www.worldwaterworks.com/resources/testimonials). We would happy to provide contact information and/or site tours of any of our facilities at your request.



## DESIGN BASIS

### 4. DESIGN BASIS

It is critical that the basis of design is accurate and meets the facility's current and future demands. The following information relates to the design basis used for this proposal. Any changes will likely impact design and costs.

<b>Project Goals:</b>	Discharge Compliance
<b>Type of Facility:</b>	
Type of Industry	Municipal: Small Boat House
<b>Facility Information:</b>	
Project Type	New Wastewater Treatment System
Discharge Type	Direct Discharge
Elevation at Site (ft)	<100.0
<b>Flow Information:</b>	
Design Month Flowrate (GPD)	5,000 (Majority of the Flow comes in 12 hours)
Design Month Flowrate (GPM)	3.5
Suggested Max Process Flowrate (GPM)	7 GPM
Peak/Max Flow (GPM)	75 GPM (For Prescreen/EQ Design Only)

**NOTE: Design assumes that a Majority of the flow comes into the system over a Twelve (12) Hour period but with equalization treated over a 24 hour period.**





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Clean Water and Energy from Wastewater

## Design Parameters:

	UNITS	INFLUENT	EFFLUENT
Total Suspended Solids (TSS)	mg/L	250	<20
Fats, Oils and Greases	mg/L	<25	<5
Biochemical Oxygen Demand (BOD)	mg/L	250	<20
Total Kjeldahl Nitrogen (TKN)	mg/L	60	N/A
Ammonia (NH <sub>3</sub> -N)	mg/L	45	N/A
Total Phosphorus	mg/L	6	N/A
pH	S.U.	6-8	N/A
Maximum Temperature	°F	75	N/A
Minimum Temperature	°F	60	N/A

**Important Notice regarding Liquid/Solids Separation Systems:** Clarifiers are designed to remove free TSS and insoluble organics (insoluble BOD/COD) only. The actual removal efficiencies will be significantly affected by the pH, TDS, temperature and the chemical program utilized on the clarifier. Chemical testing and analysis should be performed by a local chemical supplier to estimate the anticipated annual chemical costs necessary to achieve performance.

**Important Notice regarding Biological Systems:** Biological systems may require nutrients and/or micronutrients to achieve proper performance. Any estimated usage rates provided are based upon analytical data provided by Seller. A local chemical supplier would need to estimate anticipated annual costs. Biological systems can be inhibited severely by toxic compounds and excess polymer. If inhibition is greater than 20% that of normal biological activity, performance warranty will be null and void.

**Seller is not guaranteeing the operational costs associated with this system.**

## 5. TECHNOLOGY OVERVIEW

### Equalization Tank (EQ)

World Water Works' Equalization Tank design provides normalization of flow and loading while also providing a place for pH monitoring and control if needed in the future. The design considers variability of the wastewater, climate, space and other factors to provide as consistent flow and load to downstream equipment as feasible. Sizing calculations are shown on page 9a.

### Side Hill Screen (SHS)

The SideHill Screen (SHS) is ideally suited for process and wastewater streams containing solids, which are easily separated from the liquid and will slide easily. The smallest screen can handle 75 GPM.

The system operates by feeding the influent into a headbox where hydraulic turbulence keeps solids in suspension. The wastewater then overflows a distribution weir that orients the flow tangentially onto a steeply sloped screen surface. The liquid passes through the openings in the wedgewire to a drainage pan, located on the backside of the screen, and the solids slide down the surface of the screen to the discharge lip.

The SHS element is a curved, slotted, wedgewire screen with slots ranging from 0.010 to 0.100 inches oriented perpendicular to the direction of flow. The decks are positioned at a steeply sloped angle providing an effective stripping of liquid and allowing the solids to slide off the deck.

### Ideal MBBR™ – Moving Bed Biofilm Reactor

The Ideal MBBR™ - Moving Bed Biofilm Reactor system removes soluble materials from the waste stream through highly efficient aerobic biological degradation. The Ideal MBBR process achieves high removal rates through a patented process, which requires only two control points: sufficient Dissolved Oxygen (DO) and sufficient Nutrients (Nitrogen (N) and Phosphorus (P)). This process provides the smallest footprint biological system, which is tolerant of both load swings and temporary load deprivation.

The MBBR is a tank partially filled with specialized media. The media provides a highly advantageous site for the bacteria to grow and thrive. A stainless steel manifold installed in the bottom of the tank provides both DO and mixing by means of a blower. A stainless steel sieve near the top of the tank allows the water to exit the reactor while retaining the media in the tank. If sufficient nutrients are not available in the feedwater to the MBBR, to support a ratio of 100:4-5:1 BOD:N:P respectively, then the wastewater will be supplemented. The bacteria will digest the organics in the wastestream converting the soluble material to biomass, which can be removed downstream of this process through an Ideal DAF™. A dissolved oxygen meter will provide the ability to control the amount of dissolved oxygen injected into the wastestream.

## 6. PROCESS DESCRIPTION

### Wastewater Treatment Flow

- Wastewater will be pumped from a wet well (as provided By Others) to a WWW Supplied Presceen (Sidehill Screen (SHS)) (Pumps from Wet Well to WWW Supplied Primary Screen is BY OTHERS)
- Wastewater will flow by gravity from the SHS to an EQ Tank
  - Please note that pumps to the SHS are BY OTHERS.
  - The SHS will come with a cover, spray bar and solids chute which will direct solids from the screen to a container (by others) located at grade.
  - The SHS will be mounted on top of the EQ Section of the WWW Package Vessel.
  - The EQ Tank will provide ~42% of the Design Flow Rate in Capacity (~2,094 Usable Gallons)
- The WWW Ideal EQ Tank will be mixed with coarse bubble diffusion.
  - Level Controls and Back-Up Floats are included in the EQ Tank Section.
- Wastewater will be pumped from the EQ Tank to a WWW Ideal MBBR System for Treatment of BOD.
  - The flow from the EQ Tank will be controlled by VFDs or Equal (such as an electric actuated flow control valve)
  - The MBBR will be a Single (1) Train, Two (2) Stage Process
  - Wastewater will then flow by gravity from MBBR #1 to MBBR #2
- Wastewater will then flow by gravity from the final MBBR Section (MBBR #2) to the Clarifier Section for final solids removal.
- Effluent from the Clarifier Section will flow by gravity to a final discharge location.
  - Elevations that allow for gravity feed from Clarifier to final discharge location to be verified BY OTHERS.
  - Estimated Elevation of Clarifier Discharge is ~6' from grade.

### Clarifier Solids Flow

- Solids from the Clarifier Section will be pumped from the Clarifier to the sludge storage section of the Package Plant. The Sludge Tank is ~4,189 gal Capacity and should provide ~15 days of storage capacity at max design flows depending upon %TS of Sludge and actual influent flows/loads. The Sludge Storage Section is Aerated w/Coarse Bubble Diffusion.
- Solids will be held in the sludge holding tanks until final disposal or dewatering (By Others)
- The solids holding tank will have a flange connection that will allow for interconnecting piping back to the equalization tank; which will also have a flange connection, to prevent any sludge tank overflows from going anywhere other than the EQ Tank. Sizing calculations are shown on page 9b.

## EQUALIZATION BASIN CALCULATIONS FOR HEEIA KEA WWTP

- **Assumptions:** (For Flow Data - See Appendix B)

- 1,911 GPD Average Daily Flow
- 1,940 GPD Median Daily Flow
- 2,634 GPD Peak Daily Flow

- **Calculations:**

- Equalization Storage available: 2,100 Gallons

The equalization basin is at its low level at the start of every working day. Since the Small Boat Harbor is only open 12 hours per day and the WWTP is in service 24 hours per day this assumption is more than valid.

- For both average daily flow and Median Daily flow the equalization basin can hold 100 percent of the flow.
- For the peak daily flow, the equalization basin can handle 80 percent of the peak flow. The treatment system treats at 3.5 gallons per minute under normal operations. Therefore, as long as the peak flow enters the equalization basin over a period of longer than 152 minutes (2.55 hours), the plant will treat lower the equalization tank level and provide storage to accommodate 100 percent of the Peak Daily Flow. This is a very conservative assumption.

The equalization basin will have an overflow into the first MBBR as a safeguard. In addition, the WWTP can accommodate an operational flow up to 7 gallons per minute.

## CLARIFIER LOADING RATES FOR HEEIA KEA WWTP

- **Assumptions:**
  - 5,000 GPD Influent Flow (Design)
  - 3.5 GPM Average System Flow (Design)
  - 7.0 GPM Max System Flow
    - This would only happen if, for some reason, we treated all flow all the flow in 12 hours. With all the EQ, this should never happen.
  - Clarifier: 4' L X 8' W X 8' H (6' SWD)
    - SA = 32 ft<sup>2</sup>
    - Vol = ~1,436 Gal
- **Loading Calcs:**
  - Detention Time (DT):
    - @ Design: ~6 hrs 54 min
    - @ Max: ~3 hrs 26 min
  - Surface Overflow Rate (SOR) or Surface Loading Rate (SLR):
    - @ Design: 156.2 GPD/ft<sup>2</sup>
    - @ Max: 312.5 GPD/ft<sup>2</sup>

## SCOPE OF SUPPLY

### 7. SCOPE DOCUMENT

The below model numbers and equipment selection is based upon the information and data provided. In order to provide this proposal, certain assumptions were made. For example items as transfer pump designs, blower designs and VFDs (where applicable) may be adjusted based upon final layouts, head pressures and other elements that could impact the selections.

Project Mgt, Eng & Design				
Quantity	Model	Equipment Description	Description	Provided By
1.0	DRAW-BP	Process Engineering, Design & Project Management	Drawing Package - Basic Package - IS Project	WWW

Transfer System #1: Wet Well to WWW Prescreen				
Quantity	Model	Equipment Description	Description	Provided By
0.0	PUMP-TR-100	Transfer Pump	All Pumps, VFDs, Level Controls, Etc: <b>By Others/Existing</b>	Others

Prescreen				
Quantity	Model	Equipment Description	Description	Provided By
1.0	SCREEN-SHS 1838	Sidehill Screen	18" Sidehill Screen; 0.4" 304SS Wedgewire Screen w/Cover, Spray Bar and Solids Chute. (To be mounted on top of WWW EQ Section of Package Plant- <b>BY OTHERS</b> )	WWW
			Mounting of WWW SHS on top of EQ Section of WWW PP Vessel: <b>By Others</b>	

Transfer System #2: SHS to EQ Tank				
Quantity	Model	Equipment Description	Description	Provided By
0.0	Gravity	N/A	By Gravity	N/A

Equalization				
Quantity	Model	Equipment Description	Description	Provided By
1.0	TANK-PPR	Package Plant Vessel	Polypropylene Vessel w/Access Ladder and Platforms OD: ~27' L X 10' W X 8'H ID: ~25' L X 8' W X 6-7' SWD	WWW
1.0	TANK-PPR	Equalization Tank	<b>EQ Section:</b> ~5' L X 8' W X 7' SWD (~2.1Kgal Usable Capacity)	WWW
1.0	MANI-LT06	Mixer Aeration Manifold	316SS Aeration Manifolds (Only Piping Internal to WWW Supplied Vessel; <i>All External Piping: BY OTHERS</i> )	WWW
1.0	BLOW-	Blower	EQ Aeration/Mixing will be provided by utilizing the MBBR Blowers.	WWW
1.0	LC-LT-Pressure	Level Control	Pressure Style Level Control	WWW
1.0	LC-LS-Float	Float Level Controls	Level Switch – Float (HL Alarms)	WWW

Transfer System #3: EQ Tank to MBBR				
Quantity	Model	Equipment Description	Description	Provided By
2.0	PUMP-SP-22	Transfer Pump	0.5 HP Sump Pump (Pending Final Design) (1: Operational; 1: Stand-By)	WWW
1.0	VALVE-Elect-BF-2	Control Valve - Auto Positioning	2"Control Valve - Electric Butterfly Valve - Positioning	WWW
1.0	FLOW-Mag-2	Flowmeter	Flow Meter-Magmeter-2"	WWW

Biological Process				
Quantity	Model	Equipment Description	Description	Provided By
1.0	TANK-PPR	MBBR Reactor Tank	Polypropylene Vessel w/Access Ladder and Platforms OD: ~27' L X 10' W X 8'H ID: ~25' L X 8' W X 6' SWD	WWW
1.0	TANK-PPR	MBBR Reactor Tank	MBBR Portion of Main Vessel: Single Train; Dual Reactor ID: ~3.0' L X 8' W X 6' SWD (Per Reactor)	WWW
2.0	MBBR-MEDIA-ABC-5R	MBBR - Media	Moving Bed Biofilm Reactor Media - 650 m <sup>2</sup> /m <sup>3</sup> – Recycle	WWW
2.0	MANI-LT06	MBBR Manifolds	316SS Aeration Manifold (Only Piping Internal to WWW Supplied Vessel; <i>All External Piping: BY OTHERS</i> )	WWW
2.0	MBBR-SIEV-Other10	MBBR Sieve	Media Retention Sieve (1/MBBR)	WWW
2.0	MBBR-SIEV-Other6	MBBR Overflow Sieve	Media Overflow Sieve (1/MBBR)	WWW
2.0	MBBR-SIEV-Other6	MBBR Drain Sieve	Media Drain Sieve (1/MBBR)	WWW
1.0	LC-LS-Float	Float Level Controls	Level Switch – Float (HL Alarms)	WWW
3.0	Blow-0030-L	Blower	4 HP Kaeser Blower (2: Operational; 1: Stand-By) (1: MBBRs #1/#2; 1: EQ/Sludge Tanks)	WWW
3.0	VFD-0030	Variable Frequency Drive	VFD - 4 HP Danfoss w/Nema4X Enclosure	WWW
1.0	PM-GS2	DO Probe(s) / Controller	DO Monitoring & Control Package (Includes control & one (1) Probe)	WWW
1.0	CHEM-CS1-CS	Antifoam Feed System	Chemical Feed - Standard - 1 Pump (Includes Sun Shade/Cover)	WWW





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Clean Water and Energy from Wastewater

Clarifier Section				
Quantity	Model	Equipment Description	Description	Provided By
1.0	TANK-PPR	Clarifier/Sludge Tank	Clarifier: ~4' L X 8' W X 8' (6' SWD) Section of Main Package Vessel (w/False Slopped Bottom)	WWW
2.0	PUMP-SP-22	Sludge Pump	0.5 HP Sump Pump (1: Operational; 1: Stand-By)	WWW
1.0	CHEM-CS1-BMS	Auto Polymer Dilution & Feed System	Chemical Feed - Batch Makedown System - 1 Pump	WWW

Sludge Storage				
Quantity	Model	Equipment Description	Description	Provided By
1.0	TANK-SLUDGE-	Storage Tank	Sludge: ~10' L X 8' W X 7' SWD Section of Main Package Vessel	WWW
4.0	LC-LS-Float	Level Control	Level Switch – Float (LLL/LL/HL/HHL)	WWW
1.0	MANI-LT06	Mixer Aeration Manifold	316SS Aeration Manifolds (Only Piping Internal to WWW Supplied Vessel; <i>All External Piping: BY OTHERS</i> )	WWW
1.0	BLOW-	Blower	EQ Aeration/Mixing will be provided by utilizing the MBBR Blowers.	WWW



Controls & Electrical				
Quantity	Model	Equipment Description	Description	Provided By
1.0	CTRLS-AB-CL-1	Low Voltage Electrical Cabinet	AB Compact Logix PLC w/Color HMI (Pre-Wired Nema4X Panel; Sun Screen/Cover) <sup>1</sup>	WWW
1.0	FLOW-Mag-3	Flowmeter	Flow Meter-Magmeter-3"	WWW
1.0	CTRLS-AD	Auto-Dialer	Auto Dialer System for WWW System & Primary Pump Station	WWW
1.0	CTRLS-MD	Modem	Verizon Wireless Modem <i>(All Monthly Rates to be paid BY Others)</i>	WWW

**1:** Please note that WWW's Control Panel is priced to control only equipment/items that were provided as part of WWW's Scope of Supply. Equipment/Items external to WWW's scope of supply may be added for an additional cost.

Installation				
Quantity	Model	Equipment Description	Description	Provided By
0.0	INSTALL	Installation	<i>All Installation, System assembly, Permitting, Local Engineering, Etc: BY OTHERS</i>	<i>Others</i>

QC & Shipping				
Quantity	Model	Equipment Description	Description	Provided By
1.0	QCSH-	Quality Control	Factory QA/QC	WWW
1.0	QCSH-	Shipping & Handling	FOB: Job Site (Unloading BY OTHERS)	WWW



<b>Startup and Training</b>				
<b>Quantity</b>	<b>Model</b>	<b>Equipment Description</b>	<b>Description</b>	<b>Provided By</b>
1.0	SERV-FS0-8	Startup and Training Services	Field Service - 8 Days On Site, 4 Travel Days, 2 Trips	WWW

<b>Warranty</b>				
<b>Quantity</b>	<b>Model</b>	<b>Equipment Description</b>	<b>Description</b>	<b>Provided By</b>
1.0	WTY-2	Warranty	2 Year Mechanical / Process Warranties	WWW



## 8. UTILITIES (To Be Provided By Others)

### POWER

High Voltage Power	208 VACV, 3 Phase, TBD Amps <i>Subject to Final Design</i>
Control Power	24 VDC
Low Voltage Power	
Ancillary	110 V, 1 Phase 20 Amp
Chemical Feed(s)	110 V, 1 Phase 20 Amp <i>Subject to Final Design</i>

FRESHWATER ~5 gpm, 60 psi, *(Chemical Makedown, SHS and Washdown)*

INTERNET ACCESS Dedicated, Into the Control Panel

## 9. DRAFTING ENGINEERING SERVICES

World Water Works offers a variety of drafting and engineering package options from basic packages to full design/build engineering packages. Based upon the scope of supply and client discussions the following package has been selected. Please let us know if a different level of drawings and engineering services are required.

### Basic Integrated Solution Engineering Package (limited to WWW's Scope of supply)

The Basic Integrated Solution Engineering Package includes:

- ✓ Piping & Instrument Diagrams (P&ID) for all unit processes of equipment provided
- ✓ General Equipment Layouts for all equipment provided within scope of supply
- ✓ Electrical Panel Layouts and PLC panels (if applicable)
- ✓ Equipment Cut Sheets
- ✓ A Hydraulic Profile will be provided for WWW's Scope of Supply Only (Screen>Clarifier)
- ✓ An Electrical One-Line Diagram will be provided.
- ✓ **One submittal, one review, one revision are included.**

This package does NOT include:

General Floorplan, General Piping Plan or Piping Details, Electrical Details, Existing Site Plan, Proposed Site Plan, Demolition Plan, Structural and Foundation Plans, Stamped Drawings, or multiple revisions and additions do to client changes (Additional changes will be billed hourly rates of \$200/hour).

Drawing package upgrades are available upon request.



## 10. FACTORY TESTING – QUALITY CONTROL

World Water Works conducts numerous tests over the course of the manufacturing process to meet the highest of quality standards. WWW documents and keeps on record these tests which are available to our clients. WWW invites the engineer and/or the client to witness this testing in Oklahoma City, OK.

## 11. FIELD SUPPORT, STARTUP & TRAINING SERVICES

The success of any system relies not only in the excellence of the technology and the proper design; it also relies upon proper operational ownership. With years of experience, WWW has developed highly effective training methods to assure success.

World Water Works offers a variety of field service package options that can be tailored to best meet the project needs and treatment goals. Based upon the scope of supply and client discussions the following package has been selected. Please let us know if a different level of onsite time is desired.

### **START-UP PACKAGE – Install Support, Startup, & Optimization Training (FSO-8)**

This package includes (Maximum of 2 trips):

TRIP 1: (4) days onsite and (2) days of travel in (1) trip to the project site.

System installation check-outs, Dry testing, Controls & Instrumentation Calibration and Check-out, Troubleshooting, Wet testing, One-sheet Set-up, Detailed Startup Strategy Review, Go Live, System Checks & Optimization, Troubleshooting, Hands-on Training

TRIP 2: (4) days onsite and (2) days of travel in (1) trip to the project site.

After BioAcclimation (if applicable), System Optimization, Troubleshooting, Hands-on Training

This package also includes two (2) 1-2 hour classroom-training sessions. Training materials will be sent prior to arrival onsite. This package includes one (1) year of free phone support. If additional onsite support is desired, it will be billed at \$1,000/day plus expenses and will be billed at a minimum of 1 day onsite / 2 days travel.

**Important Notice:** All onsite service is based on Travel on Monday and Fridays with days on site Tuesday, Wednesday, and Thursday. If weekend travel and/or onsite service is required, additional costs will be applied. Travel is based on notification two weeks in advance to be on site for meetings, service, etc.

If additional onsite support is desired, it will be billed at \$4,500/trip at a minimum of 1 day onsite / 2 days travel. Each additional day on site is \$1,000/day.

**Installation, Operation and Maintenance Manuals.** Seller provides an electronic copy of the Installation, Operation and Maintenance (“IOM”) Manual for its products. The electronic version will be provided in PDF format. **Hard copies of manual are available for an additional cost of \$1,000 per copy.**



## PRICING and DELIVERY

### 12. TIMELINE

Submittal Preparation	8-10 weeks
Equipment Construction	18-22 weeks
Inspection & Shipment	2-4 weeks

Note: Project delivery timing will be subject to timing of the order and timely approvals and payments by the customer. WWW manufactures its technology fully in-house which gives us greater flexibility in meeting scheduling demands. Please inquire about special timing requirements.

### 13. SHIPPING

Incoterm	FOB Destination
Shipping & Handling Terms	Freight Allowed



## CONTRACTUAL INFORMATION

### 16. MECHANICAL WARRANTY & PERFORMANCE GUARANTEE

Equipment will be warranted from defects in materials, workmanship and design for a period of 12 months from the date upon which the goods are used or put into operation or 18 months from shipment, whichever occurs first. Warranty is contingent upon the system being stored, installed, operated and maintained in accordance with World Water Works' instructions. Extended warranties are available for an additional cost. World Water Works will provide a Performance Guarantee based upon final design and scope mutually agreed upon.

### 17. CUSTOMER TO SUPPLY (Unless Otherwise Specified in This Document)

- All Costs of Installation to include, but not be limited to: System Unloading, Piping and Electrical Installation, any/all Building/Foundation work, Permitting Costs, etc.
- Sufficient room for the equipment, sufficient water, sufficient heating and/or cooling, and sufficient compressed air to meet the requirements of the project.
- All utilities, sewer and solid waste disposal systems, chemicals, and laboratory testing required to operate the system to include, but not be limited to: phone, electrical power supply, fresh water and compressed air.
- Customer shall inform Company of any third party inspection requirements. Customer shall pay any and all charges, which may be incurred for third party approval. Licenses and permits as required.
- Personnel trainable in operation and control of system and that follows WWW's recommendations.
- The above listed materials are based on the Company's interpretation of the plans and specifications. Any changes to this proposal are subject to price revision.
- Additional Customer requirements may be defined based upon final design and scope mutually agreed upon.

### 18. TERMS AND CONDITIONS

Standard Terms and Conditions of sale are available upon request.

# MBBR PACKAGE PLANT PROCESS & INSTRUMENTATION DRAWINGS

PO#:  
JOB#:

HEEIA KEA HARBOR

KANEOHE, HI  
USA

WORLD WATER WORKS  
4000 SOUTHWEST 113TH STREET  
OKLAHOMA CITY, OK 73173  
USA

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Inc. Except with written permission,  
the document and information are  
not to be copied, reproduced or  
delivered to others.

REV	DATE	DESCRIPTION	BY
0	2/19/2018	PRELIMINARY	JT



CLIENT:	HEEIA KEA HARBOR
LOCATION:	KANEOHE, HI
FILE NAME:	Heeia Kea Harbor-KaneoheHI-MBBR Package Plant
DESCRIPTION:	MBBR PACKAGE PLANT

PRELIMINARY	
P.O.#	
DRAWN BY:	JT
CHECKED BY:	GP
DATE:	2/17/2018
SCALE:	N/A
JOB #	
DRAWING #	0601
SHEET:	1
OF	4 SHEETS

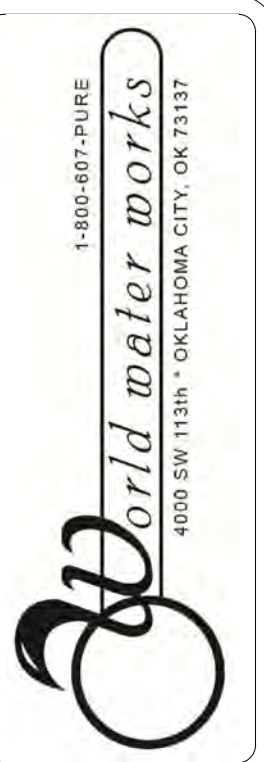


# 06-P&ID

Drawing	Description
01	COVER PAGE
02	Drawing List
03	P&ID KEY
04	DAF
05	EQUIPMENT LIST

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CLIENT: HEEIA KEA HARBOR  
 LOCATION: KANEHOHE, HI  
 FILE NAME: Heeia Kea Harbor-KaneoheHI-MBBR Package Plant  
 DESCRIPTION: MBBR PACKAGE PLANT

PRELIMINARY

P.O.#

DRAWN BY: JT

CHECKED BY: GP

DATE: 2/17/2018

SCALE: N/A

JOB #

DRAWING # 0602

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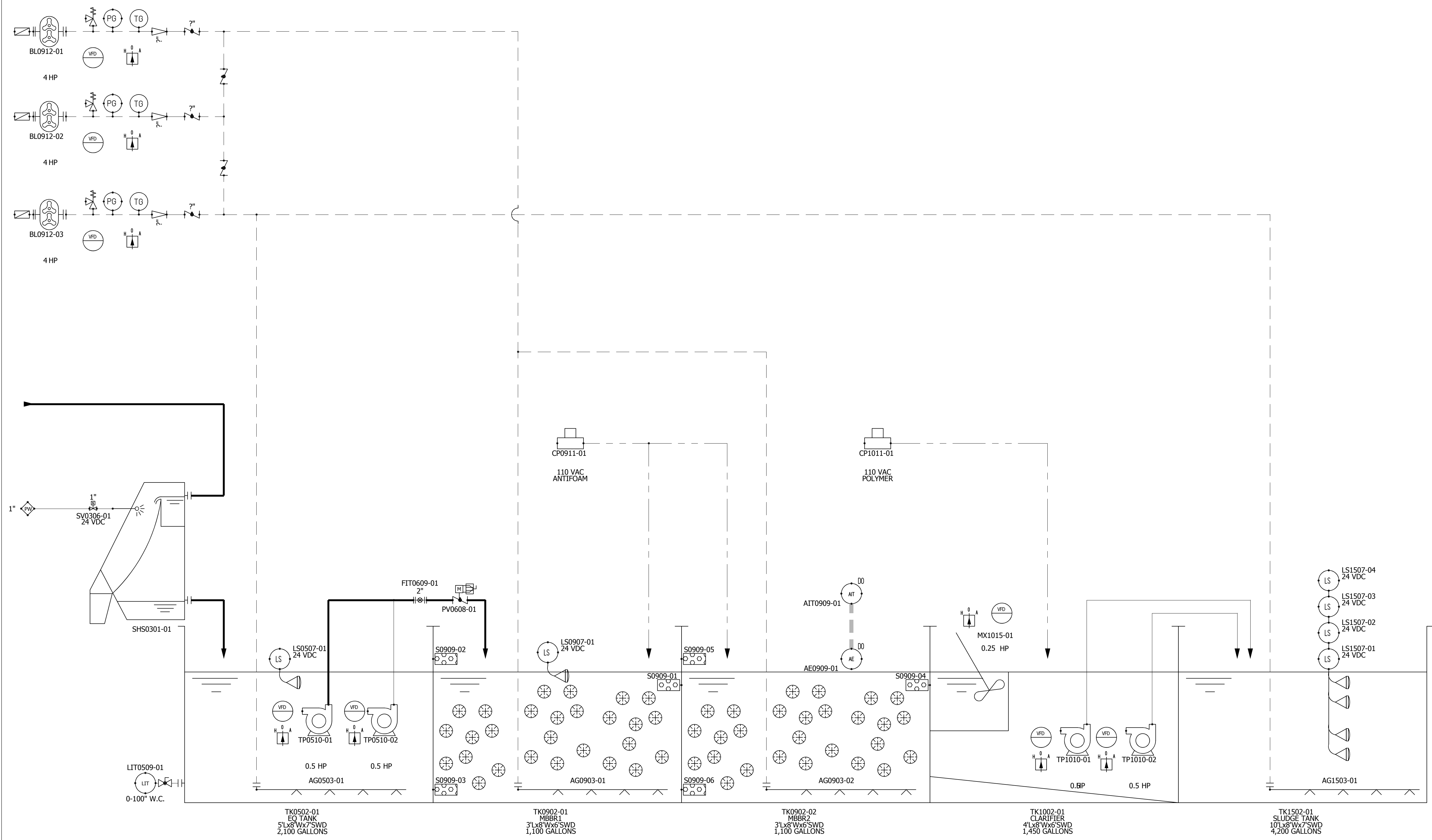
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0	2/19/2018	PRELIMINARY	JT



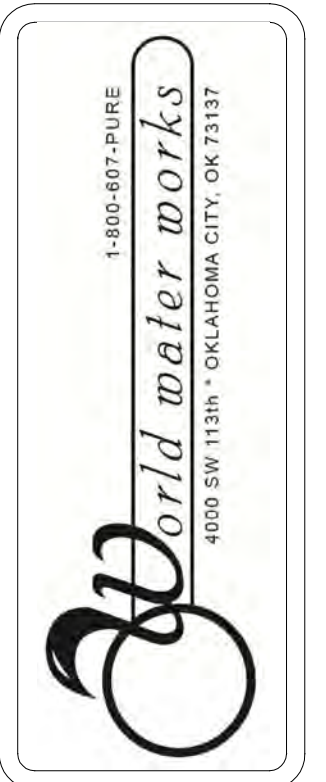
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- WWW SCOPE DEFINED BY RED DOTTED LINES
- CUSTOMER PIPING SHALL BE INDEPENDENTLY SUPPORTED

MAIN
SECONDARY
FLEX
AIR
CHEMICAL
ELECTRICAL



REV	0	DATE	2/18/2018	DESCRIPTION	PRELIMINARY
BY	JT				

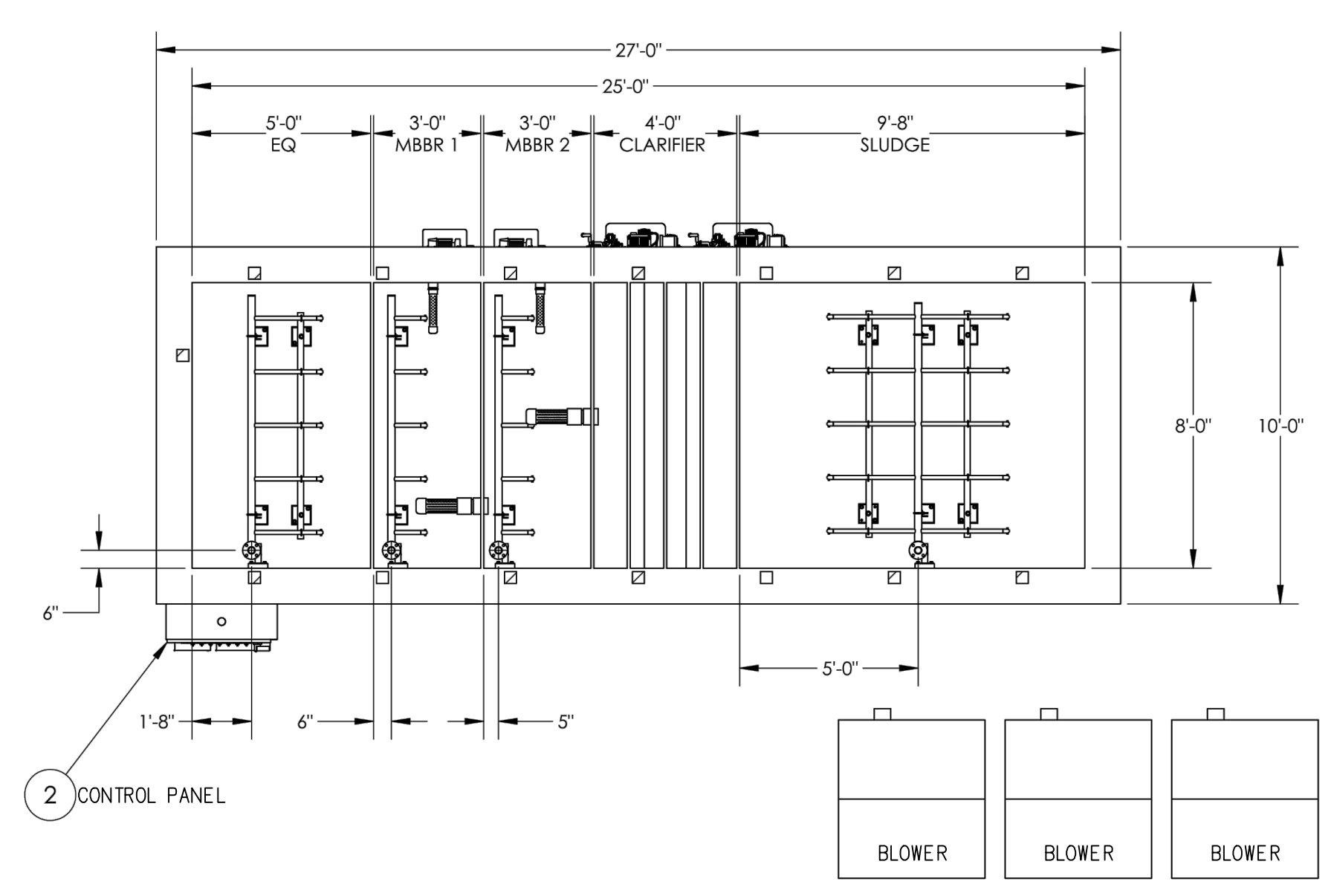


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LOCATION:	KANEHOE, HI
FILE NAME:	Heeia Kea Harbor-KanehoeHT-MBBR Package Plant
DESCRIPTION:	PACKAGE PLANT

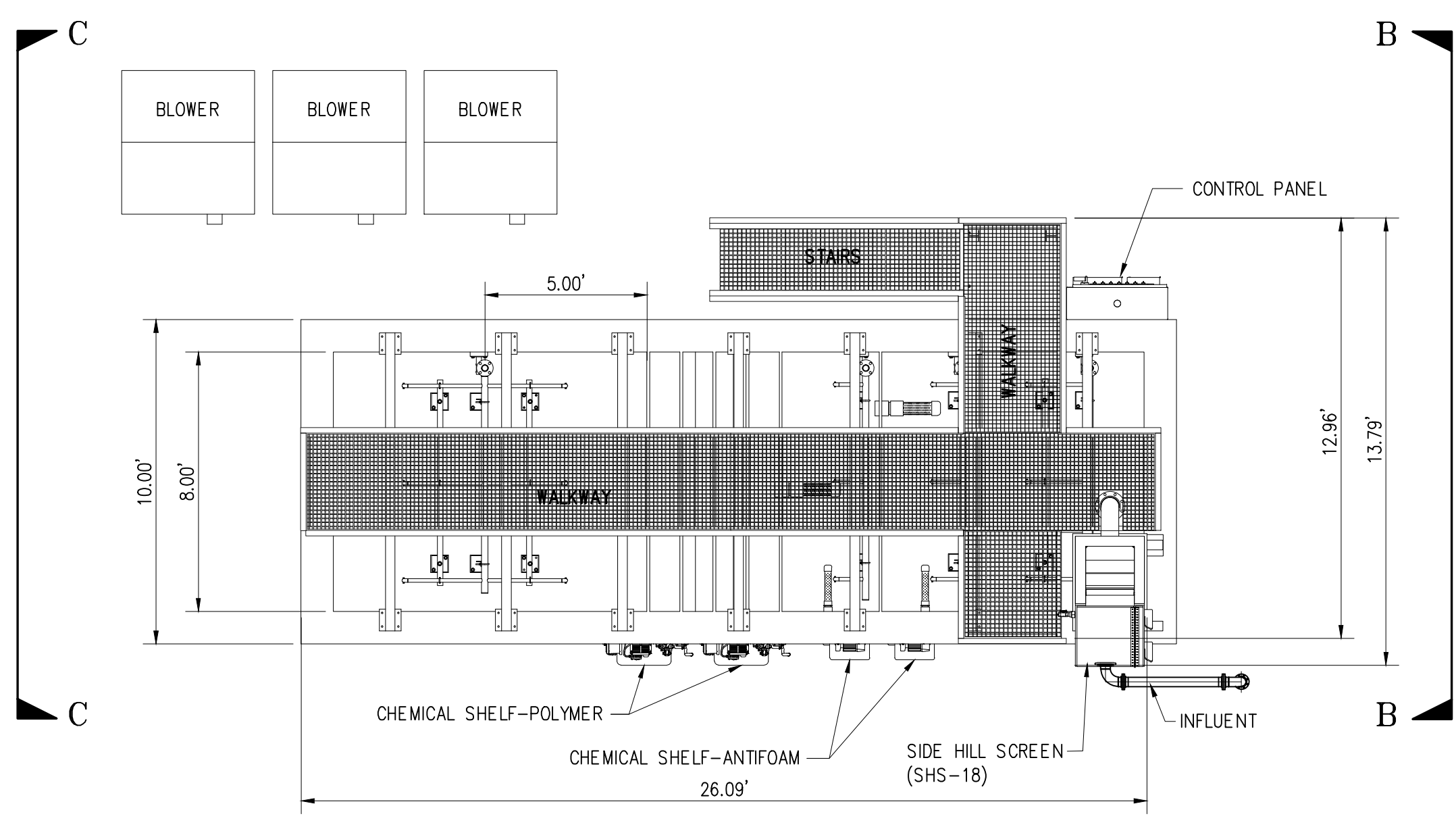
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P.O.#:	
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CHECKED BY:	GP
DATE:	2/17/2018
SCALE:	N/A
JOB #:	
DRAWING #:	0604
SHEET:	4
OF	4 SHEETS

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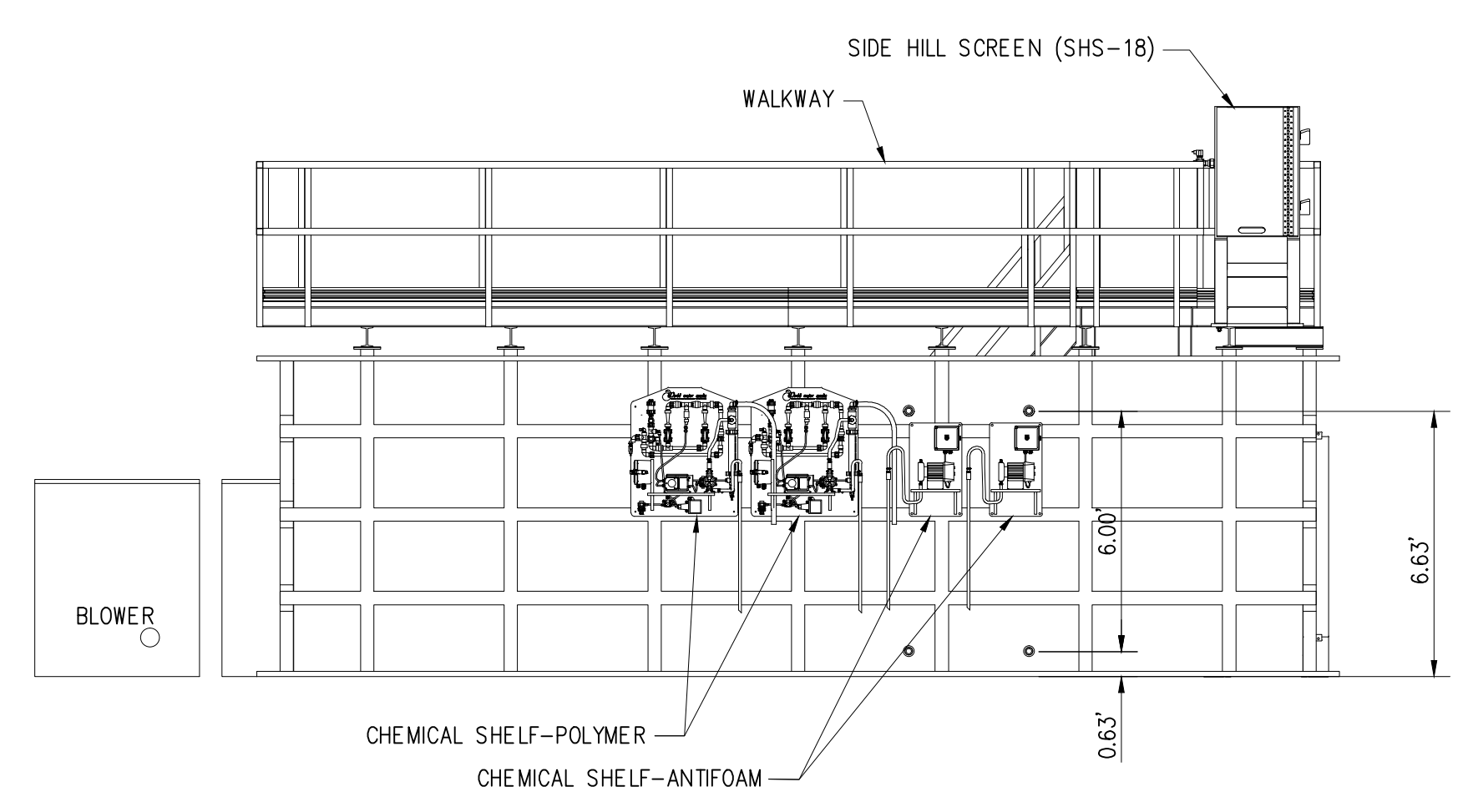
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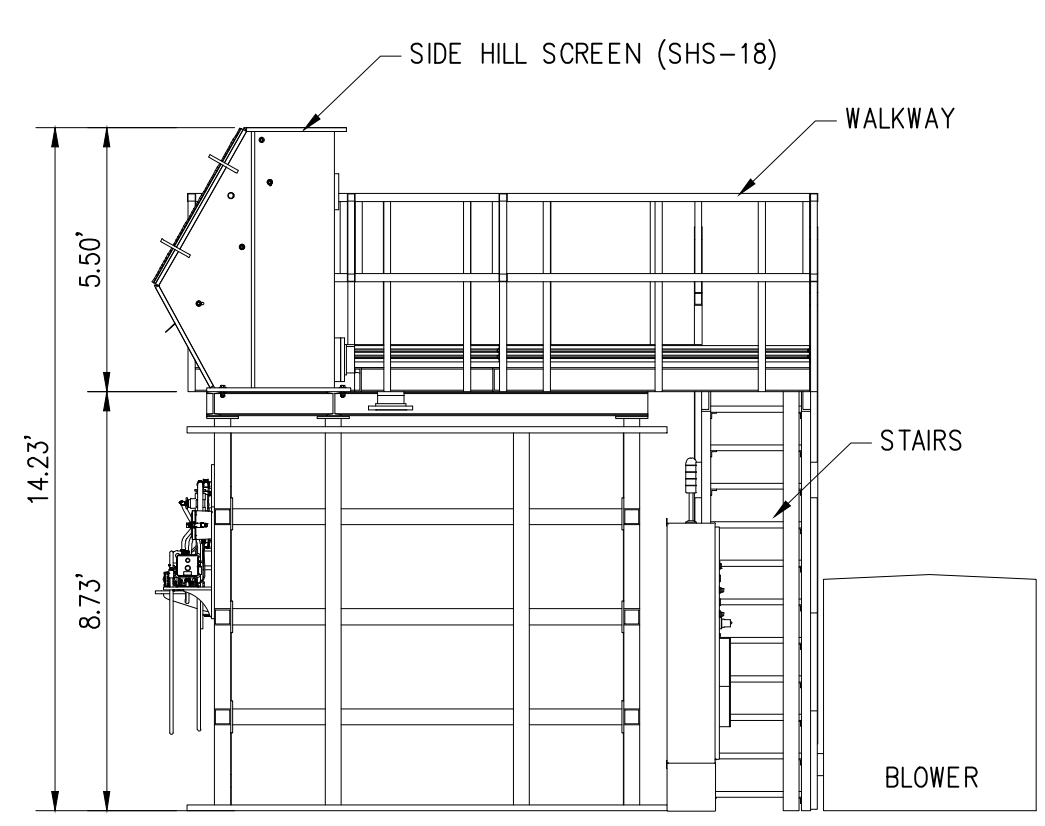
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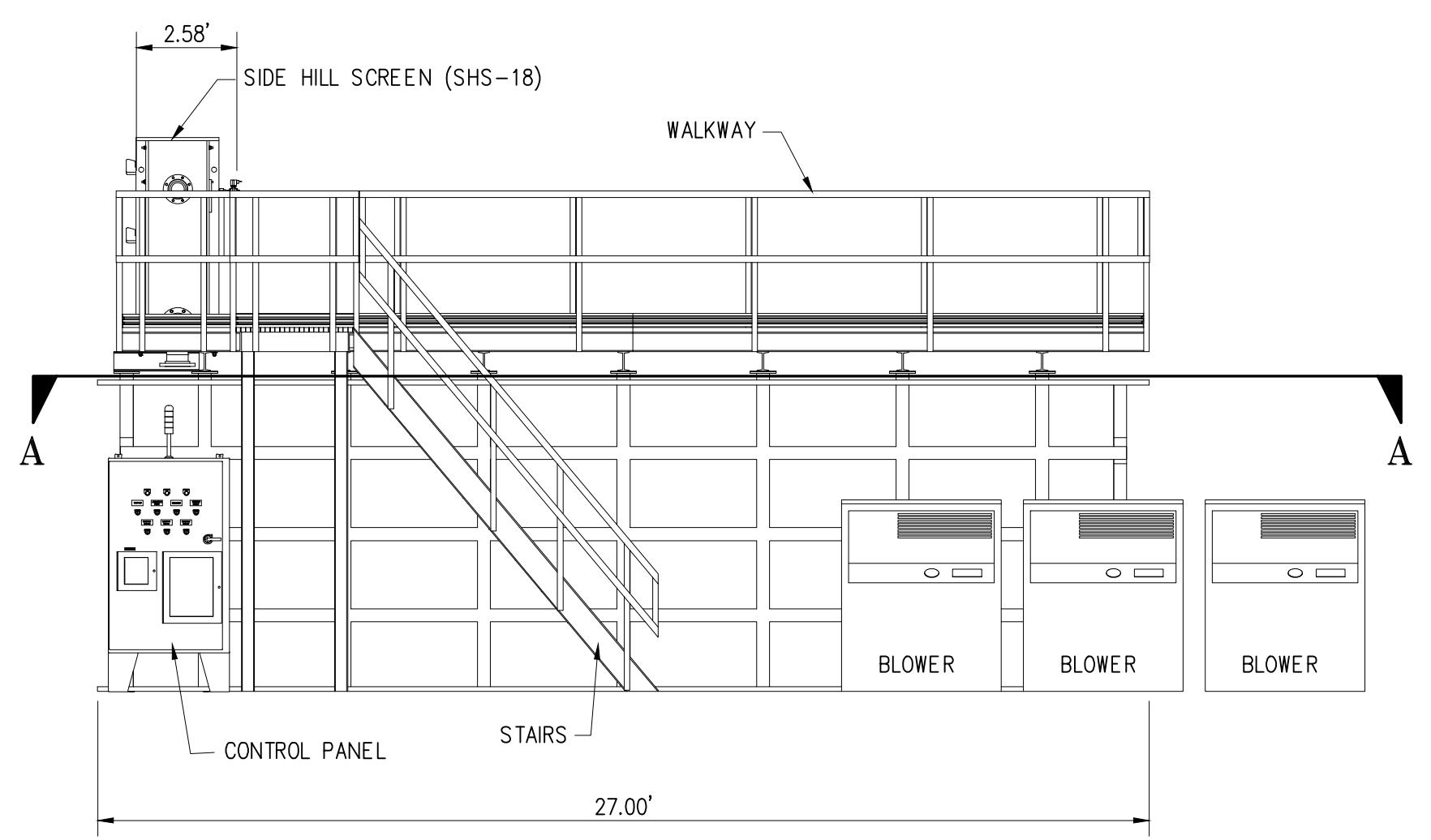
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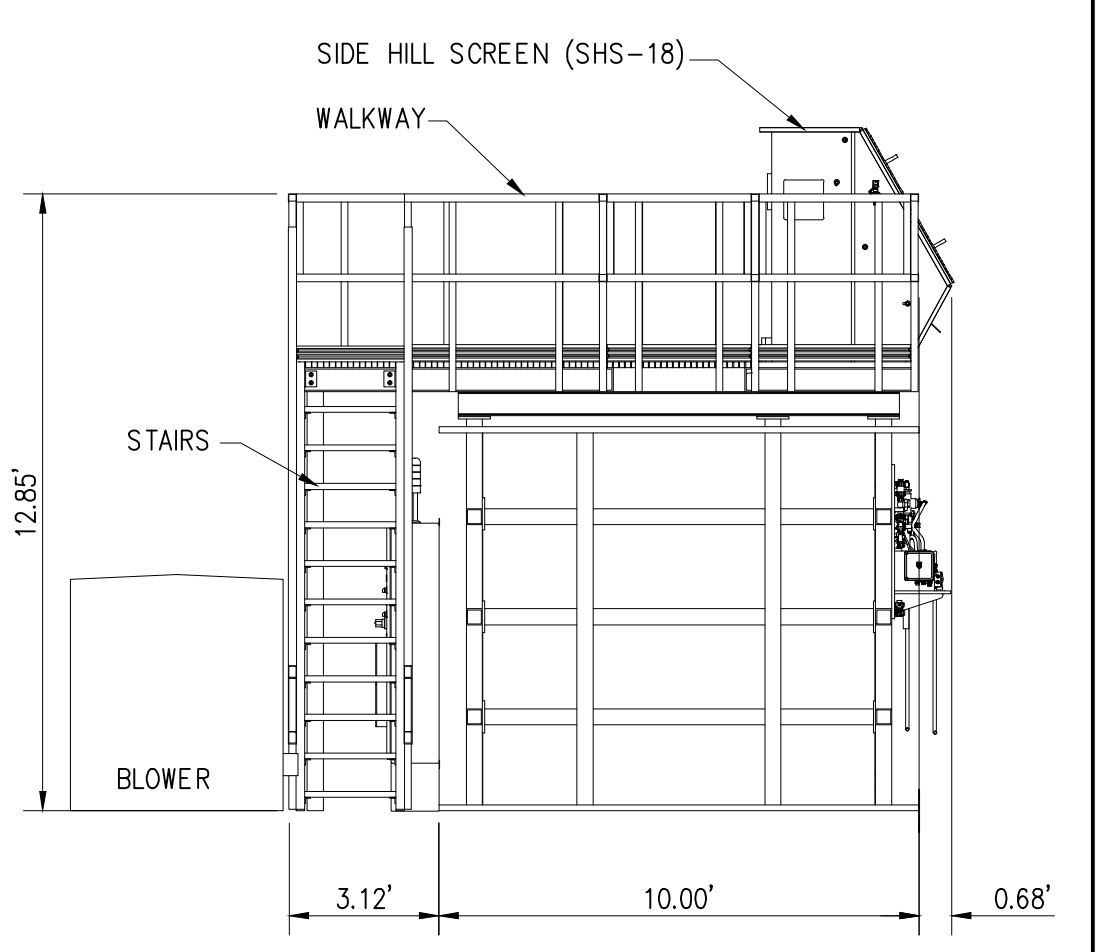
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SECTION B-B


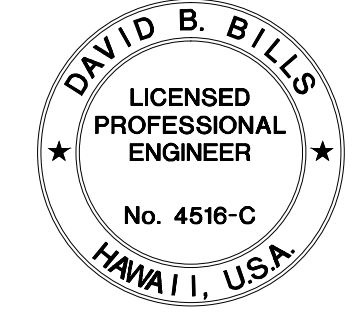


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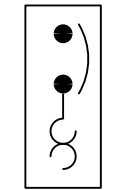
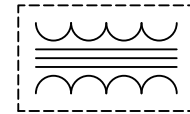
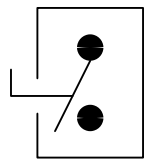
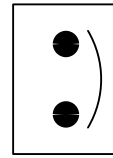
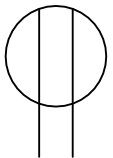
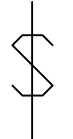
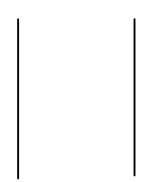
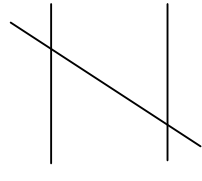
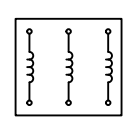
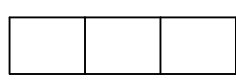
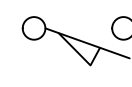


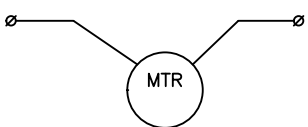
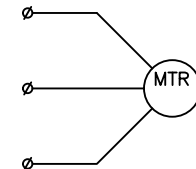
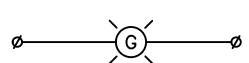
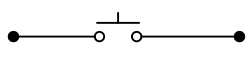
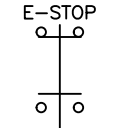
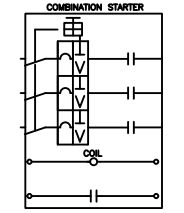
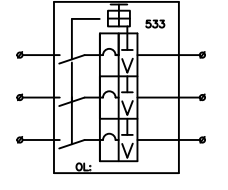

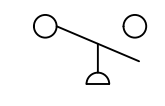
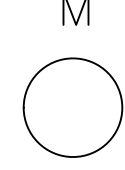
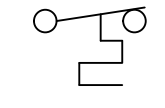
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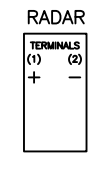
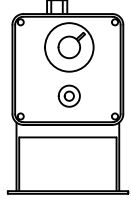
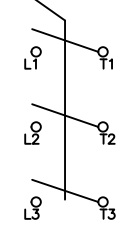
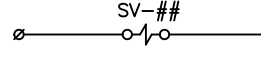
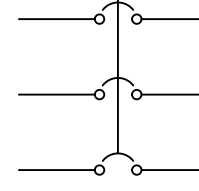
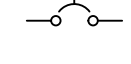
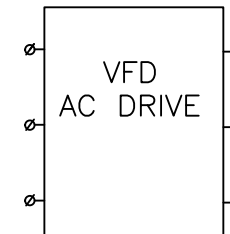
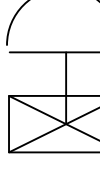

WASTEWATER TREATMENT PLANT DETAILS  
NOT TO SCALE

REVISION NO.	SYM.	DESCRIPTION	SHT./OF	DATE	APPROVED
<p>THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.</p>					
 <small>SIGNATURE</small> <small>LICENSE EXP: 4/30/20</small>		<p>STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES DIVISION OF BOATING AND OCEAN RECREATION</p> <p>HEEIA KEA SMALL BOAT HARBOR WASTEWATER TREATMENT SYSTEM IMPROVEMENTS</p> <p>WWTP DETAILS - 1</p> <p>BILLS ENGINEERING, INC.</p>			
		<small>DESIGNED BY:</small> BU		<small>SUBMITTED BY:</small> BEI	
<small>DRAWN BY:</small> RE/SI		<small>DATE:</small>		<small>CHECKED BY:</small> DB	
<small>APPROVED:</small>		<small>SCALE:</small> AS SHOWN		<small>DRAWING NO.:</small>	
<small>CHIEF ENGINEER:</small>		<small>DATE:</small>		<p><b>C006</b></p>	

Thu, 12 Apr 2018 - 2:49pm  
N:\Projects\662-00 HEEIA KEA WWTP\Const. Plans\662-00 C006 WWTP DETAILS - 1.dwg

	MANUAL MOTOR PROTECTOR
	TRANSFORMER
	NON FUSED DISCONNECT SWITCH
	CIRCUIT BREAKER
	WALL OUTLET
	LIGHT SWITCH
	NORMALLY OPEN CONTACT
	NORMALLY CLOSED CONTACT
	LINE REACTOR
	POWER DISTRIBUTION BLOCK
	LIMIT SWITCH

	SINGLE PHASE MOTOR
	THREE PHASE MOTOR
	LIGHT
	PUSH BUTTON
	E-STOP
	COMBO STARTER WITH ADJUSTABLE AMP RATING
	MANUAL CIRCUIT PROTECTOR WITH ADJUSTABLE AMP RATING
	TERMINAL STRIP
	PRESSURE SWITCH
	MOTOR STARTER COIL
	TEMPERATURE SWITCH

	RADAR LEVEL CONTROL
	CHEMICAL PUMP
	DISCONNECT SWITCH
	SOLENOID VALVE
	3 POLE BREAKER
	1 POLE BREAKER
	VFD AC DRIVE
	CONTROL VALVE
	RELAY COIL

# HEEIA KEA PRELIMINARY ELECTRICAL PRINTS

## TABLE OF CONTENTS

0801	KEY / TABLE OF CONTENTS
0802	208 VAC WIRING DIAGRAM (1)
0803	208 VAC WIRING DIAGRAM (2)
0804	208 VAC WIRING DIAGRAM (3)
0805	24 VDC & 110 VAC WIRING DIAGRAM
0806	SLOTS 1-2, ANALOG OUTPUTS
0807	SLOT 3 ANALOG INPUTS
0808	SLOTS 4-5 DIGITAL INPUTS
0809	SLOT 6-7 RELAY OUTPUTS
0810	CHEMICAL PUMPS
0811	CABINET LAYOUT
0812	BILL OF MATERIAL
0813	ONE LINE POWER REQUIREMENTS

WWW CONFIDENTIAL

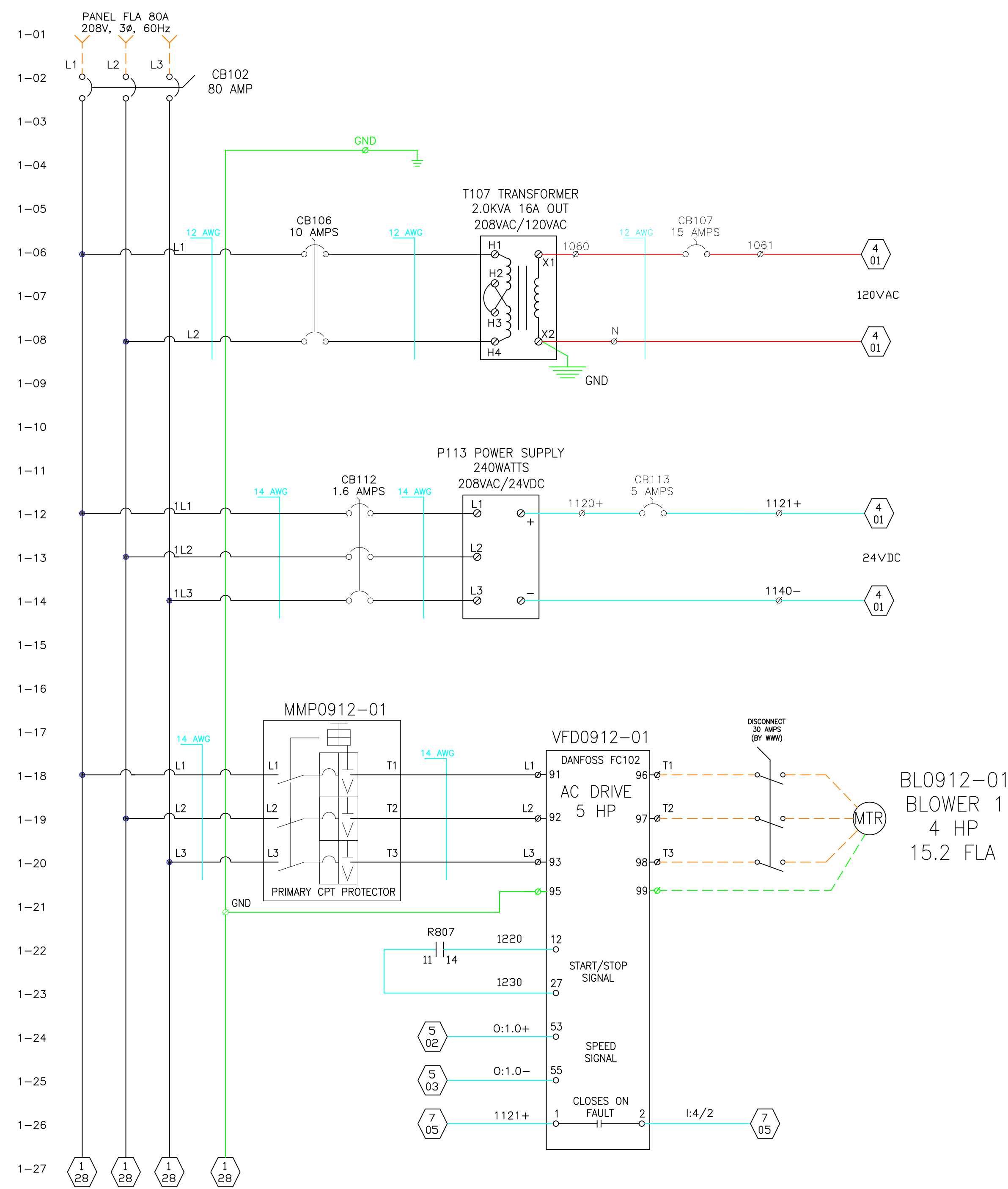
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BY	
DESCRIPTION	
DATE	
REV.	

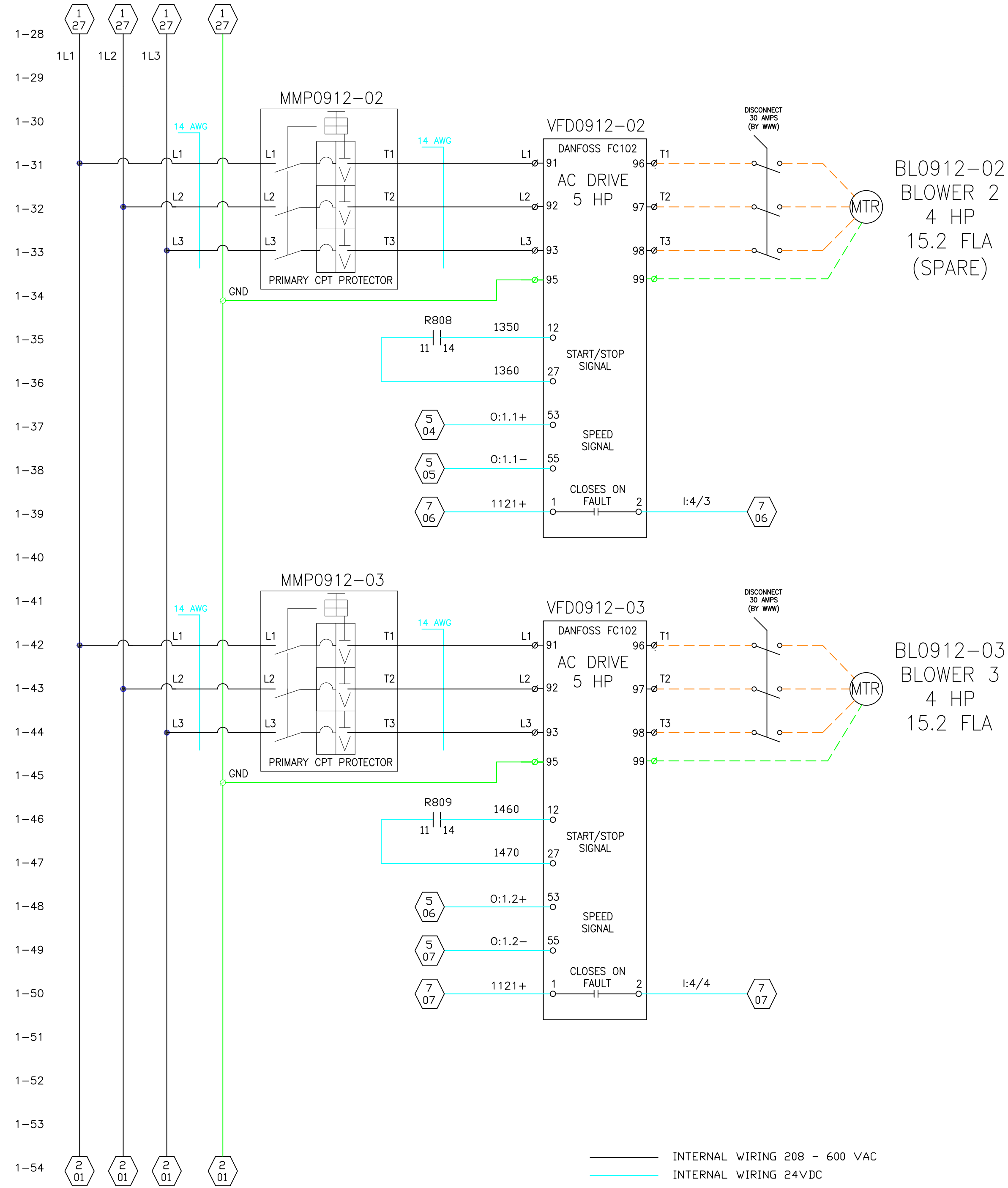
1-800-607-PURE  
  
 4000 SW 113th • OKLAHOMA CITY, OK 73137

CLIENT: TWINCRAFT SKINCARE  
 LOCATION: ESSEX, VT  
 FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_208V\_MOTORS.DWG  
 DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0801
SHEET:	1
OF	13 SHEETS



BL0912-01  
BLOWER 1  
4 HP  
15.2 FLA



BL0912-02  
BLOWER 2  
4 HP  
15.2 FLA  
(SPARE)

BL0912-03  
BLOWER 3  
4 HP  
15.2 FLA

- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- - - FIELD WIRING BY OTHERS

- NOTES:
1. ALL CONTROL LINES LEAVING THE PANEL SHOULD BE 12 GAUGE THHN STRANDED.
  2. CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.
  3. SYMBOL FOR LINES TO GO TO TERMINAL STRIP. ∅
  4. DASH LINES ARE FIELD WIRING.
  6. INSIDE DASH LINES ARE FIELD WIRING.
- ⓧ  
Ⓨ USED FOR INDEXING TO SHEET -X AND LINE-Y.

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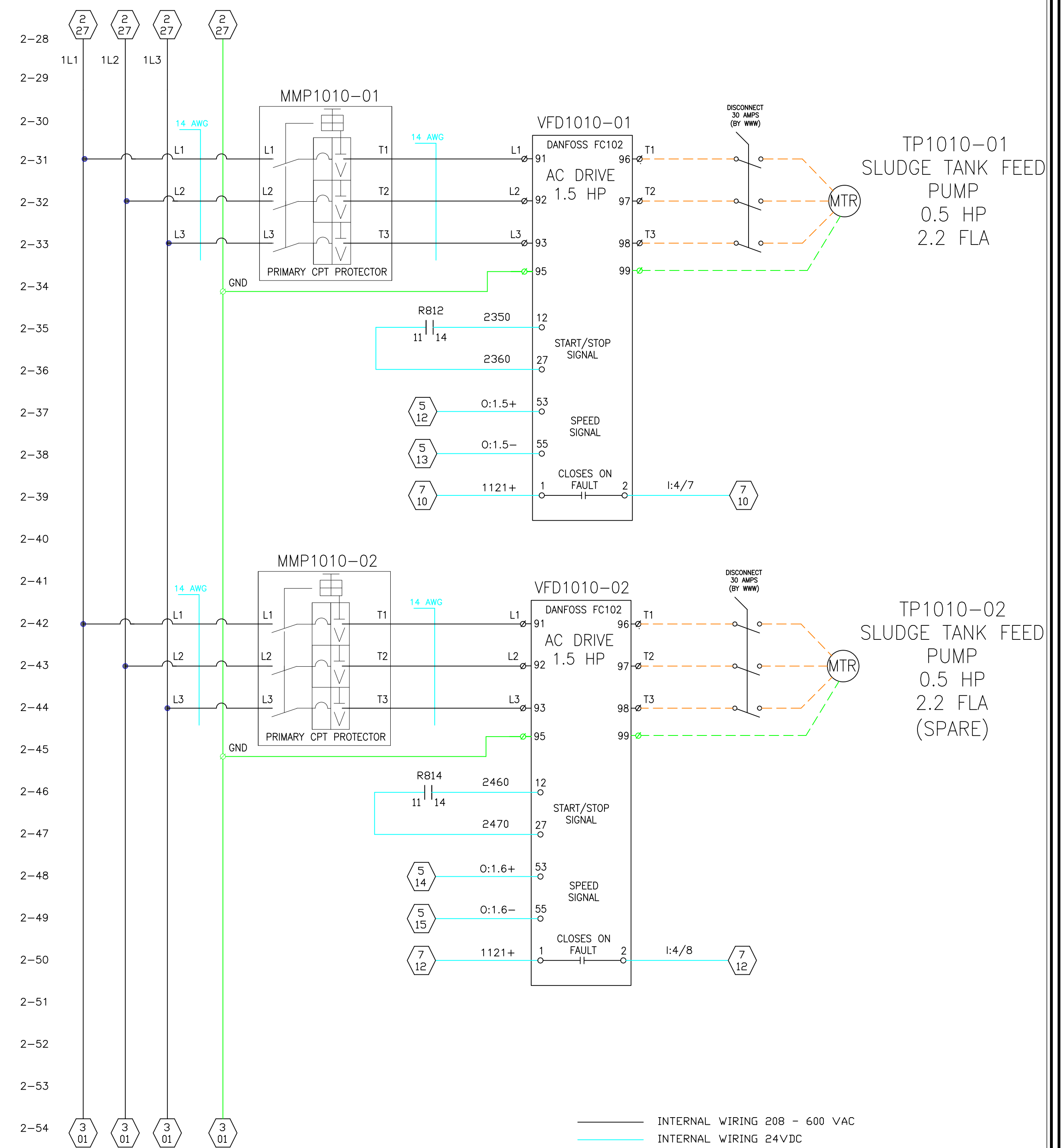
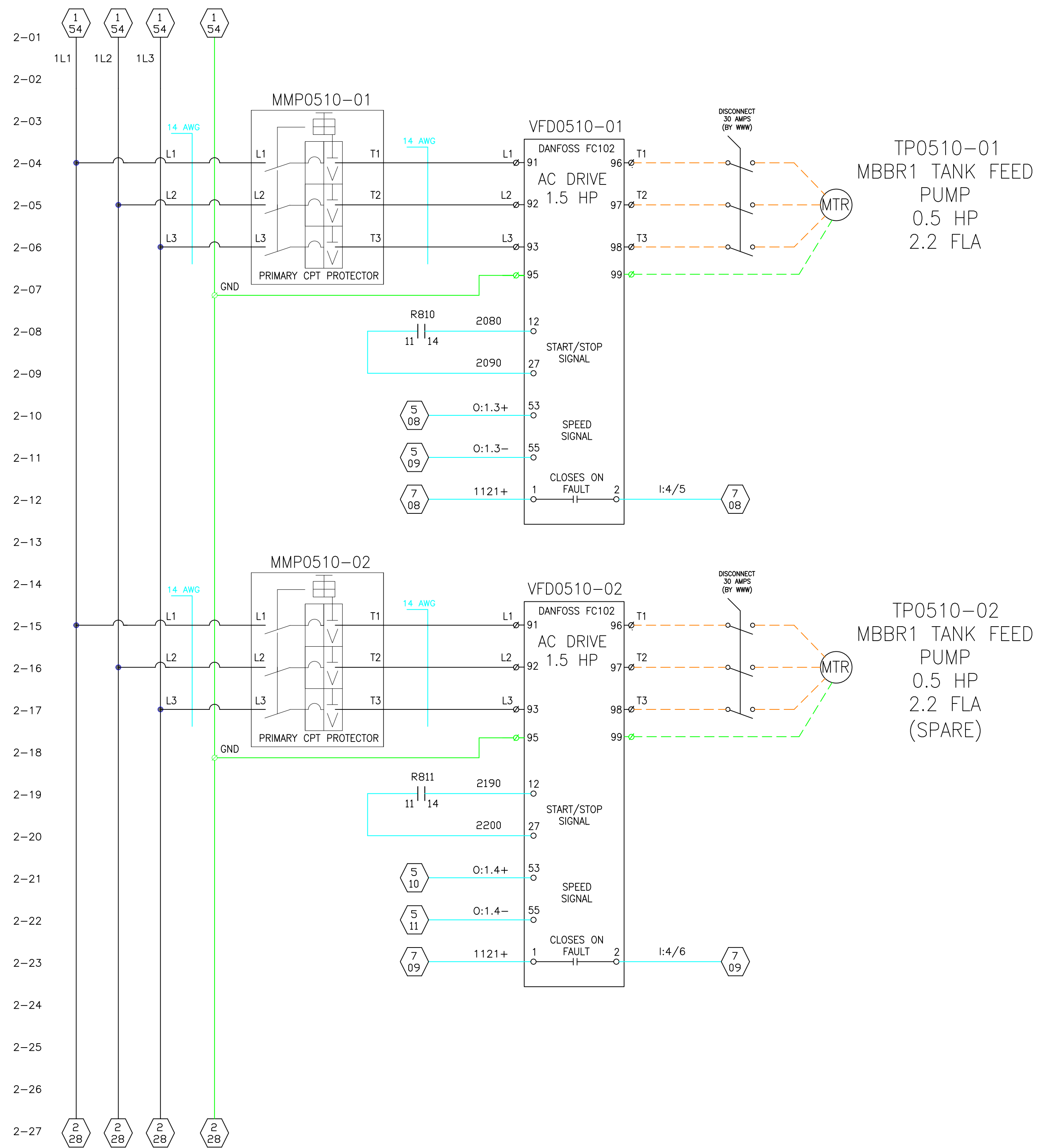
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BY	
DESCRIPTION	
DATE	
REV. #	



CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NARMEHA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_208V\_MOTORS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0802
SHEET:	2
OF	13 SHEETS



INTERNAL WIRING 208 - 600 VAC  
INTERNAL WIRING 24VDC  
INTERNAL WIRING 120VAC  
EXTERNAL WIRING BY WORLD WATER WORKS  
FIELD WIRING BY OTHERS

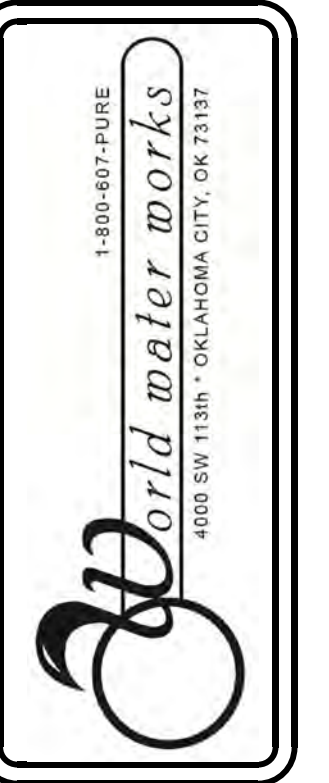
- NOTES:
1. ALL CONTROL LINES LEAVING THE PANEL SHOULD BE 12 GAUGE THHN STRANDED.
  2. CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.
  3. SYMBOL FOR LINES TO GO TO TERMINAL STRIP.
  4. DASH LINES ARE FIELD WIRING.
  6. INSIDE DASH LINES ARE FIELD WIRING.

USED FOR INDEXING TO SHEET - X AND LINE-Y.

WWW CONFIDENTIAL

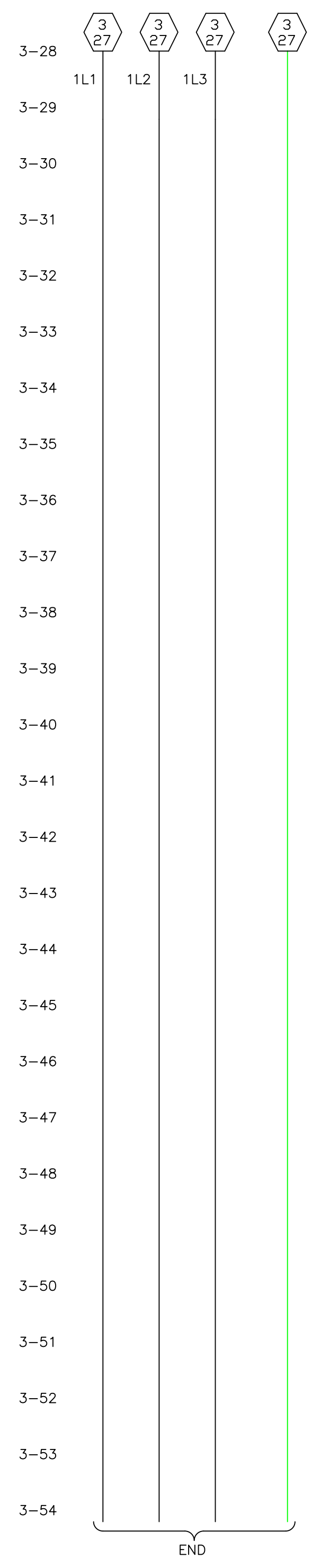
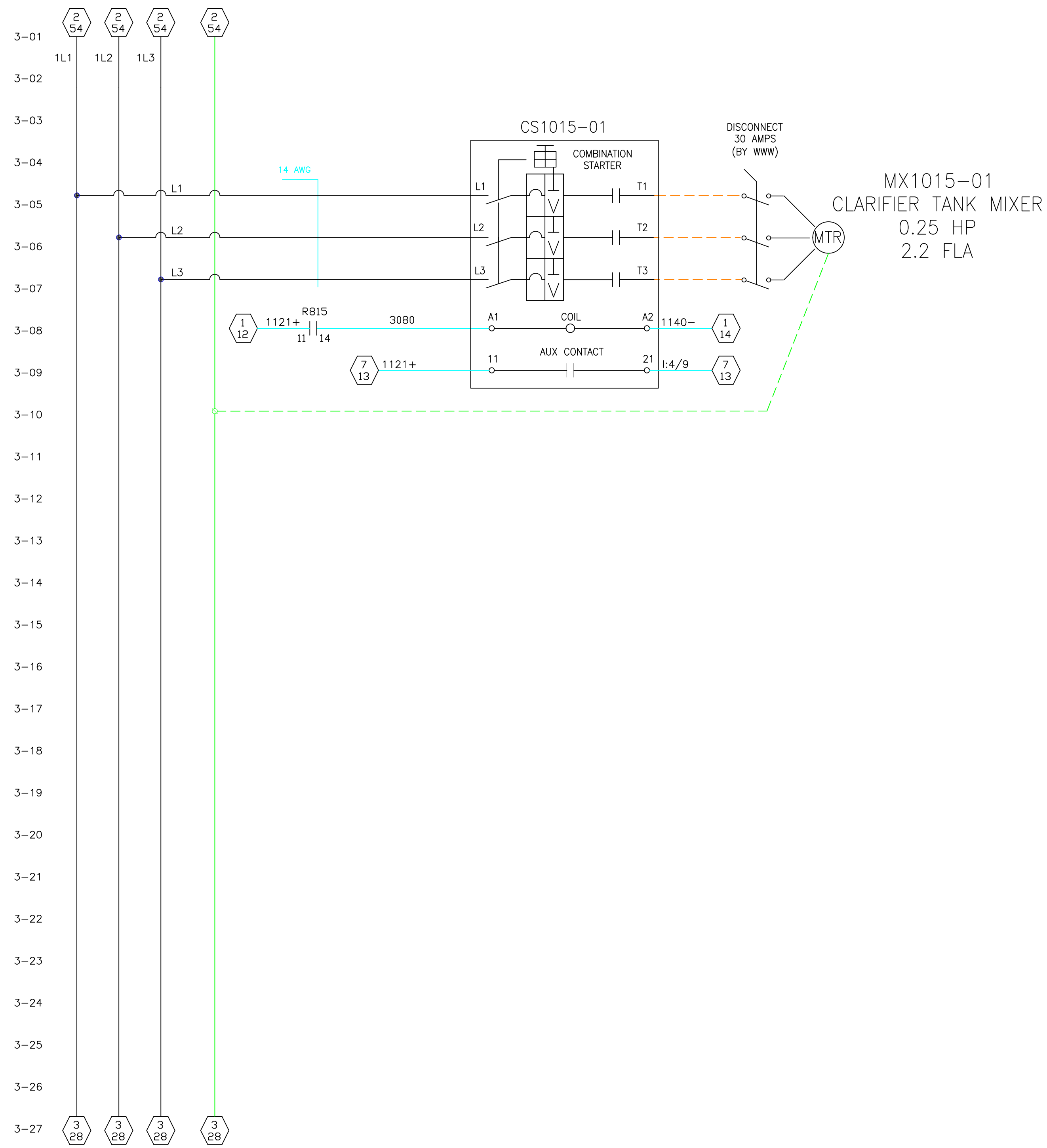
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REV.	DATE	DESCRIPTION	BY



CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BV\_METDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0803
SHEET:	3
OF	13 SHEETS



- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- - - - - FIELD WIRING BY OTHERS

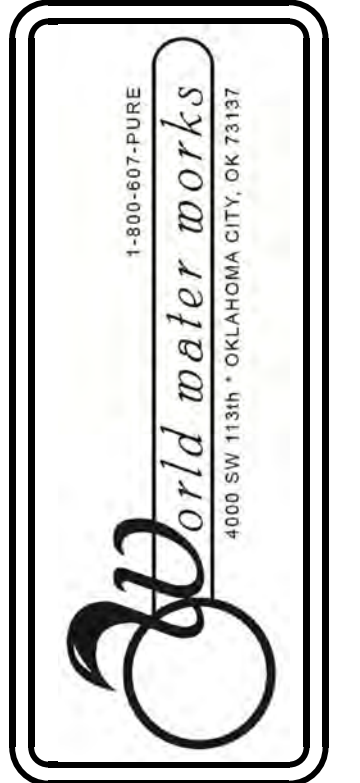
- NOTES:
1. ALL CONTROL LINES LEAVING THE PANEL SHOULD BE 12 GAUGE THHN STRANDED.
  2. CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.
  3. SYMBOL FOR LINES TO GO TO TERMINAL STRIP.  $\emptyset$
  4. DASH LINES ARE FIELD WIRING.
  6. INSIDE DASH LINES ARE FIELD WIRING.

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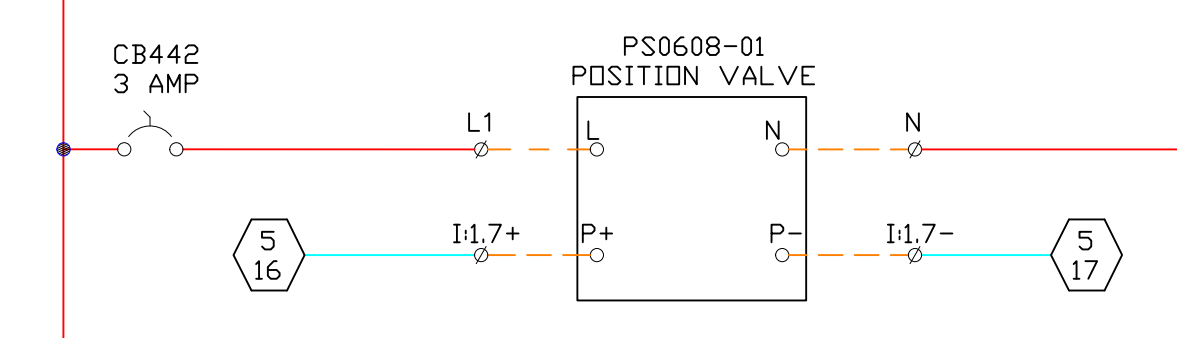
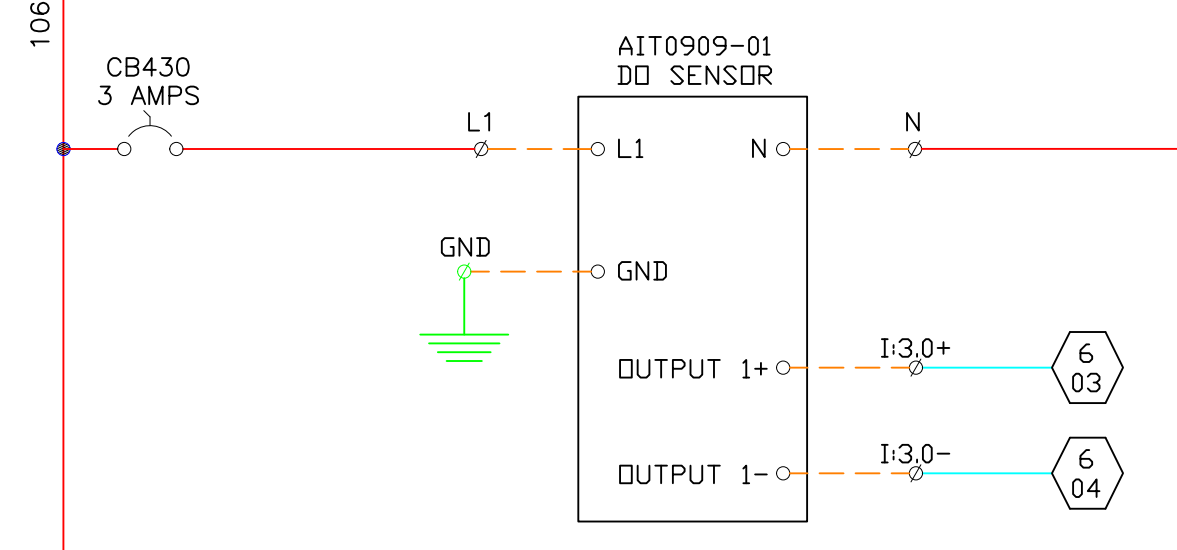
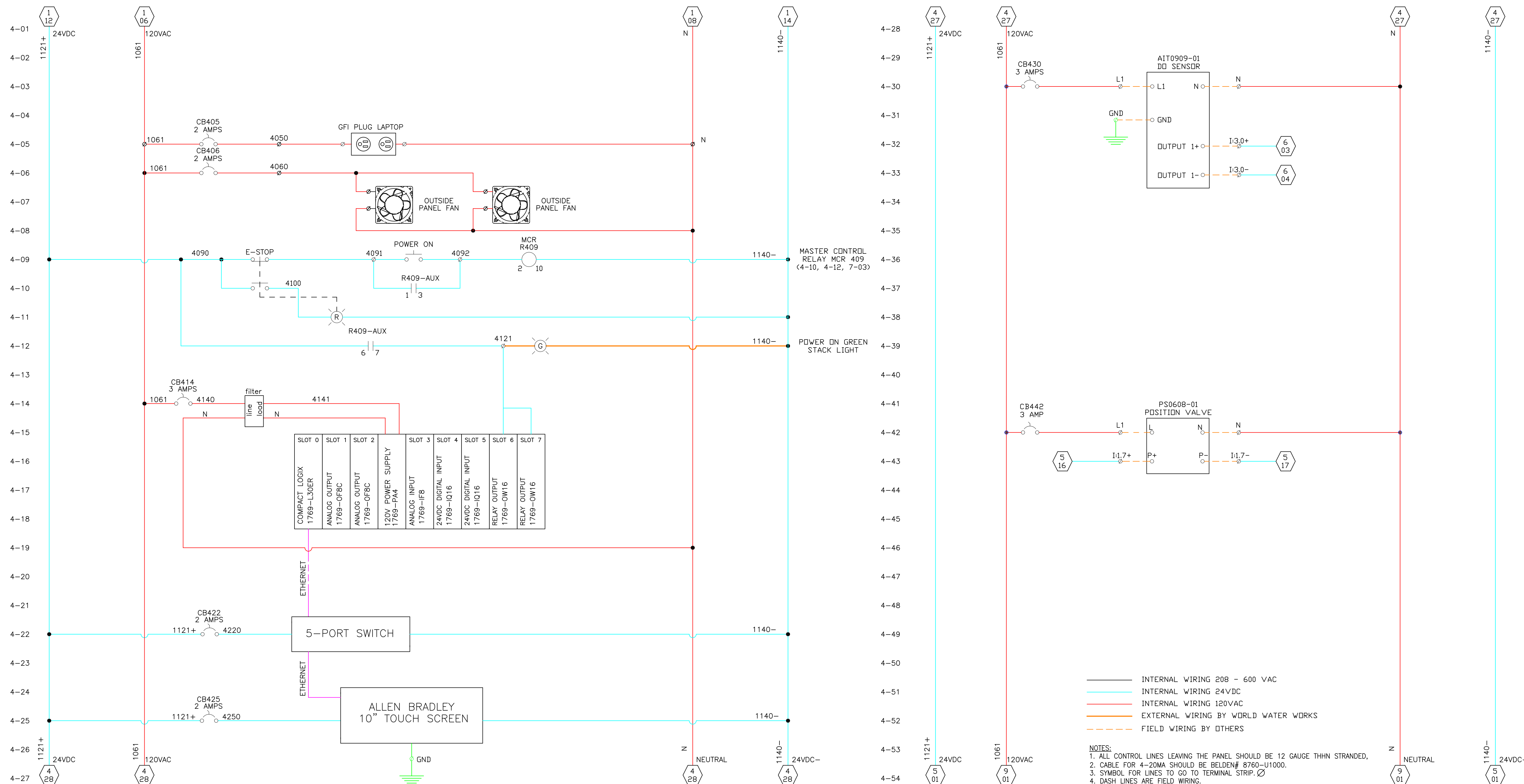
REV.	DATE	DESCRIPTION	BY



CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NAMBHEETA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MOTDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0804
SHEET:	4
OF	13 SHEETS





- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- FIELD WIRING BY OTHERS

- NOTES:**
- ALL CONTROL LINES LEAVING THE PANEL SHOULD BE 12 GAUGE THHN STRANDED.
  - CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.
  - SYMBOL FOR LINES TO GO TO TERMINAL STRIP.
  - DASH LINES ARE FIELD WIRING.
  - INSIDE DASH LINES ARE FIELD WIRING.

(X Y) USED FOR INDEXING TO SHEET -X AND LINE-Y.

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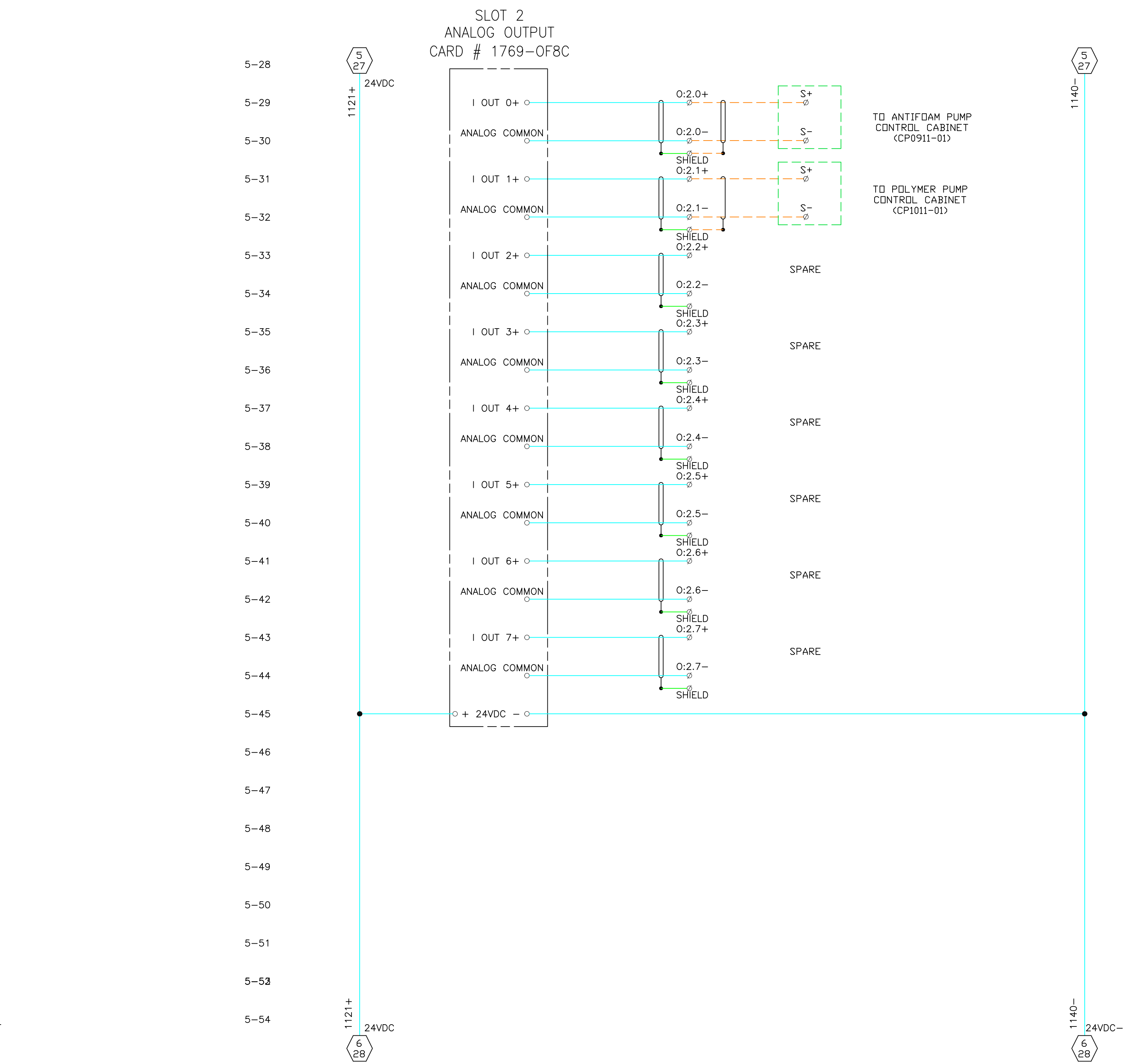
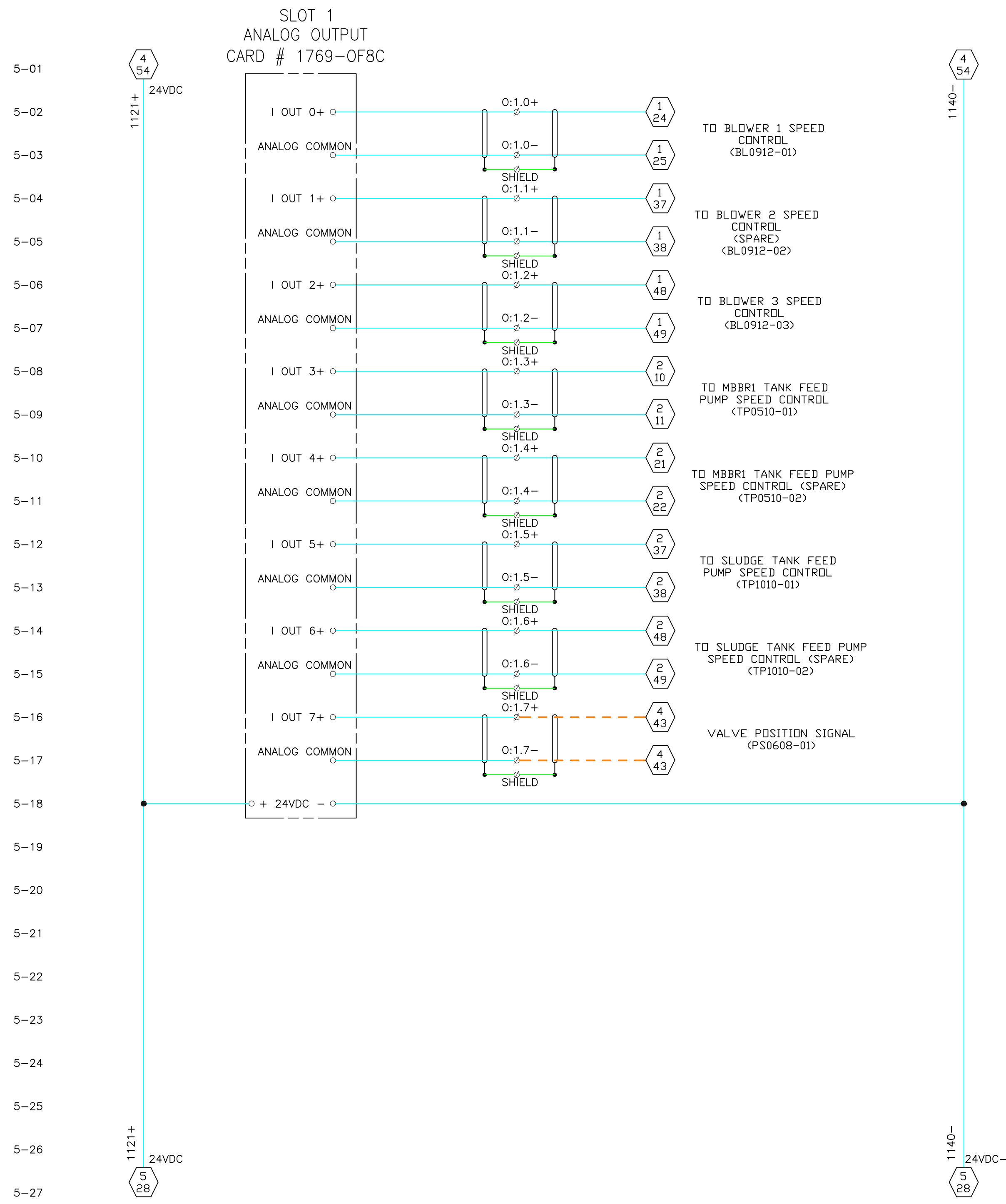
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BY	
DESCRIPTION	
DATE	
REV. #	



CLIENT: TWINCRAFT SKINCARE  
 LOCATION: ESSEX, VT  
 FILE: NARHEETA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MOTDRS.DWG  
 DRAWING DESCRIPTION: ELECTRICAL PRINTS

<b>FOR APPROVAL</b>	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0805
SHEET:	5
OF	13 SHEETS



- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- FIELD WIRING BY OTHERS

- NOTES:
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  - CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.
  - SYMBOL FOR LINES TO GO TO TERMINAL STRIP.
  - DASH LINES ARE FIELD WIRING.
  - INSIDE DASH LINES ARE FIELD WIRING.

X Y USED FOR INDEXING TO SHEET -X AND LINE-Y.

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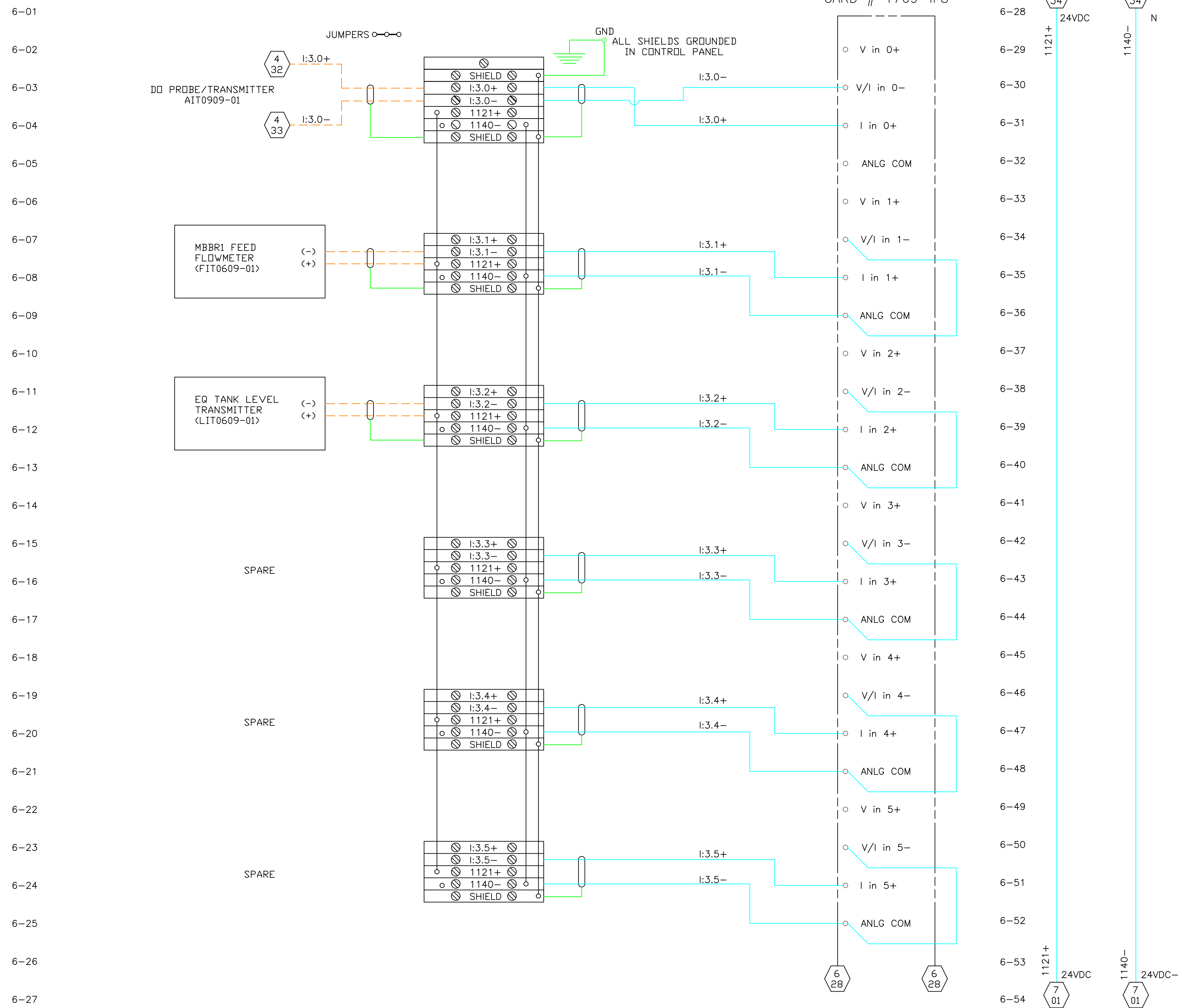
BY	
DESCRIPTION	
DATE	
REV.	



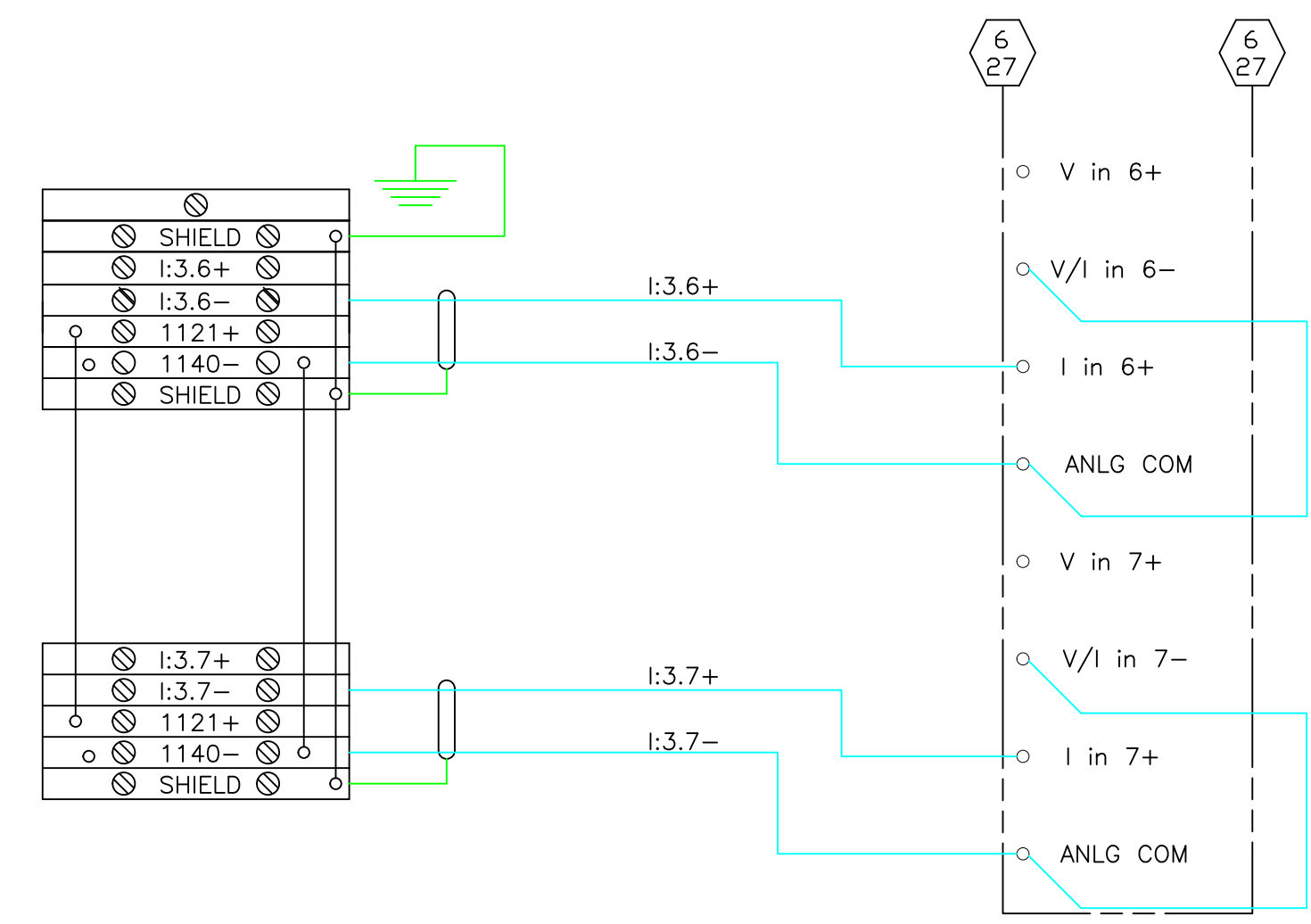
CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_METDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0806
SHEET:	6
OF	13 SHEETS

SLOT 3  
ANALOG INPUT  
CARD # 1769-IF8



SPARE  
SPARE



- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- - - FIELD WIRING BY OTHERS

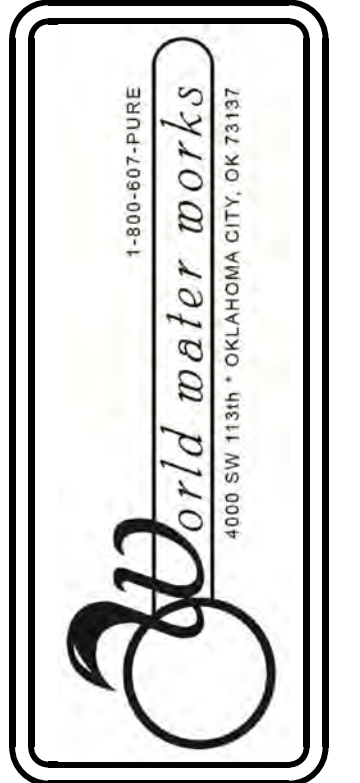
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X Y USED FOR INDEXING TO SHEET -X AND LINE-Y.

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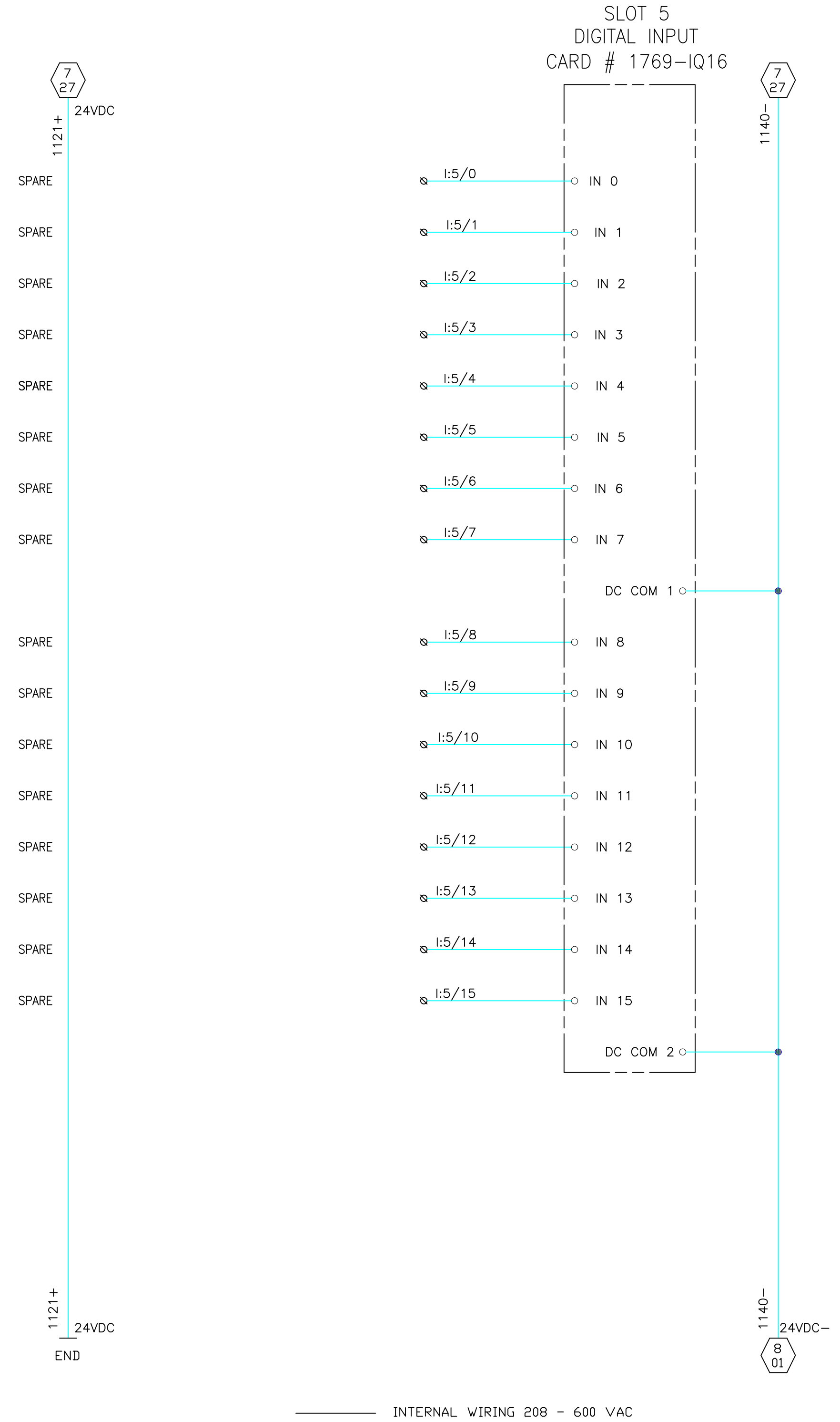
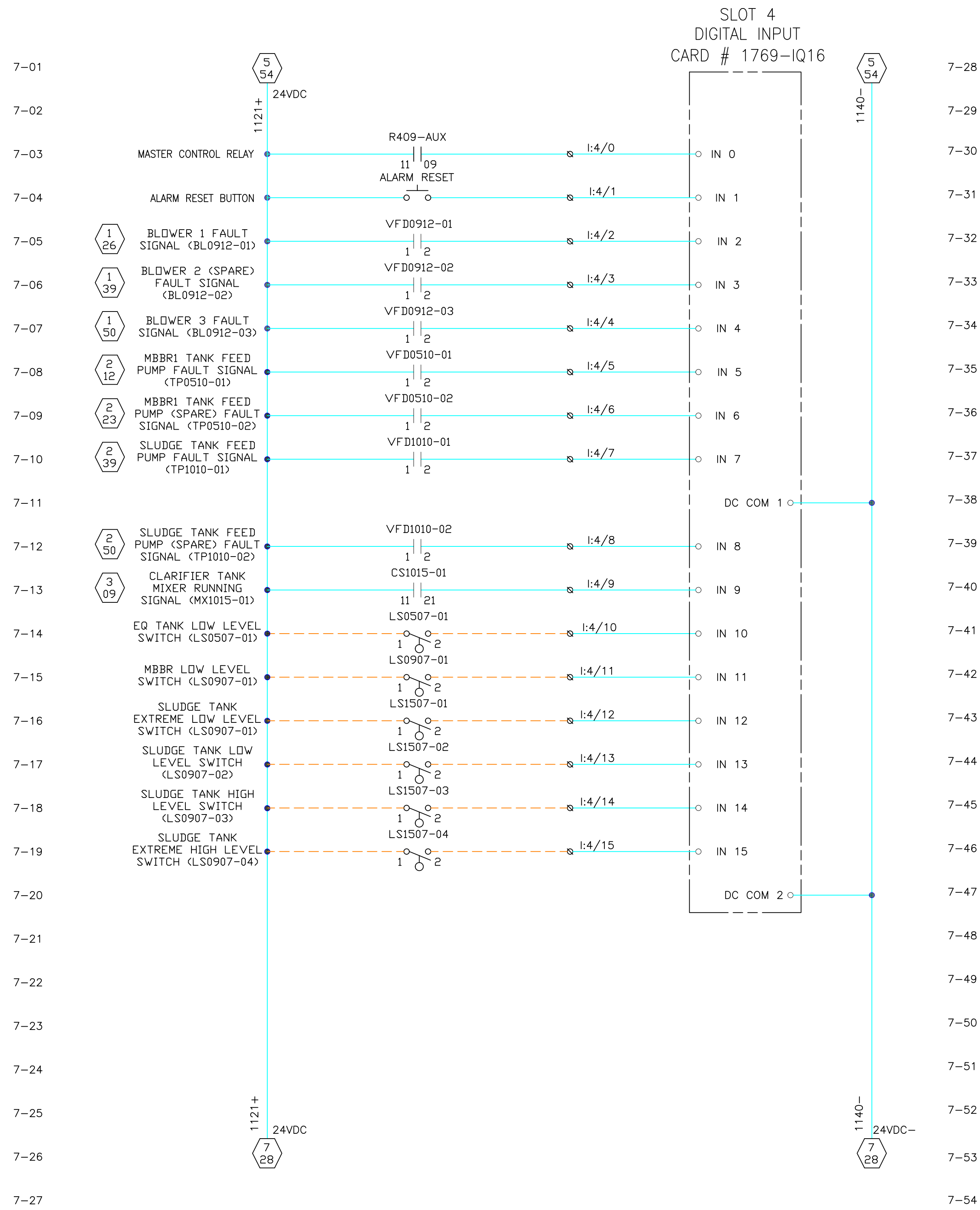
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BY	
DESCRIPTION	
DATE	
REV. #	



CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NAMBHEEIA KEA BASE PRELIMINARY ELECTRICAL 20BY METDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0807
SHEET:	7
OF	13 SHEETS



- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- - - - - FIELD WIRING BY OTHERS

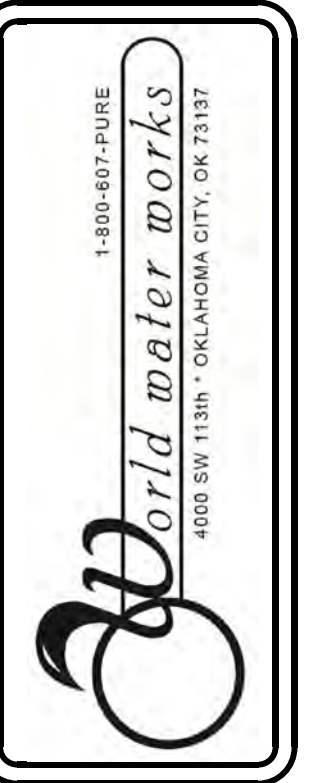
**NOTES:**  
 1. ALL CONTROL LINES LEAVING THE PANEL SHOULD BE 12 GAUGE THHN STRANDED.  
 2. CABLE FOR 4-20MA SHOULD BE BELDEN# 8760-U1000.  
 3. SYMBOL FOR LINES TO GO TO TERMINAL STRIP.  
 4. DASH LINES ARE FIELD WIRING.  
 6. INSIDE DASH LINES ARE FIELD WIRING.

**X Y** USED FOR INDEXING TO SHEET -X AND LINE-Y.

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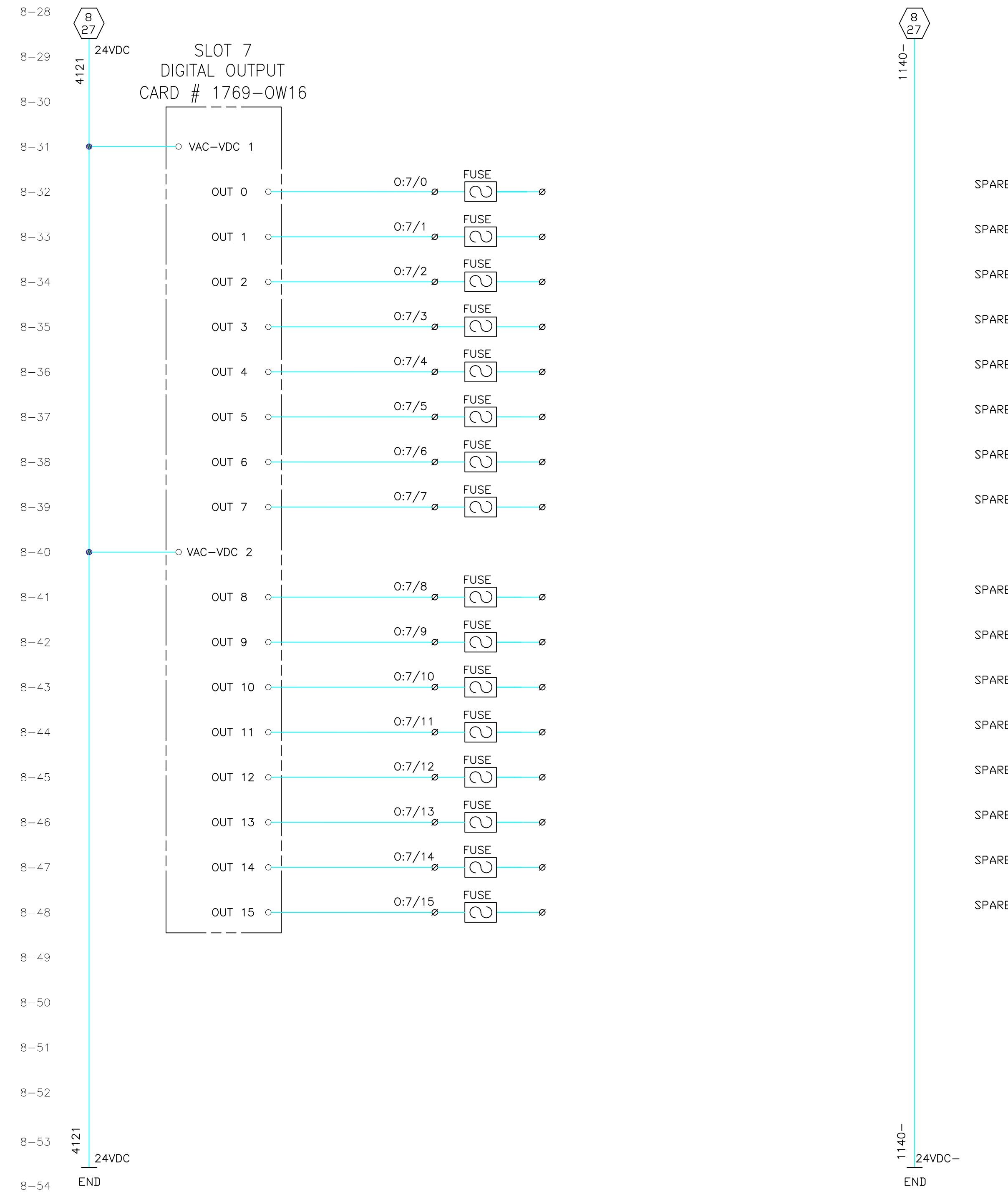
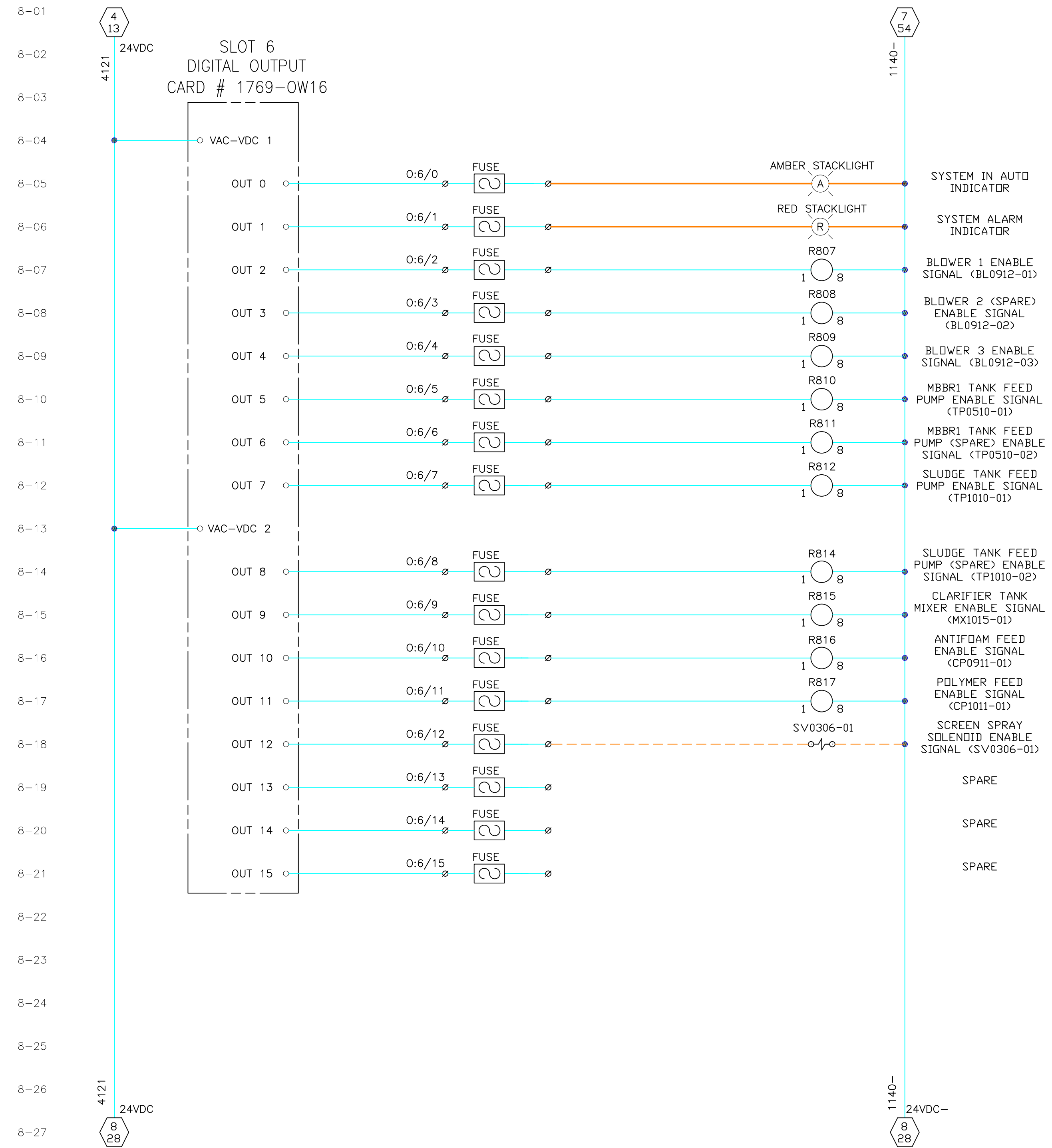
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BY	
DATE	
REV. #	
DESCRIPTION	



CLIENT: TWINCRAFT SKINCARE  
 LOCATION: ESSEX, VT  
 FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MOTDRS.DWG  
 DRAWING DESCRIPTION: ELECTRICAL PRINTS

<b>FOR APPROVAL</b>	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0808
SHEET:	8
OF	13 SHEETS



- INTERNAL WIRING 208 - 600 VAC
- INTERNAL WIRING 24VDC
- INTERNAL WIRING 120VAC
- EXTERNAL WIRING BY WORLD WATER WORKS
- - - - - FIELD WIRING BY OTHERS

**NOTES:**  
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(X Y) USED FOR INDEXING TO SHEET -X AND LINE-Y.

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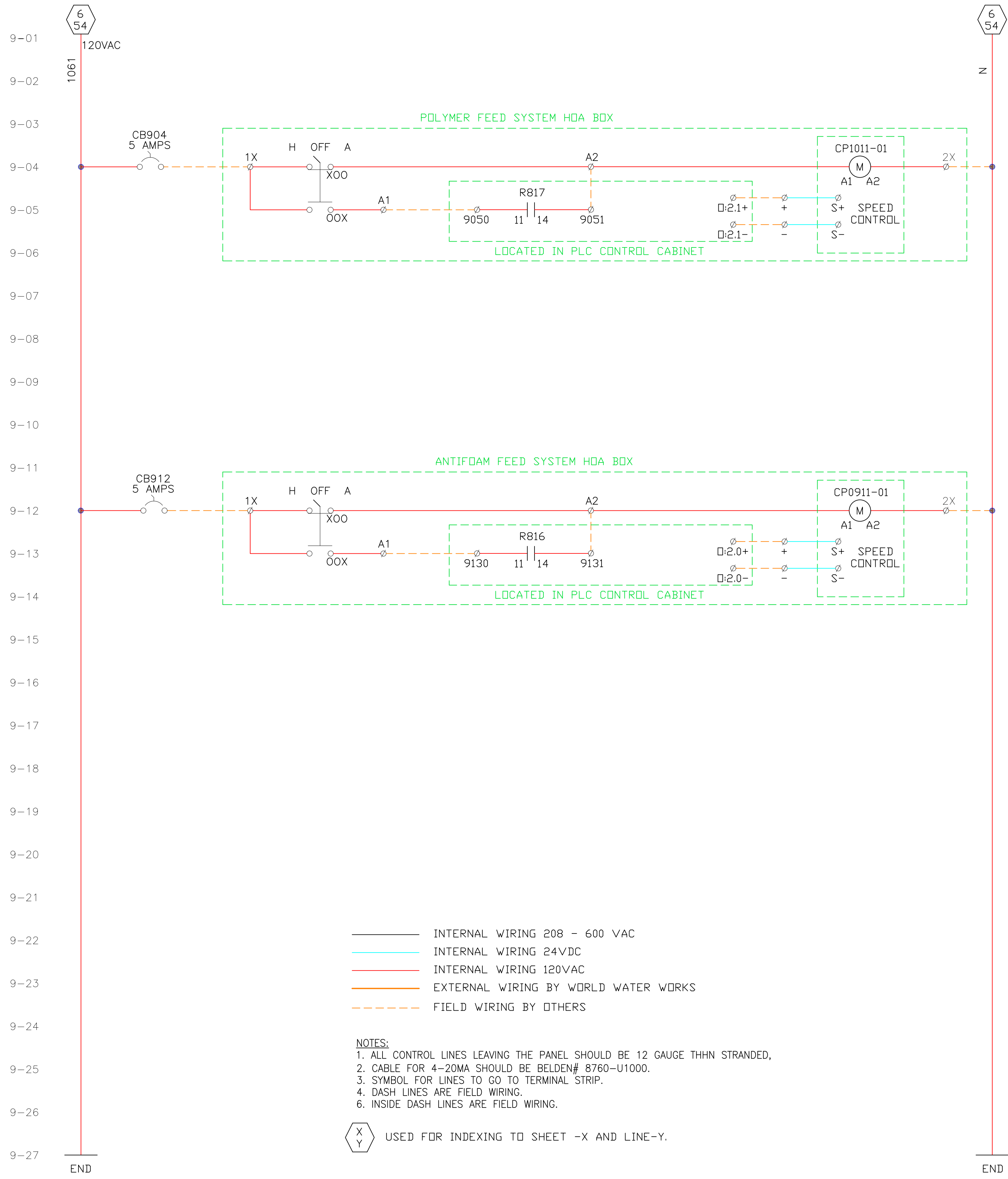
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REV. #	DATE	DESCRIPTION	BY

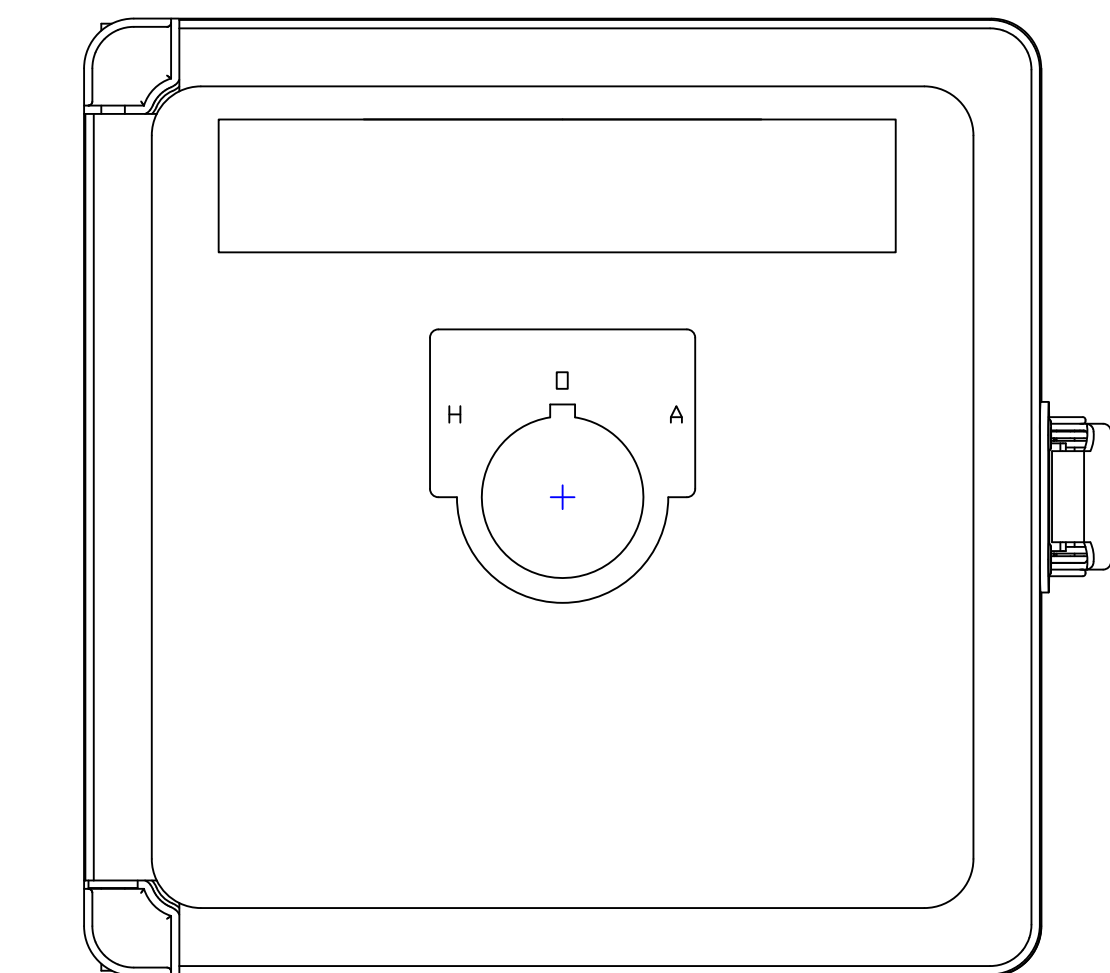
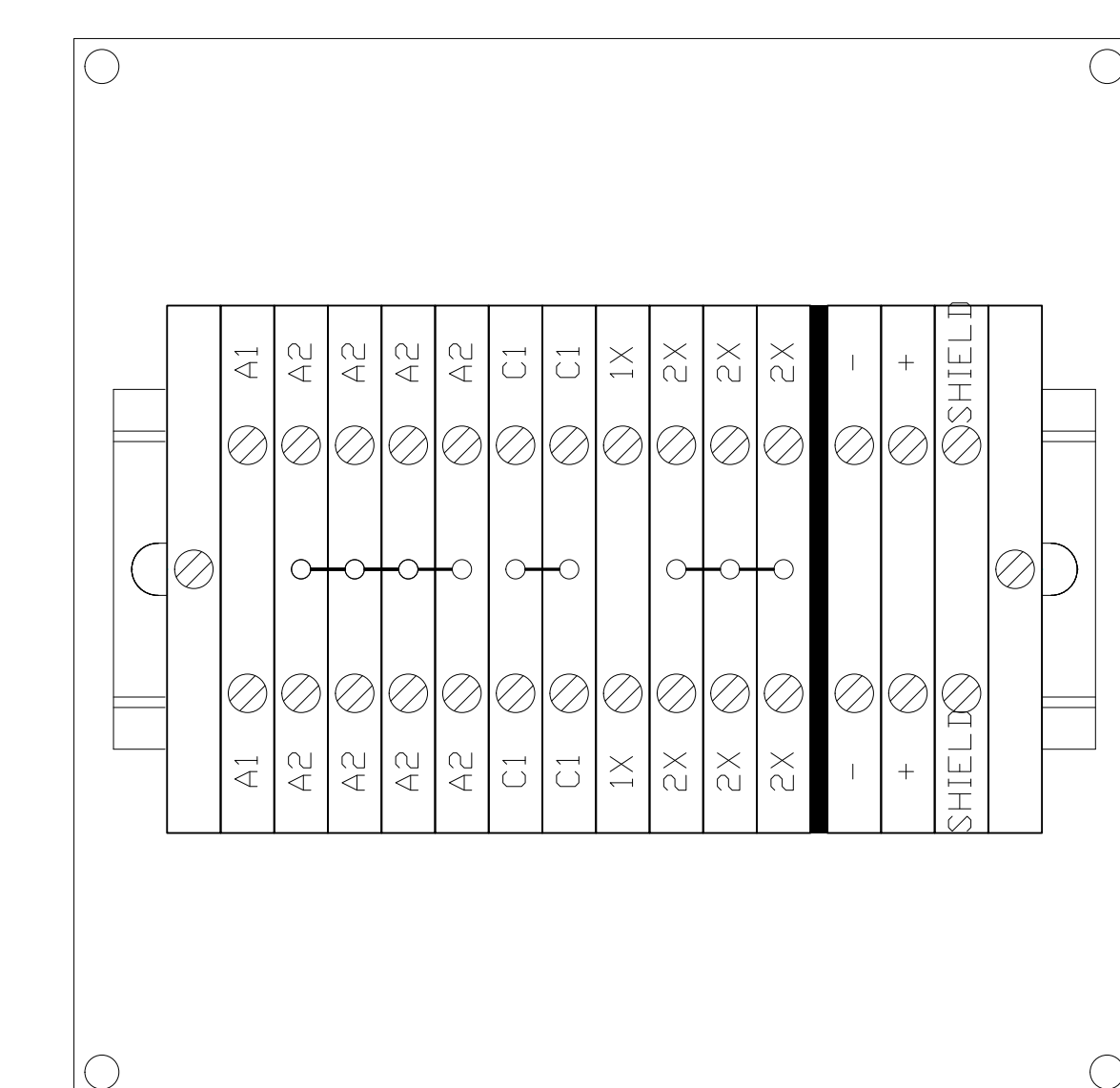


CLIENT: TWINCRAFT SKINCARE  
 LOCATION: ESSEX, VT  
 FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MOTDRS.DWG  
 DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0809
SHEET:	9
OF	13 SHEETS



# CHEMICAL SYSTEM CABINET LAYOUT



LAYOUT FOR CHEMICAL PUMPS  
CP0911-01 AND CP1011-01  
(2 TOTAL JUNCTION BOXES)

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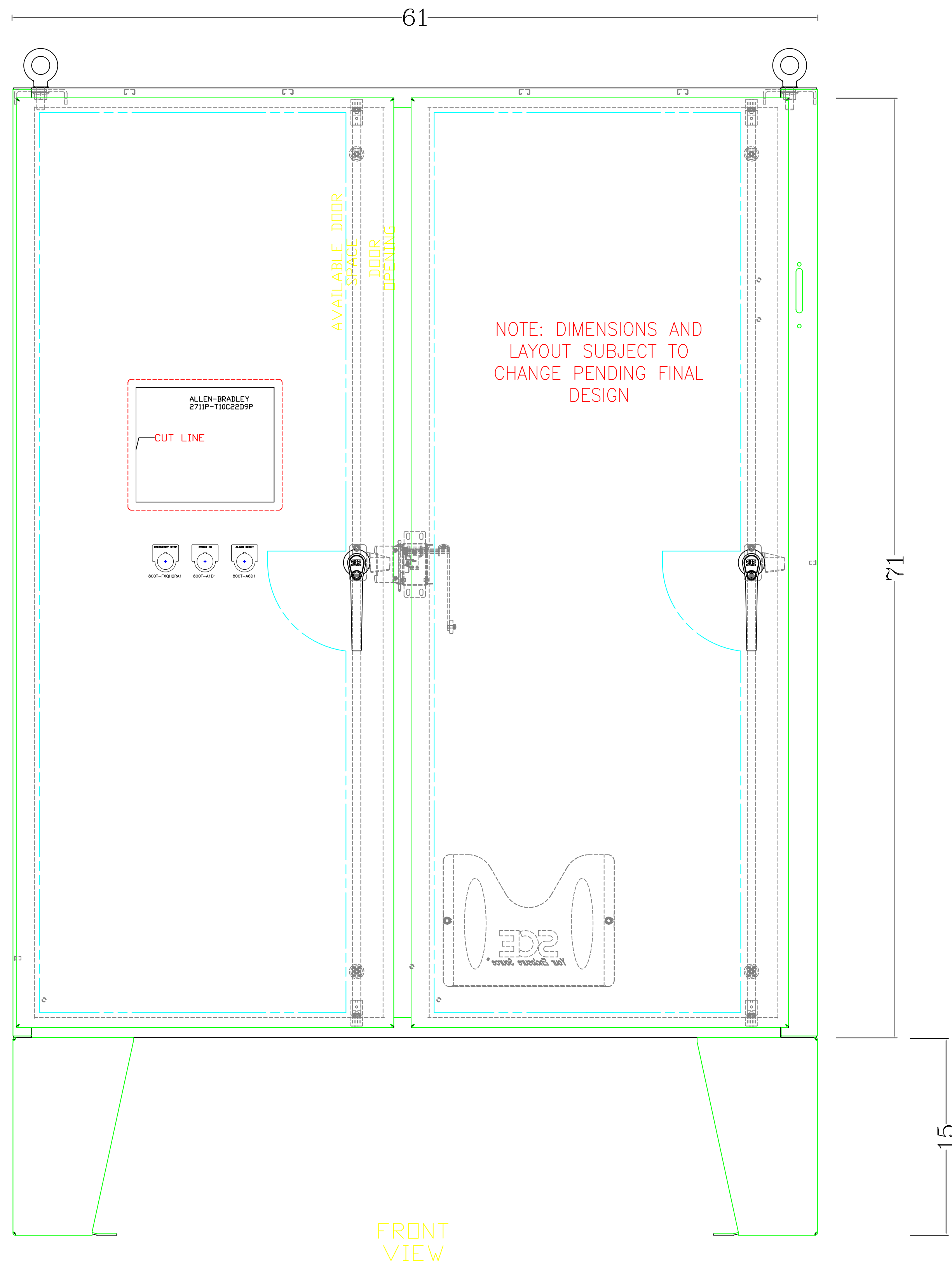
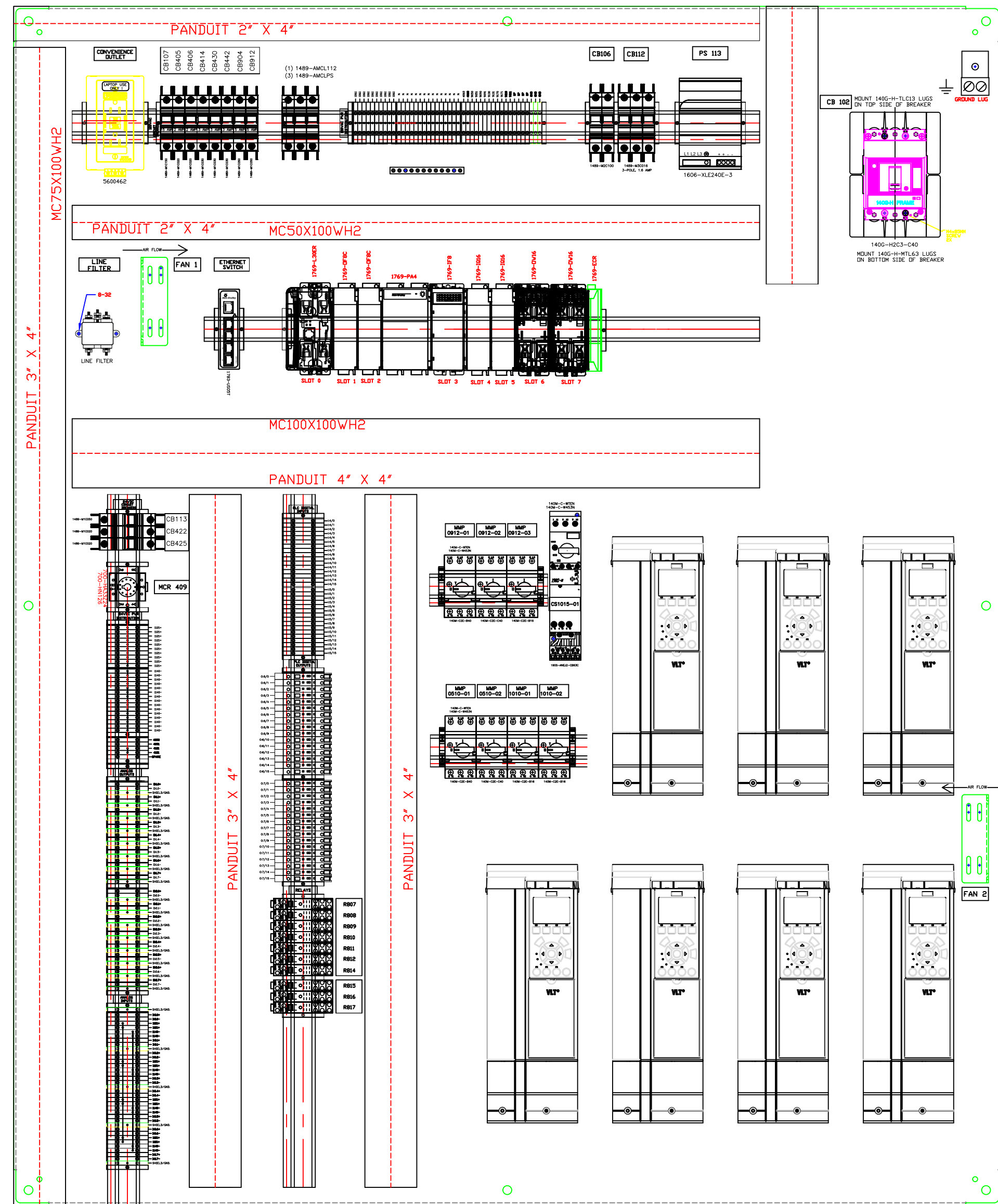
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REV. #	DATE	DESCRIPTION	BY

1-800-607-PURE  
**World water works**  
4000 SW 113th • OKLAHOMA CITY, OK 73137

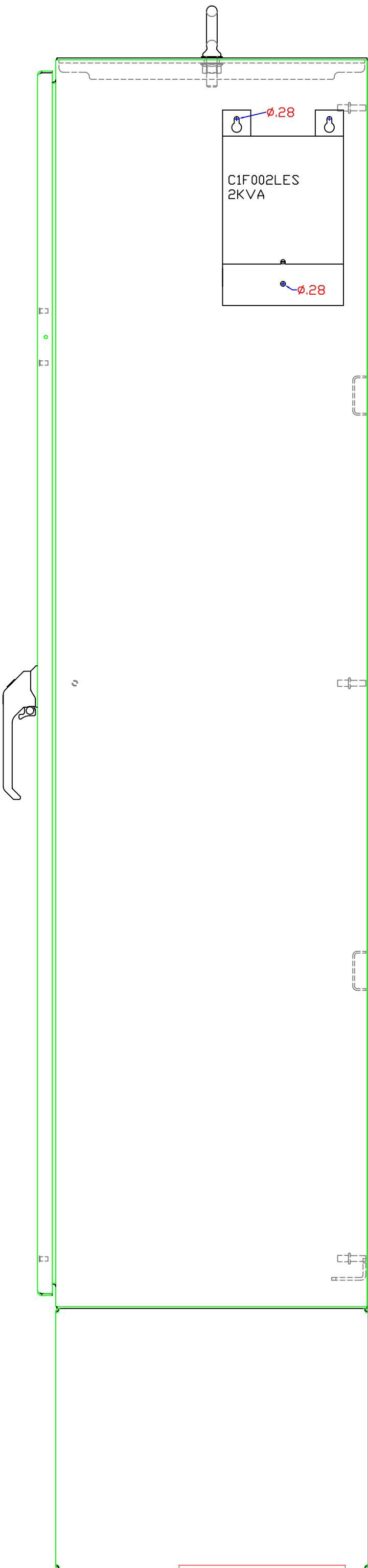
CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MOTDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0810
SHEET:	10
OF	13 SHEETS



NOTE: DIMENSIONS AND LAYOUT SUBJECT TO CHANGE PENDING FINAL DESIGN

FRONT VIEW



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REV.	DATE	DESCRIPTION	BY

1-800-607-PURE  
**World water works**  
 4000 SW 113th • OKLAHOMA CITY, OK 73137

CLIENT: TWINCRAFT SKINCARE  
 LOCATION: ESSEX, VT  
 FILE: NARHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_208V\_METERS.DWG  
 DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0811
SHEET:	11
OF	13 SHEETS

BILL OF MATERIALS IS  
TO BE DETERMINED

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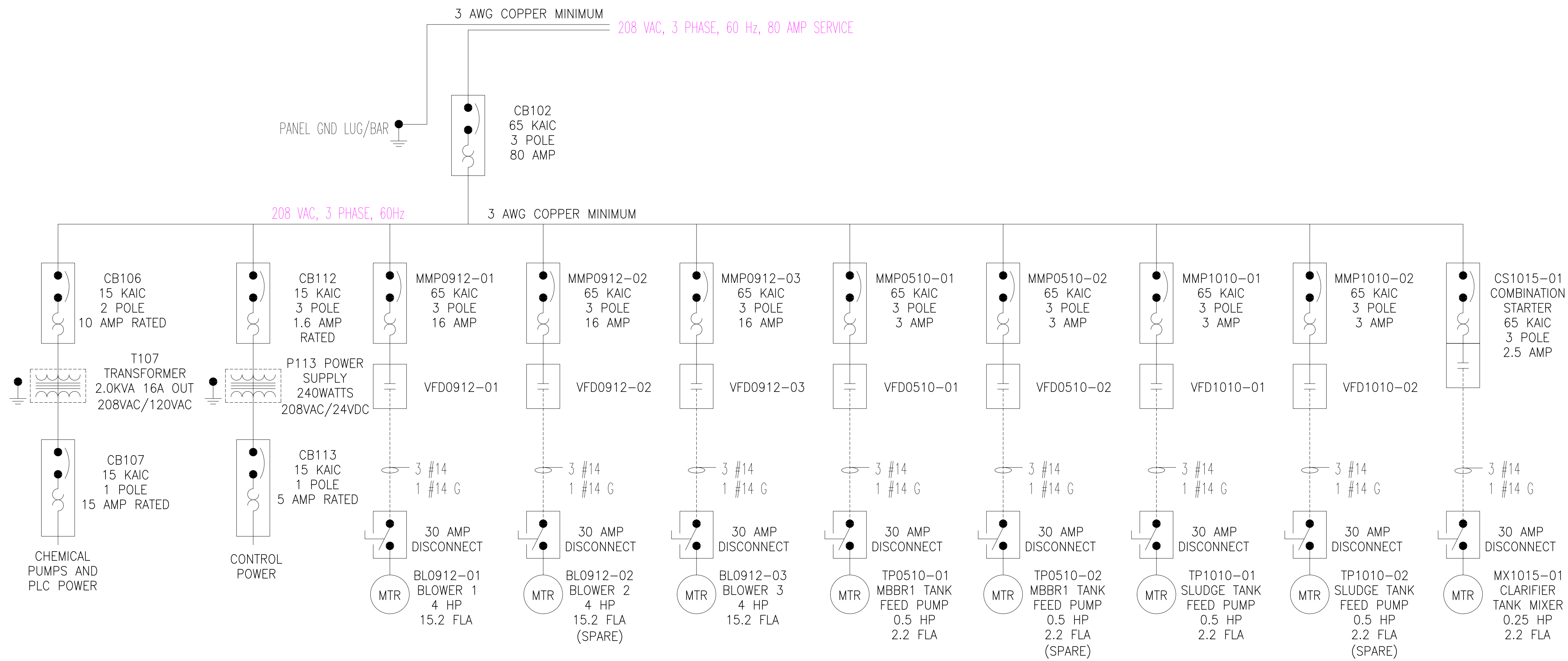
REV.	DATE	DESCRIPTION	BY



CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NAMBHEEIA KEA BASE PRELIMINARY ELECTRICAL 20BY METDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0812
SHEET:	12
OF	13 SHEETS





NOTES:

1. PROPERLY SIZED EQUIPMENT GROUNDING CONDUCTORS SHALL BE INSTALLED IN ALL CONDUITS INCLUDING SINGLE AND THREE PHASE.
2. ALL WIRE SIZE MUST BE VERIFIED FOR FINAL INSTALLATION.

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REV.	DATE	DESCRIPTION	BY

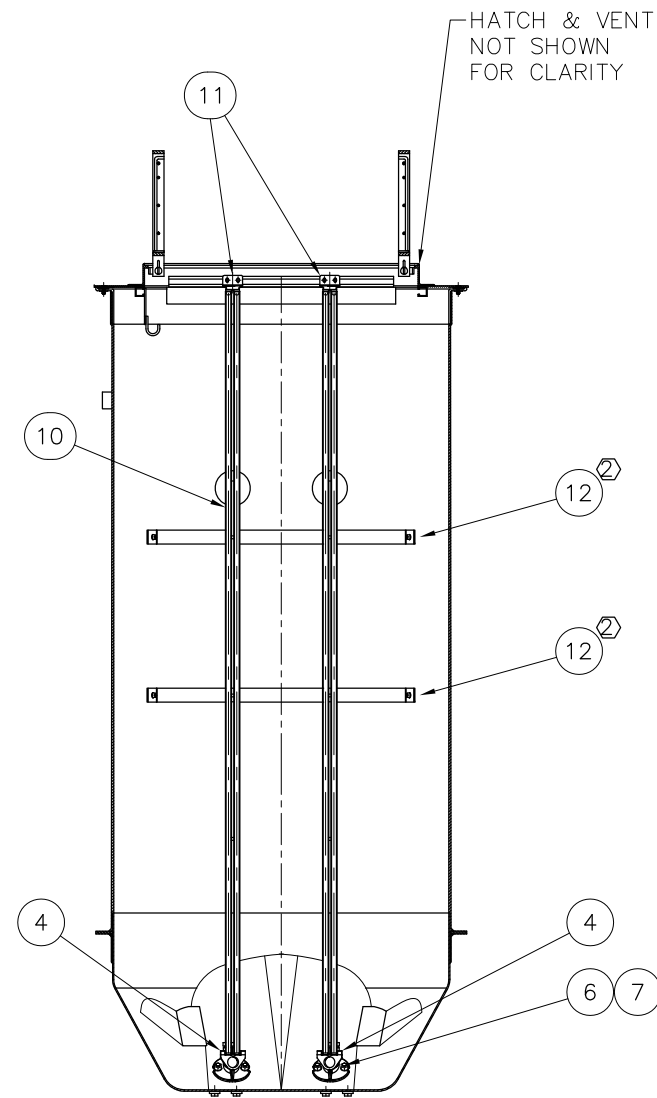


CLIENT: TWINCRAFT SKINCARE  
LOCATION: ESSEX, VT  
FILE: NAMBHEEIA\_KEA\_BASE\_PRELIMINARY\_ELECTRICAL\_20BY\_MITDRS.DWG  
DRAWING DESCRIPTION: ELECTRICAL PRINTS

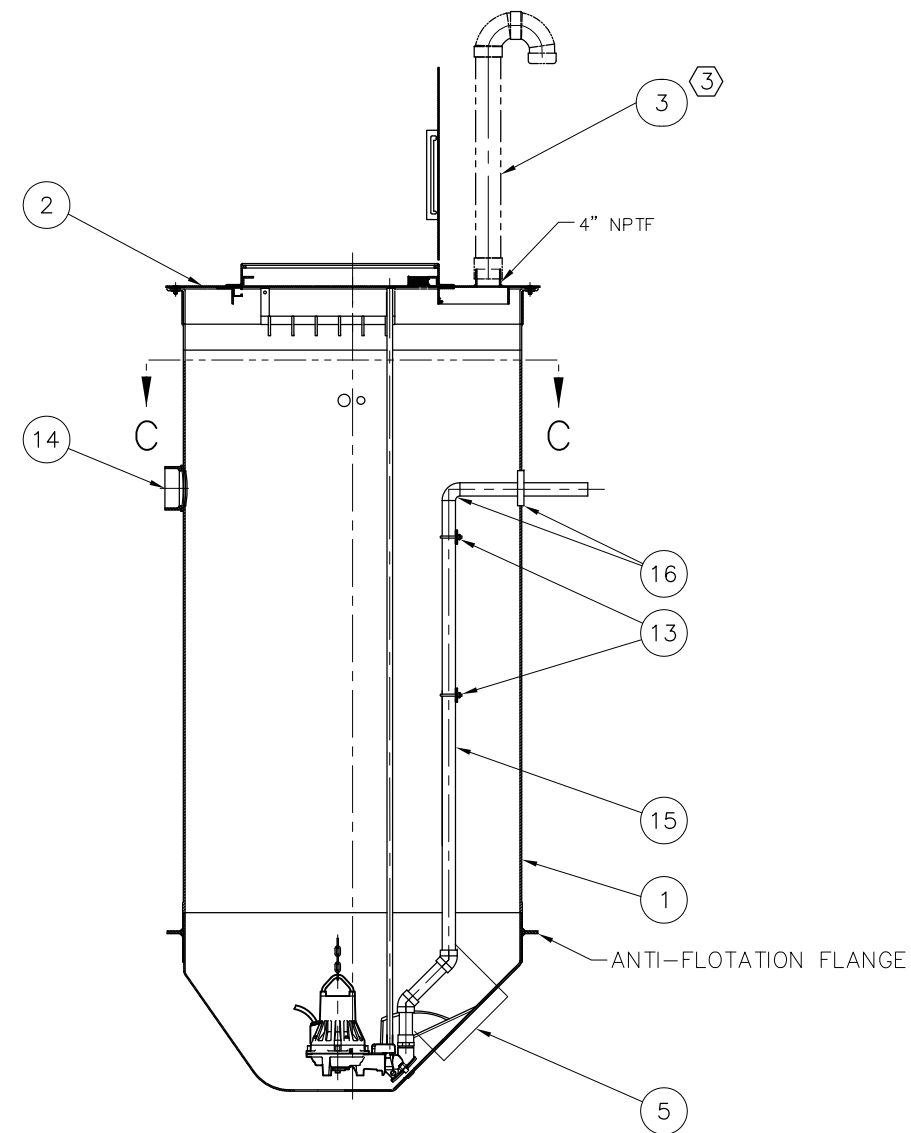
FOR APPROVAL	
P.O.#:	TBD
DRAWN BY:	CST
CHECKED BY:	
DATE:	02/28/2018
SCALE:	NONE
JOB #:	TBD
DRAWING #:	0813
SHEET:	13
OF	13 SHEETS

## **APPENDIX D**

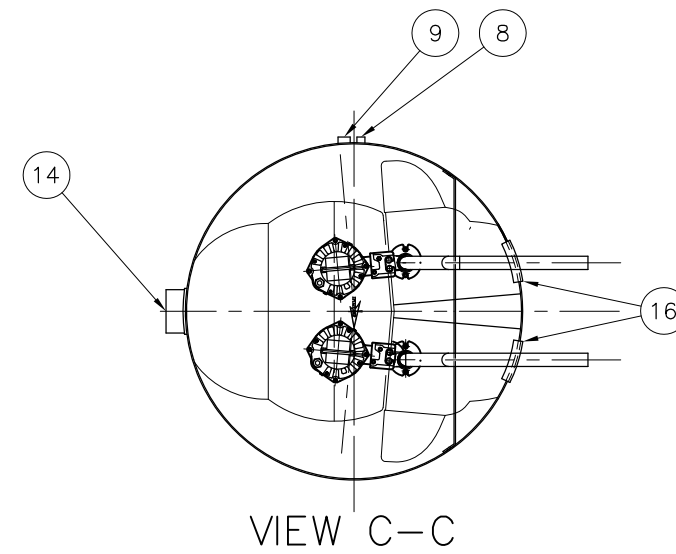
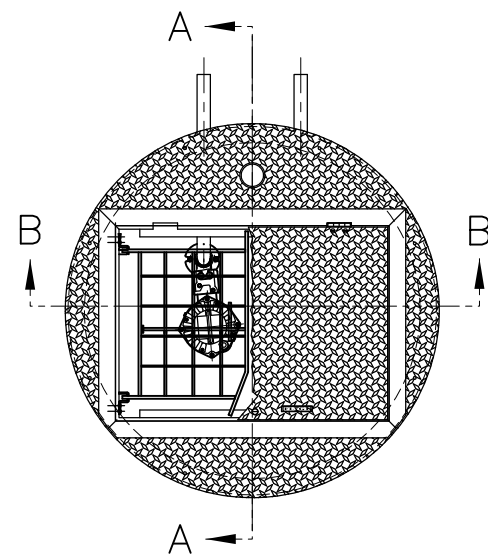
### Flygt Pre-fabricated Lift Station



VIEW B-B



VIEW A-A



VIEW C-C

NOTES:

1. STATION DEPTH: MIN 6ft., MAX 25ft. AVAILABLE IN 1ft. INCREMENTS.
2. ALL BOLT PENETRATIONS THRU WALLS MUST BE SEALED WITH SILICONE SEALANT.
3. OPTIONAL PVC CANDY CANE STYLE VENT SHOWN. MUSHROOM STYLE VENT ALSO AVAILABLE.

\* McMASTER CARR

ITEM	DESCRIPTION	PART NUMBER	QTY
16	PIPING KIT, 2"		1
15	PIPE, 2", SCH 40, PVC SST		ft (4x)
14	HUB		1
* 13	U-BOLT 3/8-16 OD 2-1/2, 2" PIPE	29605T6	4
12	BRACING, DISCHARGE PIPE		2
11	UPPER GUIDE BAR KIT, 3/4"		2
10	GUIDE BAR, 3/4", 316 SST		4
9	SEAL, CABLE WALL, PUMP		1
8	SEAL, CABLE WALL, LEVEL SENSOR	1860SCF125P	1
* 7	WASHER, 3/8 ID, 1 1/2 OD, GENERAL PURPOSE, 316 SST	91950A036	4
* 6	NUT, 3/8-10, 316 SST	94805A135	4
5	PIPING KIT, JOG OVER FOR 2"		2
4	DISCHARGE CONNECTION, 2"	619 95 00	2
3	VENT PIPE, 4"(OPTIONAL)	14-68 22 02	1
2	COVER, 5'		1
1	BASIN/CYLINDER ASSEMBLY, 5'		1

UNLESS OTHERWISE NOTED:

MACHINE TOLERANCE ON:

WHOLE AND FRACTIONS ± 1/32  
 1 PLACE DEC. ± 0.1  
 2 PLACE DEC. ± 0.02  
 3 PLACE DEC. ± 0.005  
 ANGLES ± 0.15°

FABRICATION TOLERANCE ON:

UP TO 12" ± 1/32  
 OVER 12" TO 48" ± 1/16  
 OVER 48" TO 120" ± 1/8  
 OVER 120" ± 3/16  
 ANGLES ± 0.5°

**FLYGT**  
 a xylem brand

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SHEET 1 OF 1

NO.	REVISION	BY	DATE	APVD.	DATE	APVD.	DATE	BY	DATE	BY	REF. NUMBER	SCALE	REV.
											14-682472-	NUMBER	
											SCALE PLOT TO FIT		

**APPENDIX E**  
Trojan UV Disinfection System

WASTEWATER DISINFECTION  
FILTERED IN-PIPE TREATMENT





## Proven Trojan products. A new application. Validated, chemical-free disinfection from the industry leader

Around the globe, wastewater treatment plants of all sizes are responding to the water quality and quantity demands of the communities they serve. As more municipalities adopt wastewater reuse policies and practices, wastewater treatment plants are required to treat effluent to higher levels –essentially eliminating all pathogens prior to reuse or discharge.

Depending on site and design conditions, wastewater treatment plants producing

filtered effluent sometimes prefer a disinfection solution using closed-vessel or pressurized UV reactors. The TrojanUVFit™ offers an effective and energy-efficient closed-vessel UV solution. This compact reactor is available in multiple configurations to treat a wide range of flow rates. The streamlined hydraulic profile of closed-vessel systems disinfect filtered effluent without breaking head in the treatment process. These benefits along with UV's ability to provide environmentally-friendly, chemical-free treatment for chlorine resistant microorganisms (such as *Cryptosporidium* and *Giardia*) make the

TrojanUVFit™ closed-vessel solution an attractive option for wastewater disinfection.

Trojan Technologies is an ISO 9001:2000 registered company that has been leading the UV disinfection market with open-channel solutions for wastewater disinfection (e.g. TrojanUV3000Plus™) in over 5,000 municipal installations worldwide – the largest UV installation base. The TrojanUVFit™, the latest addition to the Trojan product line, rounds out a complete portfolio of products for wastewater disinfection and reuse applications.

# Key Benefits

TrojanUVFit™

**Fully Validated Performance.** System sizing is based on actual dose delivery verified through bioassay validation. Real-world, field performance data eliminates sizing assumptions and risks associated with theoretical dose calculations.

**Compact Design.** The small reactor footprint simplifies indoor retrofit installations and reduces construction costs.

**Reliable, Proven Components.** UV lamps, quartz sleeves, electronic ballasts, sensors and sleeve wiping system have been tested, proven reliable and are operating in hundreds of installations.

**Design Flexibility.** Reactors can be installed in parallel or in series, making it simple to incorporate redundancy or future expansion needs.

**Wide Range of Flow Rates.** Peak flow rates per reactor are suitable for either individual post-filter or manifold installation. Flows up to 7 MGD per reactor – the largest validated low-pressure lamp in-pipe wastewater system in the industry.

**Validated Lamp Performance.** Lamp output and aging characteristics validated through industry protocols and proven through years of operating experience.

**Automatic Wiping.** Automatic sleeve wiping saves operator's time and money. Ensures the maximum UV output is available for disinfection and minimizes energy consumption.

**Global support. Local service.** Trojan's comprehensive network of certified service providers offers fast response for service and spare parts.

**Guaranteed Performance and Comprehensive Warranty.** Trojan systems include a Lifetime Disinfection Performance Guarantee. Ask for details.

# TROJAN UVFIT™

Designed for efficient, reliable performance

## System Control Center

The microprocessor or PLC-based controller continuously monitors and controls UV system functions. SCADA communication via ModBus for remote monitoring, control and dose pacing is available. Programmable digital and analog I/O capabilities can generate unique alarms for individual applications and send signals to operate valves and pumps.

## Sleeve Wiping System

Automatic sleeve wiping system operates on-line without interrupting disinfection. The wiping sequence occurs automatically at preset intervals without operator involvement.

## Amalgam Lamps

High-output amalgam lamps are energy-efficient and save operating costs due to reduced electrical consumption. Lamps are located within protective quartz sleeves with easy access from the service entrance.



## UV Intensity Sensor

Highly accurate, photodiode sensor monitors UV output within the reactor. The sensor ensures UV light is fully penetrating the water for complete disinfection.

*Compact reactors designed for high flow rates also available. This reactor contains lamps in both ends of the reactor. Multiple inlet and outlet flange orientations are available.*



## Power Distribution Center (PDC)

The PDC panel distributes power to the reactor, UV intensity sensor and sleeve wiping system. The panel also houses high-efficiency, variable-output (60 – 100% power) or constant-output ballasts with proven performance in hundreds of installations around the world.



## End Cap

The end cap protects and isolates connections for components such as lamps, sleeves and wiping system. Power is automatically disconnected if end cap is removed thereby ensuring a safe working environment for operators.

## UV Reactor

Electropolished 316L stainless steel chamber available in multiple configurations for a wide range of flow rates. Optional flange orientations allow reactors to fit into existing piping galleries or tight spaces.

## Regulatory-Endorsed Bioassay Validation

Field testing ensures accurate dose delivery

### Benefits:

- Validated in accordance with industry protocols established by National Water Research Institute (NWRI)
- Performance data is generated from actual field testing over a wide range of flow rates and water quality (UV transmission)
- Bioassay testing offers peace of mind and improved public and environmental safety due to verified dose delivery – not theoretical calculations

## Compact Reactor for Installation Flexibility

Efficient, cost-saving design enables retrofit or new construction

### Benefits:

- Compact footprint simplifies installation and minimizes related capital costs – ideal for retrofit and new construction applications
- Lamps and sleeves are fully serviceable from the reactor end – allowing the system to be installed against walls, other equipment or piping
- Low headloss design simplifies integration into existing process, and avoids additional pumping and associated capital and operational costs
- Multiple flange orientations available – increasing design flexibility



*Reactors can be installed in parallel or in series for increased design and installation flexibility.*

## Amalgam Lamps Require Less Energy

Maintain maximum output and reduce O&M costs

### Benefits:

- Each lamp draws 250 Watts
- Trojan's amalgam lamps maintain 98% output during entire lamp life – 20% less decline than competitive UV lamps
- Validated performance provides assurance of reliable dose delivery and prolonged lamp life
- Deliver consistent and stable UV output over a wide range of water temperatures

# Built for Reliable Performance and Easy Maintenance

Designed for trouble-free operation and minimal service

## Benefits:

- Routine procedures, including lamp changeouts are simple and require minimal time – reducing maintenance costs
- Access to internal components (lamps, sleeves, cleaning system) through service entrance at one end.
- Service entrance and connections isolated and protected by end cap
- Intensity sensor continuously monitors UV output to ensure dose delivery



*The TrojanUVFit™ lamps are easily replaced in minutes without the need for tools.*

# Robust Sleeve Wiping System

Automatic wiping system maintains consistent dose delivery

## Benefits:

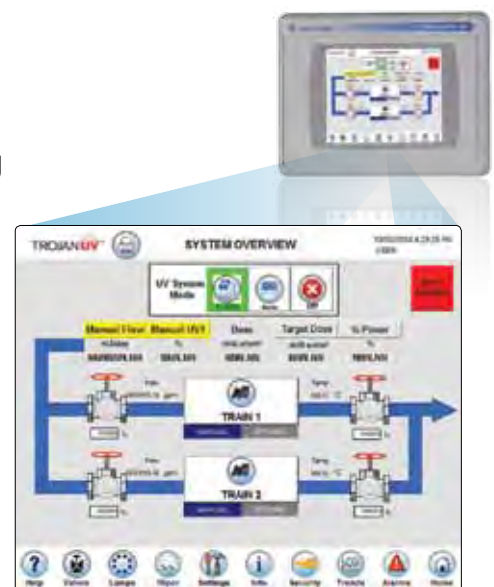
- Wiping system minimizes fouling of quartz sleeves
- Ensures consistent UV dose delivery and optimum performance
- Automatic wiping occurs while the lamps are disinfecting, reducing downtime
- Optional off-line chemical cleaning to reduce maintenance associated with manual cleaning

# User-Friendly Operator Interface

Touch-screen display allows easy operation and monitoring

## Benefits:

- Microprocessor or PLC-based system controls all functions and dose pacing to minimize energy use while maintaining required UV dose
- Controller features intuitive, graphical display for at-a-glance system status
- Controller communicates with plant SCADA systems for centralized monitoring of performance, lamp status, power levels, hours of operation and alarm status



*The PLC-based controller combines sophisticated system operation and reporting with an operator-friendly, touch screen display.*

System Specifications						
Model	04AL20	08AL20	18AL40	32AL50	72AL75	D72AL75
Number of Lamps	4	8	18	32	72	144
Lamp Type	High-efficiency, High-output, Low-Pressure Amalgam					
Sleeve Wiping	Automatic Wiping System					
Ballast	Electronic, constant output (100% power) or Electronic, variable output (60 to 100% power)					
Reactor Chamber						
Materials of Construction	316L Stainless Steel					
Standard Flange Size (ANSI/DIN), inches (mm)	6 (150)	10 (250)	12 (300)	20 (500)	20 (500)	
Outlet Flange Orientation	Multiple orientations available 3, 6, 9, or 12 o'clock position					
Approx. Reactor Length, inches (mm)	80 (2032)	80 (2032)	82 (2083)	90 (2286)	90 (2286)	152 (3860)
Max. Operating Pressure, PSI (bar)	150 (10)	150 (10)	150 (10)	100 (6.8)	65 (4.5)	65 (4.5)
Dry Reactor Weight, lbs (kg)	107 (49)	115 (52)	400 (181)	1600 (726)	2100 (953)	3700 (1678)
Wet Reactor Weight, lbs (kg)	230 (105)		877 (398)	2200 (998)	3700 (1678)	7200 (3265)
Power Distribution Center						
Electrical Supply	208V, 1 phase, 2 wire + GND, 50/60 Hz 240V, 1 phase, 2 wire + GND, 50/60 Hz (other options available with transformer)			480Y/277 V, 3 phase, 4 wire + GND, 50/60 Hz (other options available with transformer)		
Dimensions, inches	24 x 24 x 10	30 x 24 x 10	36 x 48 x 10	40 x 86 x 18	48 x 86 x 24	96 x 86 x 24
Dimensions, mm	610 x 610 x 254	762 x 610 x 254	914 x 1219 x 254	1016 x 2184 x 457	1219 x 2184 x 610	2438 x 2184 x 610
Available Materials of Construction	Mild Painted Steel 304 Stainless Steel					
Panel Rating	NEMA 12, 3R or 4X			NEMA 12 or 4X		
System Control Center						
Controller*	Microprocessor			Microprocessor or PLC	PLC	
Electrical Supply	N/A (see PDC)			For PLC -120 V, 1 phase, 2 wire + GND, 60Hz (other options available with transformer)		
Panel Rating	N/A (see PDC)			NEMA 12 or 4X		
Typical Outputs Provided	Reactor status, common alarms and SCADA communication					

\* Microprocessor is built into PDC. PLC is stand alone.

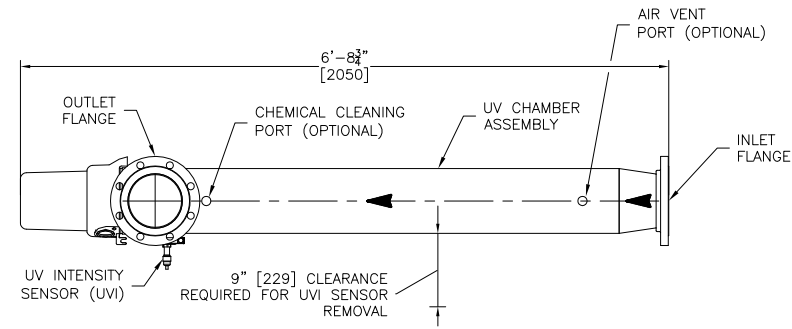
**Find out how your wastewater treatment plant can benefit from proven TrojanUVFIT™ solutions. Contact us today.**

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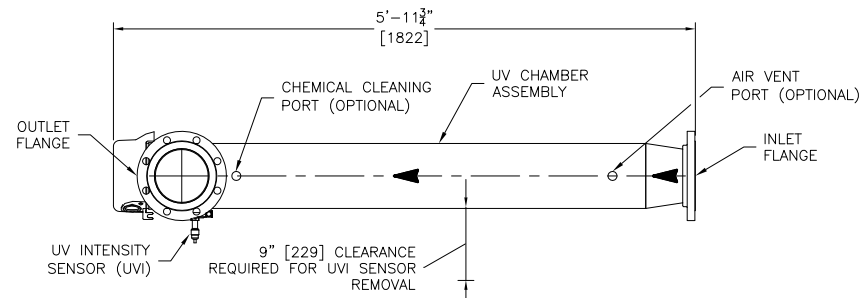
Products in this publication may be covered by one or more of the following patents:  
CA 2,349,199; US 6,342,188; US 7,282,720; US 7,368,725; US 7,390,225.  
Other patents pending.

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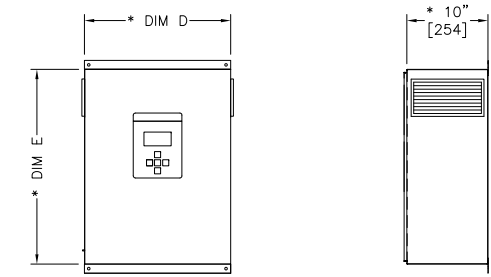
**TOP VIEW (AMWS)**

SCALE:AS SHOWN



**TOP VIEW (NON-WIPING)**

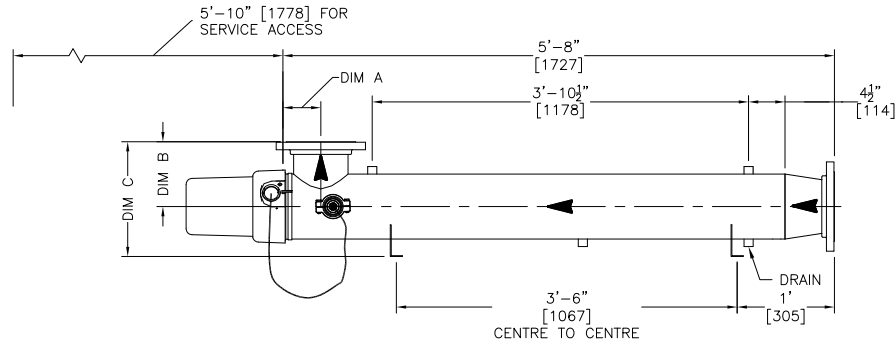
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**CONTROL POWER PANEL (CPP)**

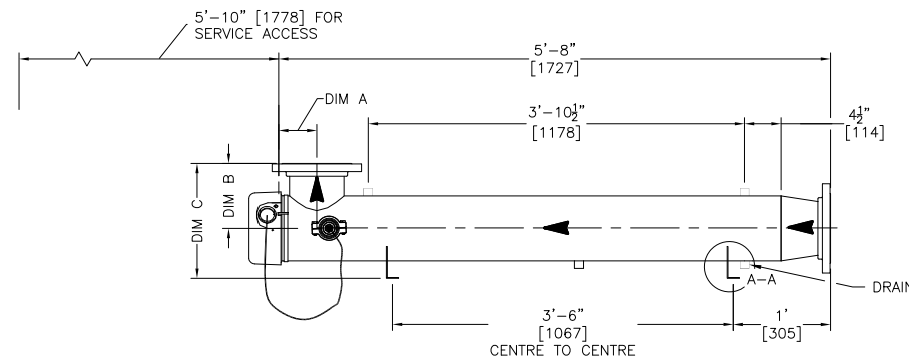
SCALE:AS SHOWN

NOTE: TYPE 12 OR TYPE 3R PANEL SHOWN.



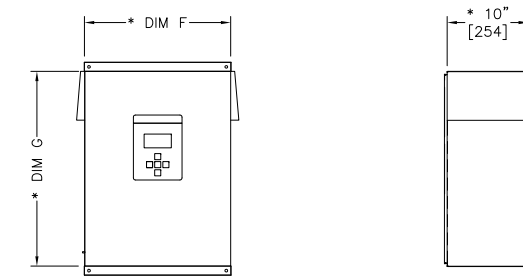
**FRONT VIEW (AMWS)**

SCALE:AS SHOWN



**FRONT VIEW (NON-WIPING)**

SCALE:AS SHOWN

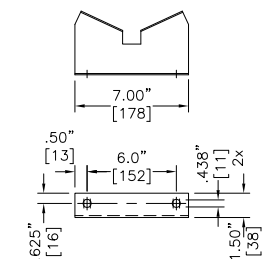


**CONTROL POWER PANEL (CPP)**

SCALE:AS SHOWN

NOTE: TYPE 4X PANEL SHOWN.

MODEL	LAMP LENGTH	UV CHAMBER ASSEMBLY DIAMETER	# LAMPS AVAILABLE	FLANGE TYPE	FLANGE SIZE	DIM A	DIM B	DIM C	DIM D (TYPE 12 OR 3R)	DIM E (TYPE 12 OR 3R)	DIM F (TYPE 4X)	DIM G (TYPE 4X)	WIPING SYSTEM
04AL20	LONG	8" [203]	4	ANSI/DIN	6" [150] (STANDARD)	7.00" [178] (FOR 6" FLANGE)	7.75" [197] (FOR 6" FLANGE)	1'-2 1/4" [375] (FOR 6" FLANGE)	2'-0" [610]	1'-4" [406]	2'-0" [610]	1'-4" [406]	AMWS (STANDARD)
08AL20			8		4" [100] (OPTIONAL)	4.62" [117] (FOR 4" FLANGE)	7.25" [184] (FOR 4" FLANGE)	1'-2 1/4" [362] (FOR 4" FLANGE)		2'-0" [610]		2'-0" [610]	2'-0" [610]



**DETAIL A-A**

SCALE: NOT TO SCALE (STANDARD MOUNTING BRACKETS)

**NOTES:**

- 1/ MAXIMUM OPERATING PRESSURE TO BE 150 psi [10 BAR].
  - 2/ STANDARD INTERCONNECTING CABLE LENGTH TO BE 15ft [4.5m].
  - 3/ [ ] INDICATES MILLIMETERS UNLESS OTHERWISE SPECIFIED.
  - 4/ CONNECTION SEALS AND HARDWARE TO BE SUPPLIED BY CUSTOMER.
  - 5/ MOUNTING AND SAMPLING PORTS ARE TO BE SUPPLIED BY THE CUSTOMER.
  - 6/ CLEARANCES FOR WIPING SYSTEMS FALL WITHIN CLEARANCES REQUIRED FOR SLEEVE REMOVAL.
  - 7/ OUTLET ORIENTATION OPTIONS : TOP (STANDARD), LEFT, RIGHT, AND BOTTOM. TOP OUTLET IS SHOWN FOR CLARITY.
- \* INDICATES DIMENSIONS SHOWN ARE SUBJECT TO CHANGE DEPENDING ON SITE SPECIFIC REQUIREMENTS.

<p>CONFIDENTIALITY NOTICE Copyright© 2013 by Trojan Technologies. All rights reserved. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form, without the written permission of Trojan Technologies.</p>	DESCRIPTION: <b>STD, TROJANUVFIT AL20 SYSTEM</b>		STD. DRAWING NO. <b>FT0004</b>
	DRAWN BY : TIY/MMB	DATE : 13AP12	REFERENCE NO. <b>N/A</b>
	CHECKED BY : AMP	DATE : 13JUN21	DWG NO. <b>D01</b>
	APPROVED BY : SAH	DATE : 13JUN24	REV. <b>C</b>
	SCALE (11x17) : 1/2" = 1'-0"	LOG NUMBER : N/A	

## **APPENDIX F**

Geotechnical Investigation Report  
by Lawrence Shinsato including  
Absorption Bed Sizing

**REPORT  
GEOTECHNICAL INVESTIGATION**

**PROPOSED WASTEWATER TREATMENT FACILITY  
HEEIA KEA SMALL BOAT HARBOR  
KAMEHAMEHA HIGHWAY  
KANEHOE, HAWAII**

for

BILLS ENGINEERING, INC.

Project No. 17-0045  
June 21, 2017

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**SHINSATO ENGINEERING, INC.**  
98-747 KUAHAO PLACE, #E  
PEARL CITY, HI 96782

**NOTE: ABSORPTION BED SIZING IS  
INCLUDED AS LAST PAGE OF THIS SECTION**

# **SHINSATO ENGINEERING, INC.**

*CONSULTING GEOTECHNICAL ENGINEERS*

98-747 KUAHAO PLACE, SUITE E  
PEARL CITY, HAWAII 96782  
PHONE: (808) 487-7855  
FAX: (808) 487-7854

---

June 21, 2017  
Project No. 17-0045

Bills Engineering, Inc.  
Attention: David Bills  
1124 Fort Street Mall  
Honolulu, Hawaii 96813-2715

Dear Mr. Bills:

This report presents the results of the geotechnical engineering services provided for the proposed Heeia Kea Harbor wastewater system improvements to be implemented in Kaneohe, Oahu, Hawaii. The location of the site, relative to the existing streets and landmarks, is shown on the Vicinity Map, Plate 1.

## 1.0 SCOPE OF WORK

The services included drilling 2 test borings to the depths of 3.0 and 4.0 feet below existing grade, performing 6 field percolation tests to determine the relative percolation rates of the underlying soils, and performing an engineering analysis to determine the recommendations to restore the existing pavement section. The following information is provided for use by the Architect and/or Engineer:

- 1) General subsurface conditions, as disclosed by the test borings.
- 2) Physical characteristics of the soils encountered.
- 3) Results of the field percolation rates.
- 4) Recommendations for the restored pavement section.
- 5) Recommendations for placement of fill and backfill.
- 6) Special considerations.

## 2.0 PLANNED DEVELOPMENT

From the information provided, the project will consist of demolishing, removing, and backfilling the existing wastewater treatment elements and replacing them with a new wastewater treatment facility.

## 3.0 FIELD INVESTIGATION

### 3.1 Drilling

The subsurface explorations consisted of drilling test borings at the locations shown on the Plot Plan, Plate 2. The test borings were advanced with a CME 55 drill rig using 4-inch diameter continuous flight augers.

The lead auger was equipped with drill bit that had changeable carbide cutting teeth. Soil cuttings are brought to the surface by the continuous flights. After the bore hole was advanced to the required depth and cleaned of cuttings by additional rotation of the augers, the augers were retracted from the bore hole for soil sampling.



### 3.2 Field Logging

During the subsurface explorations, a continuous log of the boring was kept. The logs included visual classification of the soils encountered using the Unified Soil Classification System as well as other pertinent information which were gathered during the drilling process. The final boring logs included in this report incorporates engineering analysis and results of the laboratory tests.

### 3.3 Field Percolation Testing

The percolation test was performed using test procedures developed by the Robert A. Taft Sanitary Engineering Center. In general, this consists of drilling the test hole, filling the bottom with 2 inches of coarse sand and then saturating the hole with water (overnight for clayey soils). The test is conducted by filling the hole with clear water and then measuring the drop in water level with time. The results of the measurements are used to determine the percolation rate.

## 4.0 SITE CONDITIONS

### 4.1 Surface

The site is presently occupied by an existing wastewater treatment plant facility that is located at the corner of Kamehameha Highway and the entrance road to the Heeia Kea Small Boat Harbor. The facility includes a restroom building and electrical panels, seepage pits, aeration chambers, and equalization boxes. The facility is situated on a partially elevated grass covered pad.

The new wastewater treatment facility and leaching field will be located to the south of the existing facility. The area consist of relatively flat, grass covered ground to the west and part of the existing asphaltic concrete paved parking lot to the east.

### 4.2 Subsurface

The subsurface condition at the site was explored by drilling 2 test borings to depths of 3.0 and 4.0 feet below existing grade. The locations of the borings are shown on the Plot Plan, Plate 2. Detailed logs of the borings are presented in the Log of Borings, Plates 3 and 4.

The borings disclosed the site to be underlain by 5 inches of AC PAVEMENT, followed by medium dense, tan and brown silty SAND to the depth of 1.0 to 2.0 feet, then by medium dense, tan calcareous SAND to the final depths of the borings.

Groundwater was encountered at approximately 1.75 and 2.5 feet below existing grade at the time of the field investigation.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Special Considerations

Special considerations will be needed in the design and construction of the project due to the subsurface conditions encountered in this investigation. These include but may not be limited to the following:

- a) Groundwater was encountered at 1.75 to 2.5 feet below existing grade. This may require special design to provide separation between the bottom of the leaching field and the groundwater surface.

- b) The underlying soils are susceptible to caving especially near and below the groundwater level. This may require shoring and dewatering.

## 5.2 Field Percolation Test Results

The field work consisted of drilling 6 test borings using a 4-inch diameter auger to depths of 1.5 to 4.0 feet below existing grade. The location of the tests are shown on the Plot Plan, Plate 2.

Percolation tests P-1, P-2 and P-3 were performed above the existing groundwater level. Tests P-4, P-5 and P-6 were performed in borings that were drilled below the groundwater level. This was done to provide information about the soil percolation rates above and below the groundwater level.

The results of the percolation tests are as follows:

Percolation Test No.	Test Depth (ft)	Percolation Rate (min/inch)	Soil Description
P-1	1.5	11.4	calcareous SAND
P-2	1.5	4.0	calcareous SAND
P-3	1.5	2.8	calcareous SAND
P-4	1.5	6.7	calcareous SAND
P-5	4.0	< 1	calcareous SAND
P-6	3.0	< 1	calcareous SAND

The Department of Health Recommended Standards (Chapter 10) indicate that leach fields (absorption trenches) should not be used in soils with a percolation rate slower than 60 minutes per inch. Since the percolation tests indicate rates faster than 60 minutes per inch, leach fields (absorption trenches) may be used for disposal of septic sewage effluent.

## 5.3 Foundation Design

For the design of new structures, the following foundation design parameters are recommended:

- a) Allowable soil bearing value:
- i) 1,500 psf for footings bearing on firm on-site soils or properly compacted fill.
  - ii) The allowable soil bearing value may be increased by one-third for momentary loads due to wind or seismic forces.
  - iii) All loose and disturbed soil at the bottom of footing excavations shall be removed to firm soil or the disturbed soil shall be compacted prior to laying of steel or pouring of concrete.
- b) Footing Embedment Depth:
- i) For footings constructed on relatively level ground: minimum 12-inches below the lowest adjacent finished grade (measured to the bottom of the footing).

- ii) For footings located adjacent to utility trenches: the bottom of the footing shall be deepened below a 1 horizontal to 1 vertical plane projected upwards from the edge of the utility trench.
  - iii) For footings located adjacent to retaining walls or other structural elements which are not designed for surcharge loading: the new footing shall be deepened below a 45-degree plane projected upwards from the adjacent structure.
- c) Estimated foundation settlement:           less than 1-inch
- d) Lateral Earth Pressure Coefficients:

Material Type	Passive Earth Coefficient (Kp)	Active Earth Coefficient (Ka)	At-Rest Earth Coefficient (Ko)	Frictional Coefficient (x D.L.)	Moist Unit Weight (pcf)	Buoyant (Submerged) Unit Weight (pcf)
On-Site Sandy Soil	3.0	0.35	0.50	0.6	110	60
Imported Structural Fill	3.5	0.27	0.42	0.7	140	95

Notes:

- i) The passive, active and at-rest earth pressures are determined by multiplying the respective earth coefficient by the unit weight.
- ii) The allowable passive earth resistance values may be used for structural elements in direct contact with undisturbed material. Where the ground surface adjacent to the resisting element is exposed to the weather, the top 12 inches shall be neglected in calculating the passive earth resistance. This is to allow for soil shrinkage and/or erosion.
- iii) Lateral resistance and friction may be combined.
- iv) The above active earth coefficients do not include surcharge loads such as footings located within a 45 degree plane projected upwards from the heel of the footing, sloping ground and/or from hydrostatic pressures. If such conditions occur, the active earth pressures shall be increased accordingly.

5.4 Slab-on-Grade

Conventional slab-on-grade construction may be used. However, during construction should expansive soils be found under slab areas, the expansive soils shall be overexcavated to a minimum depth of 12-inches below the bottom of slab elevation and be replaced with non-expansive granular fill.

It is recommended that concrete floor slabs that have moisture sensitive floor covering be constructed using a vapor retarder and a capillary moisture barrier of 4-inches of clean gravel cushion material such as #3-fine gravel (ASTM Designation No. 67).

For design of slabs, a modulus of subgrade reaction of 200 pci may be used for the on-site soil or properly compacted structural fill.

Preparation of the subgrade shall be in accordance with the Site Preparation and Grading section to this report.

5.5 Pavement Design

For new pavements and any restoration of disturbed parking lot and driveway areas, the pavement section shall match the existing pavement (5-inches of AC pavement). In lieu of this, the new pavement section may consist of 3-inch of AC that is underlain by at least 6-inches of compacted, untreated aggregate base course gravel.

The top 6 inches of pavement subgrade shall be compacted to at least 95 percent of the maximum dry density (ASTM D1557).

All material quality and compaction requirements for the pavement section shall be in accordance with the Hawaii State Standard Specifications for Road and Bridge Construction, dated 2005.

5.6 Trench Excavation and Backfill

Trench excavation and backfilling work shall be performed in accordance with the applicable sections of the Hawaii State Standard Specifications for Road and Bridge Construction, dated 2005.

6.0 INSPECTION

Observations during construction has been requested for the preparation of a Final Grading Report for this project. Intermittent site visits for compaction testing will be required for fill and backfill areas. Laboratory testing will be required to determine the maximum dry density of fill and backfill materials in order to perform compaction testing.

This office should be notified a minimum of 5 days prior to the placement of fill and backfill material to complete pertinent laboratory tests and to discuss a compaction testing requirements. Requests for intermittent compaction testing by an inspector shall be made 24 hours prior to the scheduled site visit.

7.0 REMARKS

The conclusions and recommendations contained herein are based on the findings and observations made at the test boring and percolation test locations. If conditions are encountered during construction which appear to differ from those disclosed by the explorations, this office shall be notified so as to consider the need for modifications.

This report has been prepared for the exclusive use of Bills Engineering, Inc. and their respective design consultants. It shall not be used by or transferred to any other party or to another project without the consent and/or thorough review by this facility. Should the project be delayed beyond the period of one year from the date of this report, the report shall be reviewed relative to possible changed conditions.

The following are included and complete this report:

Vicinity Map -----	Plate 1
Plot Plan -----	Plate 2
Logs of Borings -----	Plate 3 - 4
Results of Field Percolation Tests	

Bills Engineering, Inc.  
June 21, 2017  
Page Six

This investigation was made in accordance with generally accepted engineering procedures and included such field and laboratory tests considered necessary for the project. In the opinion of the undersigned, the accompanying report has been substantiated by mathematical data in conformity with generally accepted engineering principles and presents fairly the design information requested by your organization. No other warranty is either expressed or given.

Respectfully submitted,

SHINSATO ENGINEERING, INC.



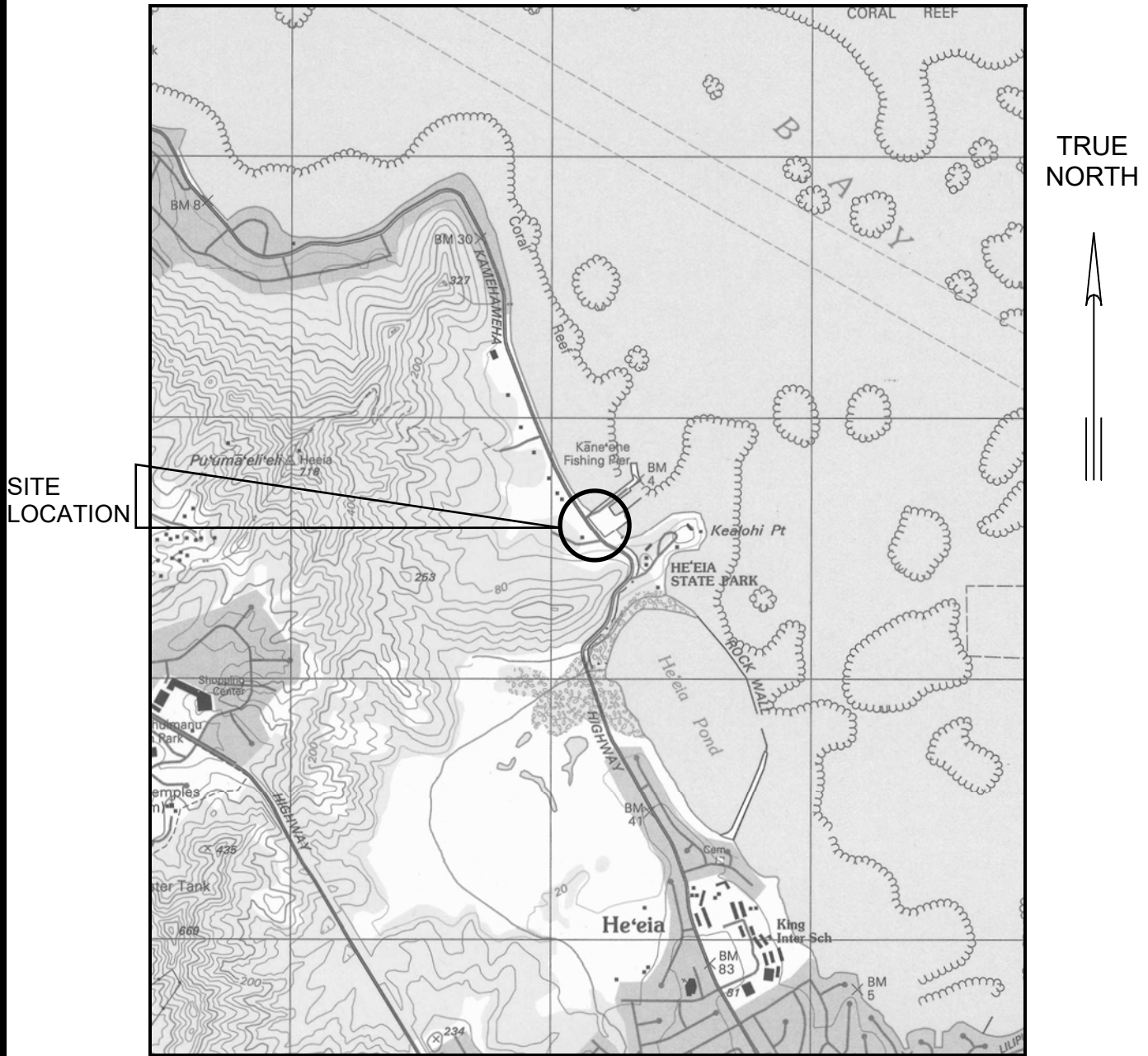
Lawrence S. Shinsato, P.E.  
President

LSS:ks



This work was prepared by me  
or under my supervision.  
License Expires 04/30/18

# VICINITY MAP



**REFERENCE:**  
 USGS TOPOGRAPHIC MAP  
 KANEOHE QUADRANGLE  
 DATED 1998  
 SCALE: 1"=2000'

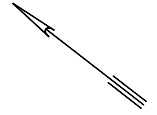


Project: HEEIA KEA HARBOR WWTP  
 KANEOHE, HAWAII  
 Project No.: 17-0045

**SHINSATO ENGINEERING, INC.**  
 CONSULTING GEOTECHNICAL ENGINEERS  
 98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

**PLATE**  
**1**

TRUE NORTH



**LEGEND:**

 APPROXIMATE BORING/PERCOLATION TEST LOCATION

**PLOT PLAN**

SCALE: 1" = 80'

0 40' 80' 160'



Project: HEEIA KEA HARBOR WWTP  
KANEOHE, HAWAII  
Project No.: 17-0045


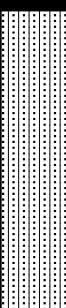


**SHINSATO ENGINEERING, INC.**  
CONSULTING GEOTECHNICAL ENGINEERS  
98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

**PLATE  
2**

# LOG OF BORING NO. 1

DRILLING METHOD: **CME 55 Drill Rig**  
 HAMMER WEIGHT (lbs): **140**  
 HAMMER DROP (in): **30**

ELEVATION (FT.): **3.87**  
 DEPTH OF BORING (FT.): **4**  
 DEPTH TO GROUNDWATER (FT.): **2.5**  
 DATE DRILLED: **May 17, 2017**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		<b>(AC)</b>	5" AC PAVEMENT;									
0.5		<b>SM</b>	silty SAND; few gravel			brown tan	slightly moist	medium dense				
2		<b>SP</b>	SAND; few gravel			tan	very moist					
2.5												
4			END OF BORING									
4.5												
5												
5.5												
6												
6.5												
7												
7.5												

Project: **HEEIA KEA HARBOR WWTP  
 KANEOHE, HAWAII**  
 Project No.: **17-0045**

**SHINSATO ENGINEERING, INC.**  
 CONSULTING GEOTECHNICAL ENGINEERS  
 98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

**PLATE  
 3**



# LOG OF BORING NO. 2

DRILLING METHOD: **CME 55 Drill Rig**  
 HAMMER WEIGHT (lbs): **140**  
 HAMMER DROP (in): **30**

ELEVATION (FT.): **3.49**  
 DEPTH OF BORING (FT.): **3**  
 DEPTH TO GROUNDWATER (FT.): **1.75**  
 DATE DRILLED: **May 17, 2017**

DEPTH (FT.)	GRAPHIC SYMBOL	UNIFIED SOIL CLASSIFICATION	DESCRIPTION	SAMPLE	BLOWS/FOOT	COLOR	MOISTURE	CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (% OF DRY WT.)	PENETROMETER (TSF)	TORVANE STRENGTH (TSF)
0		<b>(AC)</b>	5" AC PAVEMENT;									
0.5		<b>SM</b>	silty SAND;			brown tan	moist	medium dense				
1		<b>SP</b>	SAND; few gravel			tan	very moist					
1.5							▼					
2												
2.5												
3			END OF BORING									
3.5												
4												
4.5												
5												
5.5												
6												
6.5												
7												
7.5												

Project: **HEEIA KEA HARBOR WWTP  
 KANEOHE, HAWAII**  
 Project No.: **17-0045**

**SHINSATO ENGINEERING, INC.**  
 CONSULTING GEOTECHNICAL ENGINEERS  
 98-747 KUAHAO PL. #E, PEARL CITY, HI 96782

**PLATE  
 4**

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-1**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation:	<u>3.55</u>	feet
Depth to Groundwater Table:	<u>2.5</u>	feet below grade
Depth to Bedrock (if observed):	<u>Unknown</u>	feet below grade
Diameter of Hole:	<u>4.0</u>	inches
Depth to Hole Bottom:	<u>1.5</u>	feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 - 5</u>	<u>AC PAVEMENT</u>
<u>5 - 18</u>	<u>tan, medium dense, moist to very moist, SAND</u>

**PERCOLATION READINGS:**

Time 12 inches of water to seep away: 18 minutes  
 Time 12 inches of water to seep away: 53 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>10</u>	<u>14/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>14/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>14/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>14/16</u>	<u>                    </u>	<u>                    </u>

Percolation Rate (time/final water level drop): 11.4 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

Lawrence S. Shinsato  
 Engineer's Signature/Stamp  
 License Expires 04/30/16  
 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-2**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation:	<u>4.22</u>	feet
Depth to Groundwater Table:	<u>2.5</u>	feet below grade
Depth to Bedrock (if observed):	<u>Unknown</u>	feet below grade
Diameter of Hole:	<u>4.0</u>	inches
Depth to Hole Bottom:	<u>1.5</u>	feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 – 5</u>	<u>AC PAVEMENT</u>
<u>5 – 9</u>	<u>brown tan, medium dense, moist, silty SAND</u>
<u>9 – 18</u>	<u>tan, SAND few gravel</u>

PERCOLATION READINGS:

Time 12 inches of water to seep away: 10 minutes  
 Time 12 inches of water to seep away: 19 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>10</u>	<u>46/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>40/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>40/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>40/16</u>	<u>                    </u>	<u>                    </u>

Percolation Rate (time/final water level drop): 4.0 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

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 Engineer's Signature/Stamp  
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 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-3**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation: 3.88 feet  
 Depth to Groundwater Table: 2.5 feet below grade  
 Depth to Bedrock (if observed): Unknown feet below grade  
 Diameter of Hole: 4.0 inches  
 Depth to Hole Bottom: 1.5 feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 – 5</u>	<u>AC PAVEMENT</u>
<u>5 – 10</u>	<u>brown tan, medium dense, moist, silty SAND</u>
<u>10 – 18</u>	<u>tan, medium dense, moist, SAND few gravel</u>

**PERCOLATION READINGS:**

Time 12 inches of water to seep away: 5 minutes  
 Time 12 inches of water to seep away: 14 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>10</u>	<u>80/16</u>	<u>10</u>	<u>58/16</u>
<u>10</u>	<u>80/16</u>	<u>10</u>	<u>58/16</u>
<u>10</u>	<u>66/16</u>		
<u>10</u>	<u>58/16</u>		

Percolation Rate (time/final water level drop): 2.8 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

Lawrence S. Shinsato  
 Engineer's Signature/Stamp  
 License Expires 04/30/16  
 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-4**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation:	<u>3.27</u>	feet
Depth to Groundwater Table:	<u>2.5</u>	feet below grade
Depth to Bedrock (if observed):	<u>Unknown</u>	feet below grade
Diameter of Hole:	<u>4.0</u>	inches
Depth to Hole Bottom:	<u>1.5</u>	feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 – 5</u>	<u>AC PAVEMENT</u>
<u>5 – 10</u>	<u>brown tan, medium dense, moist, silty SAND</u>
<u>10 – 12</u>	<u>tan, medium dense, moist, SAND few gravel</u>

PERCOLATION READINGS:

Time 12 inches of water to seep away: 42 minutes  
 Time 12 inches of water to seep away: 61 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>10</u>	<u>26/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>24/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>24/16</u>	<u>                    </u>	<u>                    </u>
<u>10</u>	<u>24/16</u>	<u>                    </u>	<u>                    </u>

Percolation Rate (time/final water level drop): 6.7 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

Lawrence S. Shinsato  
 Engineer's Signature/Stamp  
 License Expires 04/30/16  
 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-5**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation:	<u>3.87</u>	feet
Depth to Groundwater Table:	<u>2.5</u>	feet below grade
Depth to Bedrock (if observed):	<u>Unknown</u>	feet below grade
Diameter of Hole:	<u>4.0</u>	inches
Depth to Hole Bottom:	<u>4.0</u>	feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 – 5</u>	<u>AC PAVEMENT</u>
<u>5 – 10</u>	<u>brown tan, medium dense, moist, silty SAND</u>
<u>10 – 48</u>	<u>tan, medium dense, moist, SAND few gravel</u>

**PERCOLATION READINGS:**

Time 12 inches of water to seep away: < 10 minutes  
 Time 12 inches of water to seep away: < 10 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>2</u>	<u>12</u>	<u>                    </u>	<u>                    </u>
<u>3</u>	<u>12</u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>

Percolation Rate (time/final water level drop): < 1 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

Lawrence S. Shinsato  
 Engineer's Signature/Stamp  
 License Expires 04/30/16  
 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

**DEPARTMENT OF HEALTH - WASTEWATER BRANCH  
INDIVIDUAL WASTEWATER SYSTEM (IWS) - SITE EVALUATION/PERCOLATION TEST**

**PERCOLATION TEST NO. P-6**

Date / Time: May 17, 2017 Test Performed by: Shinsato Engineering, Inc.

Owner: Heeia Kea Harbor TMK: (1) 4-6-006: 069

Elevation: 3.49 feet  
 Depth to Groundwater Table: 2.5 feet below grade  
 Depth to Bedrock (if observed): Unknown feet below grade  
 Diameter of Hole: 4.0 inches  
 Depth to Hole Bottom: 3.0 feet below grade

<u>Depth, inches below grade</u>	<u>Soil Profile (color, texture, other)</u>
<u>0 – 5</u>	<u>AC PAVEMENT</u>
<u>5 – 10</u>	<u>brown tan, medium dense, moist, silty SAND</u>
<u>10 – 48</u>	<u>tan, medium dense, moist, SAND few gravel</u>

**PERCOLATION READINGS:**

Time 12 inches of water to seep away: < 10 minutes  
 Time 12 inches of water to seep away: < 10 minutes

Check one:

Percolation tests in sandy soils, recorded time intervals and water drops at least every 10 minutes for at least 1 hour.

Percolation tests in non-sandy soils, presoaked the test hole for at least 4 hours. Recorded time intervals and water drops at least every 10 minutes for 1 hour of time for the first 6 inches to seep away in greater than 30 minutes record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

<u>Time Interval</u>	<u>Drop in Inches</u>	<u>Time Interval</u>	<u>Drop in Inches</u>
<u>3</u>	<u>12</u>	<u>                    </u>	<u>                    </u>
<u>3</u>	<u>12</u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>
<u>                    </u>	<u>                    </u>	<u>                    </u>	<u>                    </u>

Percolation Rate (time/final water level drop): < 1 minutes/inches

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable. I also attest that three feet of suitable soil exists between the bottom of the soil absorption system and the groundwater table or any other limiting layer.

Lawrence S. Shinsato  
 Engineer's Signature/Stamp  
 License Expires 04/30/16  
 IWS Site Evaluation & Percolation Test.wpd ECI June 25, 2003



June 13, 2017  
 Date

## **ABSORPTION BED SIZING CALCULATIONS**

- **Assumptions:**
  - Percolation Tests results from Geotech Report were: 1.5 min/inch (P-1), 1.5 min/inch (P-2), 1.5 min/inch (P-3), 4.0 min/inch (P-5) and 11.4 Min/inch (P-6)
  - 11.0 min/inch has been selected for sizing
  - 5000 GPD is the equivalent of 25 bedrooms
  - The absorption bed area requirement for a rate of 11.0 min/inch is 170 square feet (Chapter 11-62 Table 3)
  
- **Area Required for each bed (One Duty and One Standby):**
  - 25 Bedrooms x 170 square feet = 4,250 square feet per absorption bed (Two required)
  
- **Area Provided for each bed (One Duty and One Standby):**
  - 42.66 feet x 100 feet = 4266 square feet per bed (Exceeds Required)
- **Bonus Area Provided for each bed (One Duty and One Standby):**
  - Each Absorption Bed has an Inspection Port. This area provides percolation. It has not been provided in the absorption bed calculations but nonetheless present.
  - Inspection port corridor: 5.67 feet x 100 feet = 567 square feet



**APPENDIX G**  
Certifications by Engineer



April 23, 2018

State of Hawaii  
Department of Health  
Wastewater Branch  
2827 Waimano Home Rd  
Pearl City, HI 96782

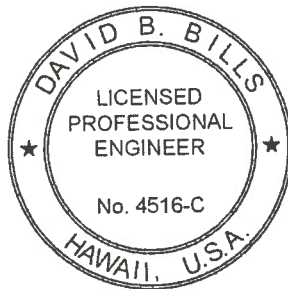
562-00

ATTN: Sina Pruder

Subject: Heeia Kea Small Boat Harbor Wastewater Treatment System

Bills Engineering, Inc, as the record Engineer, hereby certifies that the subject wastewater treatment system located at TMK: 4-6-006:064 is designed to meet all applicable requirements and standards set-forth by the State Department of Health. This statement is in accordance with 11-62.23 (1).

After the first year of operation, we will submit to the Director a written statement on the results, based on the of sampling done, on the effluent requirements based on HAR sections 11-62.23 (f) to ensure that the system is meeting current standards.



Expiration: 4-30-20

BILLS ENGINEERING, INC.

  
\_\_\_\_\_  
David B. Bills, P.E.

DB:lk



April 23, 2018

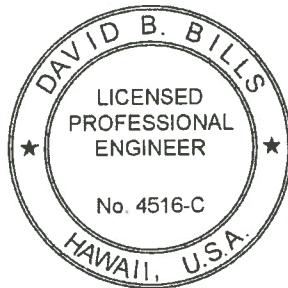
State of Hawaii  
Department of Health  
Wastewater Branch  
2827 Waimano Home Rd  
Pearl City, HI 96782

562-00

ATTN: Sina Pruder

Subject: Heeia Kea Small Boat Harbor Wastewater Treatment System

Bills Engineering, Inc, as the record Engineer, hereby certifies that operation and maintenance manual of the subject wastewater treatment system located at TMK: 4-6-006:064 is designed to meet all requirements set-forth by current standards, and that the treatment system is operated in accordance with the manual, and all applicable effluent requirements will be meet.



Expiration: 4-30-20

BILLS ENGINEERING, INC.

David B. Bills, P.E.

DB:lk

## **APPENDIX H**

### **MagFlux® Effluent Flow Meter**



# MagFlux®

## ELECTROMAGNETIC FLOW METER

3.05

### General

MagFlux® Electromagnetic Flow Meters deliver very stable and highly accurate flow measurements in conductive liquids.

MagFlux® Flow Meters have no moving parts to create hydraulic influence on the flow, use a well-proven technology, and communicate using a standard protocol.

MagFlux® Flow Sensors are available in sizes ranging from DN 15 to DN 2000, with standard construction lengths and connections.

MagFlux® Flow Meters can be installed either with the converter mounted on the flow sensor, on a wall or mounted in a panel.

### Features

- One graphic Display can operate up to 4 MagFlux® Flowmeters
- Intuitive menu structure with easy navigation
- Built-in datalogger with the display
- Large dynamic measuring range with an accuracy of up to  $\pm 0,25\%$
- Two dynamic batch counters and password protection
- Counters and pulse output with or without reset
- Modbus® communication is utilized between the display and flow converter and to other external devices
- 4-20 mA output for flow in one or both directions
- Detection of empty pipe
- Automatic electrode cleaning
- Full bore bi-directional sensor

### Application

MagFlux® Flow Meters are used for measuring and totalizing flow of conductive liquids in pressurized closed pipe systems.

MagFlux® Flow Meters measure flow in both directions of potable water, waste water and process fluids.

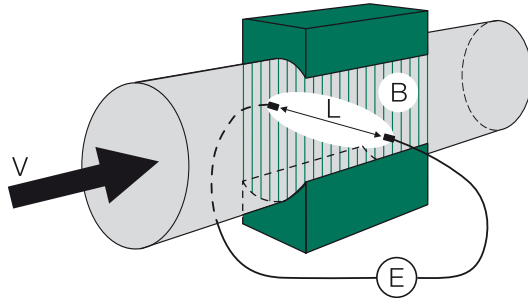


### DATASHEET

EN 3.05 MAGFLUX DATASHEET 1702

# MagFlux™ Electromagnetic Flow Meter

## Function



The MagFlux® operation is based on Faraday's law of induction. When a conductive fluid passes through a magnetic field in the sensor, an electromagnetic voltage is induced between the two electrodes in the flow sensor tube. This voltage (E) is directly proportional to the fluid velocity.

When the internal diameter of the Flow Sensor is known, the actual volume is calculated by the Converter.

The electromagnetic voltage induced between the electrodes equates to:

$$E = L \times B \times V \text{ where:}$$

E: Induced electromagnetic voltage

L: Flow sensor diameter

B: The strength of the magnetic field

V: The velocity of the liquid

The voltage E is measured and consequently converted to a volumetric flow.

## Flexible Installation

MJK's modular design is versatile. The Display Unit can be mounted up to 1000 m from the Flow Converter with ordinary twisted wires. It also provides options for mounting the Converter where it is most convenient to make the electrical connections.

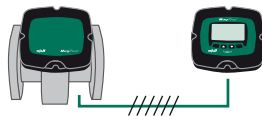
One Display Unit can control up to 4 Converters and Flow Sensors for greater economy, space savings and an improved overview of the multiple measurement values



The MagFlux® Converter and Display Unit mounted directly on the Flow Sensor.



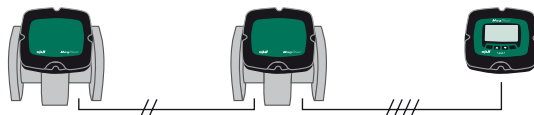
The MagFlux® Converter mounted directly on the flow sensor with a remote mounted Display Unit.



The MagFlux® Converter and Display Unit remote mounted. For example when the sensor is being buried or submerged.



The MagFlux® Converter is mounted remote from the Flow Sensor, and the Display Unit is mounted separately from the Converter. E.g when the Sensor is being buried

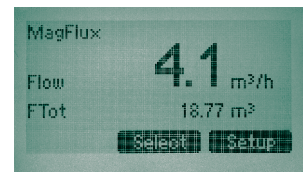


The MagFlux® Converters are mounted directly on the Flow Sensors, while the remote mounted Display Unit communicates with two MagFlux® Converters and Flow Sensors.

# MagFlux™ Electromagnetic Flow Meter

## Simple to Operate

The MagFlux® Display Unit has many unique and intelligent functions. It has a simple menu structure and can display text in several selectable languages in metric or English units.



## Registering the Flow Sensor

The MagFlux® System registers the Flow Sensor to the Converter using a unique coded sensor. It sets calibration data, the nominal diameter and the sensor configuration - making the MagFlux® System ready to measure immediately. This avoids complicated and sensitive field calibration and delicate electronics in the sensor, and allows unlimited interchanging of MagFlux® Converters and Flow Sensors.



## Counters for Flow in Both Directions

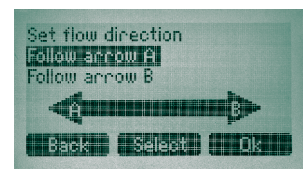
The MagFlux® Converter has resettable and non-resettable counters for flow in both directions.

MagFlux® has two batch counters with smart-batch counting.



## Forward and Backwards Flow Measurement and Totalizing

The MagFlux® System measures flow in both directions and can totalize the net flow for both. A simple menu selection determines the primary flow direction.

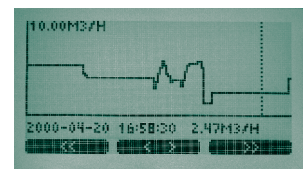


## Data Logger

The MagFlux® built-in 32 MB data logger can log up to 345,000 entries with time and date. Data is displayed graphically, but can also be exported to a PC via the USB port on the Display Unit.

## Field Link Easy-to-use software

The MagFlux® PC connection allows exporting logged data to a PC, and importing new software updates. All through intuitive steps using a common USB port.



## Flexible In- and Outputs

The MagFlux® Converter has one 4-20 mA active analogue output, two digital outputs and one digital input. The digital input can stop and zero counter settings or control the batch counters manually. Each alarm can be displayed as a pop-up alarm until they are reset.

## Automatic Electrode Cleaning

The MagFlux® built-in electronic electrode cleaning system is always active.

## User Definable Text

The MagFlux® display can be configured by the user for up to five lines of text. The graphic display is automatically adjusted to show the largest characters possible.



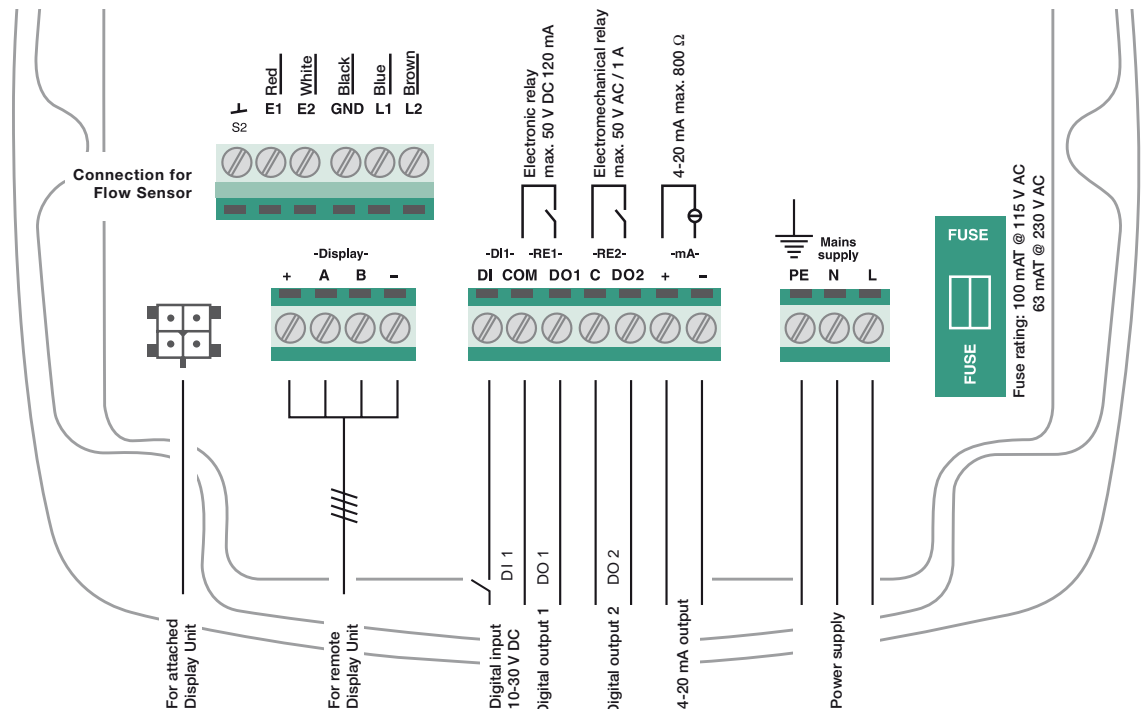
## Modbus® Communication

The display and converter uses Modbus® communication protocol for internal and external communication.

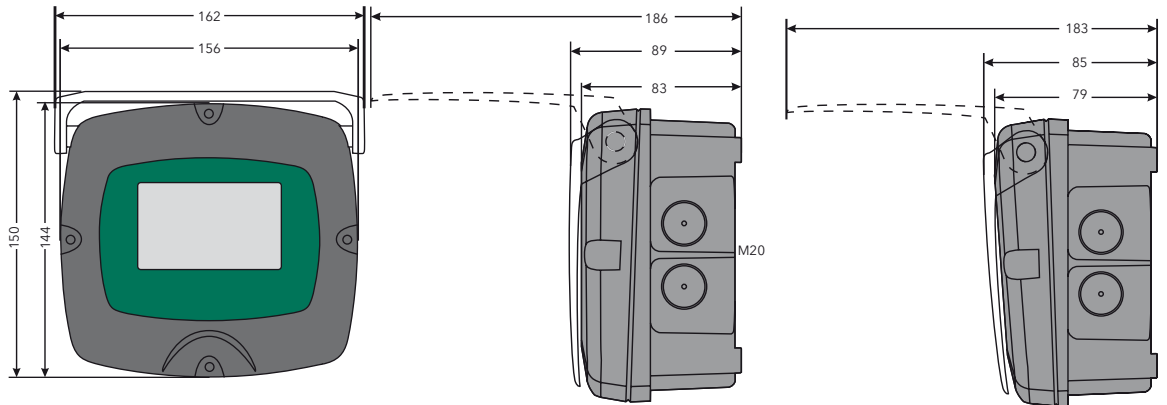


# MagFlux™ Electromagnetic Flow Meter

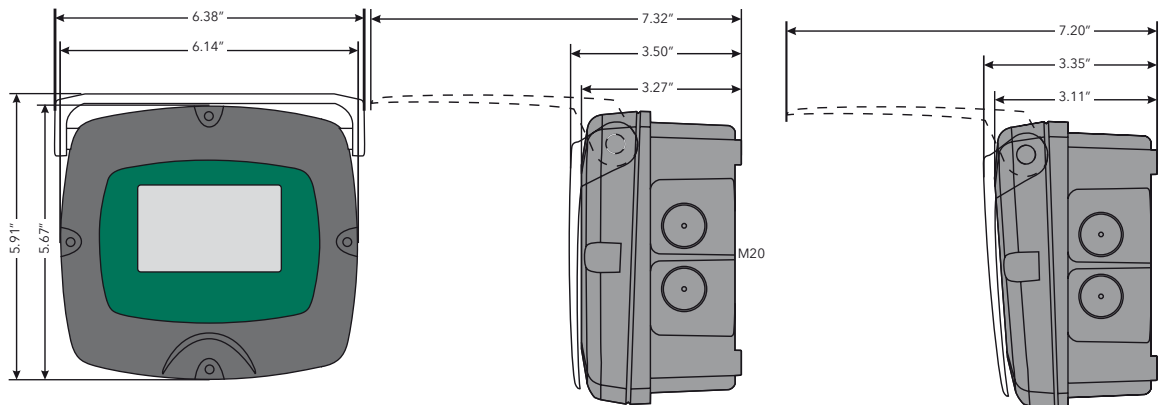
## Electrical Connection



## Dimensions millimeter



## Dimensions inch





# MagFlux™ Electromagnetic Flow Meter

## Accessories

579035  
MagFlux®  
Gel potting kit  
f/ sensor IP68

MagFlux is supplied as standard with protection class IP67. However, if you use our gel potting kit, you can increase the protection class to IP68 (which means that MagFlux sensor can withstand constant submersion in water (max. 10 m water column pressure).



207932  
Steel Cover for Field  
cabinet (small)

Stainless steel protective cap and fittings set. Protects MagFlux, Oxix and SuSix from falling objects, branches, etc. Stainless steel (SS316)



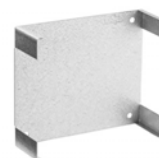
200242  
Mounting plate,  
Field Cabinet (small)

Makes it possible to fit converter to an uneven surface. Mounting plate is compatible with universal bracket. Can also be used to mount converter on pipe or stand.



207935 Panel  
Mounting Bracket for  
MagFlux®, SuSix® &  
Oxix®

Bracket specially designed for narrow or wide converter cabinet. For fitting cabinet in panel front



500220/500221  
Cover for Field Cabinet  
(small) Transparent/  
Opaque

Protects MagFlux display from strong sunlight/rain/contact.



205546  
Modbus & RS 485  
communications  
module

To communicate with an external Modbus® network. For mounting in the MagFlux display. The MJK Modbus® communication module separates the internal network from the external network, e.g. to a PLC. The module can transmit data from 4 interconnected MJK transmitters.



205547  
Profibus  
communications  
module

To communicate with an external PROFIBUS® network, we supply a Profibus DP module suitable for mounting in the MagFlux® display. The MJK PROFIBUS® communication module can transmit data from 4 interconnected MJK transmitters.



205910 mA-Bus  
Converter

The MJK mA-Bus converter is used to convert mA signals to Modbus®. measured value can be displayed on e.g. a MagFlux Display.

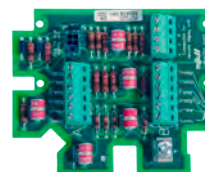


207980  
MagFlux® Verificator

MagFlux Converter Verificator, simulates the coil and electrode functions of the MagFlux sensor for testing of the readings at zero and high flow rates on the converter.

207937  
Surge Arresters for  
MagFlux®

Surge arresters to protect converters and displays from lightning transmitted in pipes.



691080  
Cable for  
MagFlux® sensor

(2x2+1) x 1.0mm<sup>2</sup> (AWG 18/19)  
Colours: red, white, blue, brown, black PUR

691095  
USB Cable

PC Mini USB/USB Cable



# MagFlux™ Electromagnetic Flow Meter

## Specifications Converter and display unit

Display	
Display	Graphic background-lit LCD-display (64 x 128 pixels) with soft keys
Display Indication	Indication of flow , flow direction, volume, totalizers, configuration and graph
Power Supply	From MagFlux Converter
Clock	Real-time clock with built-in lithium battery (lifetime 10 years@20°C)
Communication	MODBUS® RTU-mode, 9600 baud, 2-wire RS 485, master-mode
Interface	1 pcs. RS-485 Modbus® RTU-mode 1 pcs. USB 1,1 type mini B, female 1 pcs. for Communication module
Memory Storage	32 Mb Flash memory, 345.000 loggings incl. date, time and value (curve display)
Enclosure Rating	IP 67, NEMA 6
Material	Housing: Glass-reinforced Polycarbonate Protection Lid: Transparent Polycarbonate
Temperature Range	- 20 ... 60 °C / -5 ... 150°F
Operating relative Humidity	Max. 85% Noncondensing
Weight	0,5 kg / 1.1lb

Converter	
Accuracy	+/- 0,1% of reading
Repeatability	+/- 0,1%
Min. Liquid Conductivity	≥ 5 µS
Power Supply	24 V AC, 50 / 60 Hz ± 10 % or 230 (115) V AC, 50 / 60 Hz ± 10 % or 10-30 VDC
Power Consumption	Max. 10 W
Internal Communication	MODBUS® RTU-mode
External Communication	MODBUS® RTU-mode, 9600 baud, 2-wire RS 485, slave-mode
Interface	1 pcs. RS 485 for connection to Display Unit or PLC
Analog Output	1 pcs. Active 4 - 20 mA, galvanically isolated, 12 bit resolution, (max. load 800 Ω) Min. range = 0 - 0,2 m/s (0-0.6ft/s), Max. range = 0 - 10 m/s (0-30ft/s)
Digital Outputs	1 pcs. Voltage-free electromechanical relay (max. 50 V DC / 1 A) 1 pcs. Optically isolated MOSFET relay (max. 50 VAC / V DC / 120 mA) Programmable for: Totalizer counter, batch counter, high/low flow , system error, empty pipe and flow direction.
Digital Inputs	One, max. 30 V DC, < 5 V DC = 0 (low ), > 10 V DC = 1 (high), pulse length > 100 ms
Enclosure Rating	IP 67, NEMA 6
Material	Glass-reinforced Polycarbonate
Temperature Range	- 20 ... 60 °C / -5 ... 150°F
Weight	1,0 kg / 2.2lb
Approvals	cUL CE approvals EN 61000-6-4:2007-02-14, EN 61000-6-2:2005-09-08

Connection Box	
Enclosure Rating	IP 68, NEMA 6X (using gel potting kit part no. 579035). The flow meter can withstand unlimited immersion of up to 10 m of water.
Material	Glass-reinforced Polycarbonate
Temperature Range	- 20 ... 100 °C / -5 ... 212°F

# MagFlux™ Electromagnetic Flow Meter

## Order numbers

MagFlux® Converter	
Sensor mounted converter with display	
207920	MagFlux® Converter w/display unit for sensor mounting 230VAC
297920	MagFlux® Converter w/ display unit sensor mounting 115VAC
207921	MagFlux® Converter w/display unit for sensor mounting, 24VAC
207922	MagFlux® Converter w/display unit for sensor mounting, 10-30VDC
Sensor mounted converter without display	
207910	MagFlux® Converter w/o display sensor mounting, 230VAC
297910	MagFlux® Converter w/o Display unit Sensor mounting 115VAC
207911	MagFlux® Converter w/o display sensor mounting, 24VAC
207912	MagFlux® Converter w/o display sensor mounting, 10-30VDC
Sensor wall mounted converter with display	
207925	MagFlux® Converter w/display unit for wall mounting, 230VAC
297925	MagFlux® Converter w/display unit for wall mounting, 115VAC
207926	MagFlux® Converter w/display unit for wall mounting, 24VAC
207927	MagFlux® Converter w/display unit for wall mounting, 10-30VDC
Sensor wall mounted converter without display	
207928	MagFlux® Converter w/o display unit for wall mounting, 230VAC
297928	MagFlux® Converter w/o display unit for wall mounting, 115VAC
207929	MagFlux® Converter w/o display unit for wall mounting, 10-30VDC

Accessories	
106010	Cable mounting and potting of MagFlux® Sensor, ex. cable
200062	Complete MagFlux® cabinet with blind lid, sensor mounted
200242	Mounting plate, Field Cabinet (small)
205546	Modbus and RS 485 communications module
205547	Profibus DP communication module
207930	Wall mounting kit for MagFlux®, SuSix® and Oxix®
207932	Steel Cover for Field cabinet (small)
207935	Panel Mounting Bracket for MagFlux®, SuSix® and Oxix®
207936	Panel Mounting Bracket for wide Field Cabinet
207937	Surge Arrester for MagFlux® for wall mounting
207938	Surge Arrester for MagFlux® for sensor mounting
207940	Display Unit for MagFlux®, SuSix®, Oxix®
207980	MagFlux® Converter Verificator
500220	Cover for Field Cabinet (small) transparent
500221	Cover for Field Cabinet (small) Opaque
579035	MagFlux® Gel potting kit f/ sensor IP68
691075	Communication cable 2X2X0,5mm2 (AWG24) Shielded twisted pair
691080	Cable for MagFlux® sensor
691095	PC Mini USB/USB Cable
691098	USB mini/USB mini, plug for cabinet 0,2m cable
807020	Connection PCB for MagFlux
840110	MJK Field-Link

# MagFlux™ Electromagnetic Flow Meter

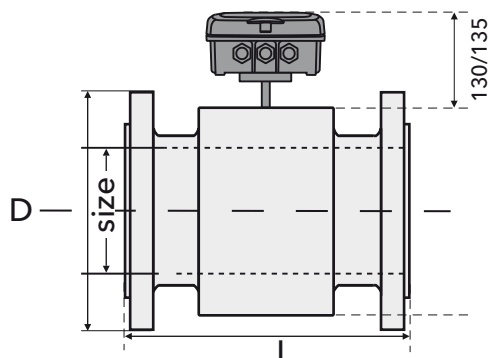
Flow sensor  
Ordering  
information



<p>Type of flange (Fit for Wafer): _____</p> <p>20: EN-1092-1 24: KSD4308 25: KSD3578 26: JIS B2220/KS B1503 / KS D4308 28: AS 4087-2004 &amp; AS 2129-2000 29: ANSI B16.5 ½"-24"/AWWA C207-01 28"-54"</p> <p>Series information: _____</p> <p>71: 7100 Flanged PTFE/PFA 72: 7200 Flanged Hard rubber 73: 7300 Wafer PTFE/PFA</p> <p>Size: _____</p> <p>ID for identifying the size. (2071XX) See Order numbers table</p>	<p>20    72    31    - 016 - 00</p>	<p>Material - Electrodes: x0: Stainless steel 316TI (default) x1: Hastelloy C electrode x2: Titanium electrode x3: Platinum irridium alloy electrode</p> <p>Material - Housing and flanges: 0x: Housing and Flanges, painted Carbon steel (default) 1x: Housing and flanges, polished stainless steel 316 2x: Housing and flanges, polished stainless steel 304, 3x: Housing polished stainless steel 304, flanges painted carbon steel 9x: Housing polished stainless steel 316 flanges painted carbon steel</p> <p>Pressure class: if EN use PN (e.g. 016 for PN16) if KS use PN (e.g. 016 for PN16) if AS use PN (e.g. 016 for PN16) if ANSI use psi (e.g. 150 for psi150) if AWWA use psi (e.g. Class D for psi150)</p>
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# MagFlux™ Electromagnetic Flow Meter

Dimensions  
Magflux®  
7100/7200  
Sensor  
EN 1092-1



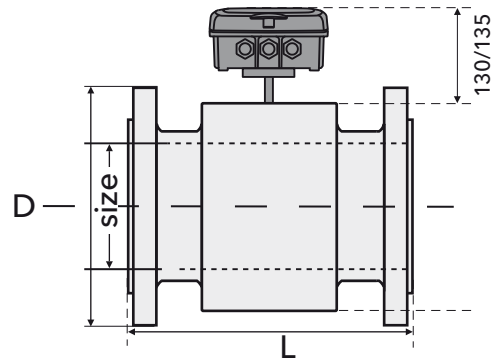
Dimensions

Magflux® 7100/7200 Sensor Sizes and Dimensions Information					
Size	Pressure	D	L	Weight	
DN	PN	[mm]	[mm]	[kg]	
EN 1092-1 Flanges					
15	½"	40	95	200	3,5
20	¾"	40	105	200	3,5
25	1"	40	115	200	3,5
32	1¼"	40	140	200	6
40	1½"	40	150	200	7
50	2"	16	165	200	8
65	2½"	16	185	200	10
80	3"	16	200	200	12
100	4"	16	220	250	16
125	5"	16	250	250	21
150	6"	16	285	300	28
200	8"	16	340	350	35
250	10"	10	395	450	43
300	12"	10	445	500	55
350	14"	10	505	550	66
400	16"	10	565	600	94
450	18"	10	615	600	105
500	20"	10	670	600	122
600	24"	10	780	600	158
700	28"	10	895	700	230
800	32"	6	975	800	325
900	36"	6	1075	900	420
1000	40"	6	1175	1000	510
1200	48"	6	1405	1200	680
1400		6	1630	1400	

Consult MJK for information on additional pressure classes

# MagFlux™ Electromagnetic Flow Meter

Dimensions  
Magflux®  
7100/7200  
Sensor  
AS 2129 & 4087



Magflux® 7100/7200 Sensor Sizes and Dimensions Information					
Size	Pressure	D	L	Weight	
DN	PN	[mm]	[mm]	[kg]	
AS 2129 Flanges					
15	½"	PN16	95	200	3,5
20	¾"	PN16	100	200	3,5
25	1"	PN16	115	200	3,5
32	1¼"	PN16	120	200	6
40	1½"	PN16	135	200	7

Consult MJK for information on additional pressure classes

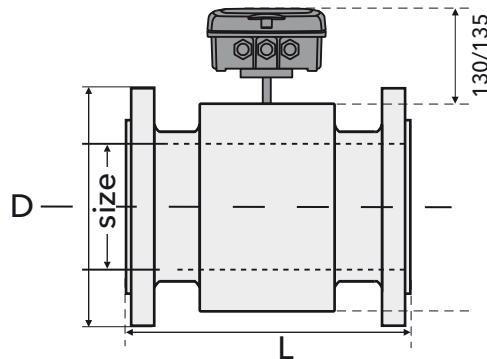
Magflux® 7100/7200 Sensor Sizes and Dimensions Information					
Size	Pressure	D	L	Weight	
DN	PN	[mm]	[mm]	[kg]	
AS 4087 Flanges					
50	2"	14	150	200	8
65	2½"	14	165	200	10
80	3"	16	185	200	12
100	4"	16	215	250	16
125	5"	16	255	250	21
150	6"	16	280	300	28
200	8"	16	335	350	35
225		16	370	450	38
250	10"	16	405	450	43
300	12"	16	455	500	55
350	14"	16	525	550	66
375		16	550	600	70
400	16"	16	580	600	94
450	18"	16	640	600	105
500	20"	16	705	600	122
600	24"	16	825	600	158
700	28"	16	910	700	230
750	30"	16	995	750	275
750*	30"	16	937	750	275
800	32"	16	1060	800	325
900	36"	16	1175	900	420
1000	40"	16	1255	1000	510
1200	48"	16	1490	1200	680

Consult MJK for information on additional pressure classes

\*) Built-in length, L=937mm

# MagFlux™ Electromagnetic Flow Meter

Dimensions  
Magflux®  
7100/7200  
Sensor  
ANSI & AWWA



**Magflux® 7100/7200 Sensor Flanges  
Sizes, Pressure and Dimensions Information**

Size	Pressure	D	L	Weight
Inch	[PSI]	[in]	[in]	[lb]
<b>ANSI B 16.5</b>				
½"	150	3.50	7.9	8
¾"	150	3.88	7.9	8
1"	150	4.25	7.9	8
1¼"	150	4.62	7.9	13
1½"	150	5.00	7.9	15
2"	150	6.00	7.9	18
2½"	150	7.00	7.9	22
3"	150	7.50	7.9	26
4"	150	9.00	9.8	35
5"	150	10.00	9.8	46
6"	150	11.00	11.8	62
8"	150	13.50	13.8	77
10"	150	16.00	17.7	95
12"	150	19.00	19.7	121
14"	150	21.00	21.7	146
16"	150	23.50	23.6	207
18"	150	25.00	23.6	231
20"	150	27.50	23.6	269
24"	150	32.00	23.6	348

**AWWA C207-01**

28"	Class D	36.50	23.6	507
32"	Class D	41.75	31.5	717
36"	Class D	46.00	31.5	926
40"	Class D	50.75	31.5	1124
48"	Class D	59.50	39.4	1499

Consult MJK for information on additional pressure classes

**Magflux® 7100/7200 Sensor Flanges  
Sizes, Pressure and Dimensions Information**

Size	Pressure	D	L	Weight
Inch	[PSI]	[in]	[in]	[lb]
<b>ANSI B 16.5</b>				
½"	300	3.75	7.9	8
¾"	300	4.62	7.9	8
1"	300	4.88	7.9	8
1¼"	300	5.25	7.9	13
1½"	300	6.12	7.9	15
2"	300	6.50	7.9	18
2½"	300	7.50	7.9	22
3"	300	8.25	7.9	26
4"	300	10.00	9.8	35
5"	300	11.00	9.8	46
6"	300	12.50	11.8	62
8"	300	15.00	13.8	77
10"	300	17.50	17.7	95
12"	300	20.50	19.7	121
14"	300	23.00	21.7	146
16"	300	25.50	23.6	207
18"	300	28.00	23.6	231
20"	300	30.50	23.6	269
24"	300	36.00	23.6	348

**AWWA C207-01**

28"	Class E	36.50	23.6	507
32"	Class E	41.75	31.5	717
36"	Class E	46.00	31.5	926
40"	Class E	50.75	31.5	1124
48"	Class E	59.50	39.4	1499

Consult MJK for information on additional pressure classes

# MagFlux™ Electromagnetic Flow Meter

## Magflux® 7100 Sensor



The liner of MagFlux® 7100 is PTFE which makes it extremely low degree of friction and at the same time very resistant to chemicals and general abrasion.

## Applications

- MagFlux 7100 with Teflon® lining is commonly used for water applications with chemicals

## Specifications MagFlux® 7100 Sensor

MagFlux® 7100 Sensor Specifications	
Mounting Flanges ⑥	EN-1092-1 / ANSI B 16.5 / AWWA C207-01 / AS 4087 / AS2129
Built-in length	Standard length according to ISO 13359
Accuracy ④	Better than ± 0,25 %
Ratio	1:100
Measuring Frequency	1,25-2,5 Hz
Materials	
Housing ⑥	Carbon steel
Flanges ⑥	Carbon steel
Measuring Pipe	Steel 1.4301 / AISI 304
Lining	PTFE (Teflon®)/PFA
Electrodes ③⑤	Steel 1,4571 / AISI 316 TI
Coating	3 layers Polyurethane paint, Thickness ≥ 310 µm
Temperature range	
Medium temperature	-20...150 °C / -4...300 °F
Ambient temperature: Compact Converter	-10.....60 °C / 15..140 °F
Remote Converter	-20...100 °C / -4...212 °F
Enclosure	IP 67, NEMA 4, Standard IP 68, NEMA 6P (10mWc, using the Gel potting kit 579035)
③Options: Hastelloy C4, platinum, and titanium. See, Flow sensor Ordering information.	
④Of measured value.	
⑤Incl. built in ground electrode.	
⑥Also available in Steel 304/316 SS. See, Flow sensor Ordering information.	



# MagFlux™ Electromagnetic Flow Meter



Sizes, Pressure and Order numbers  
7100 Sensor  
EN 1092-1

Magflux® 7100 Sensor - Sizes, Pressure and Order Number					
EN 1092-1 Flanges					
Size \ PN	PN6	PN10	PN16	PN25	PN40
DN 15					207107-040-00
DN 20					207110-040-00
DN 25					207113-040-00
DN 32					207116-040-00
DN 40					207119-040-00
DN 50			207122-016-00		207122-040-00
DN 65			207125-016-00		207125-040-00
DN 80			207128-016-00		207128-040-00
DN 100			207131-016-00		207131-040-00
DN 125			207134-016-00		207134-040-00
DN 150			207137-016-00	207137-025-00	207137-040-00
DN 200		207140-010-00	207140-016-00	207140-025-00	207140-040-00
DN 250		207143-010-00	207143-016-00	207143-025-00	207143-040-00
DN 300		207146-010-00	207146-016-00	207146-025-00	207146-040-00
DN 350		207149-010-00	207149-016-00	207149-025-00	207149-040-00
DN 400		207152-010-00	207152-016-00	207152-025-00	207152-040-00
DN 450		207155-010-00	207155-016-00		
DN 500		207158-010-00	207158-016-00		
DN 600		207161-010-00	207161-016-00		
DN 700	207164-006-00	207164-010-00	207164-016-00		
DN 800	207167-006-00	207167-010-00	207167-016-00		
DN 900	207170-006-00	207170-010-00			
DN 1000	207172-006-00	207172-010-00			

Sizes, Pressure and Order numbers  
7100 Sensor  
ANSI & AWWA

Magflux® 7100 Sensor Sizes, Pressure and Order Number		
ANSI B 16.5 Flange		
Size \ PSI	150 [PSI]	300 [PSI]
½"	297107-150-00	297107-300-00
¾"	297110-150-00	297110-300-00
1"	297113-150-00	297113-300-00
1¼"	297116-150-00	297116-300-00
1½"	297119-150-00	297119-300-00
2"	297122-150-00	297122-300-00
2½"	297125-150-00	297125-300-00
3"	297128-150-00	297128-300-00
4"	297131-150-00	297131-300-00
5"	297134-150-00	297134-300-00
6"	297137-150-00	297137-300-00
8"	297140-150-00	297140-300-00

Magflux® 7100 Sensor Sizes, Pressure and Order Number		
ANSI B 16.5 Flange		
Size \ PSI	150 [PSI]	300 [PSI]
10"	297143-150-00	297143-300-00
12"	297146-150-00	297146-300-00
14"	297149-150-00	297149-300-00
16"	297152-150-00	297152-300-00
18"	297155-150-00	297155-300-00
20"	297158-150-00	297158-300-00
24"	297161-150-00	297161-300-00
AWWA C207-01	Class D	Class E
28"	297164-150-00	297164-300-00
32"	297167-150-00	297167-300-00
36"	297170-150-00	297170-300-00
40"	297173-150-00	

# MagFlux™ Electromagnetic Flow Meter

Magflux® 7200  
Sensor



The liner of MagFlux® 7200 is Hard Rubber for general water purpose usage.

Applications



MagFlux® 7200 with Hard Rubber lining is used typical for water and waste water applications.

Specifications  
MagFlux® 7200  
Sensor

MagFlux® 7200 Sensor Specifications	
Mounting Flanges ⑥	EN-1092-1 / ANSI B 16.5 / AWWA C207-01 / AS 4087 / AS 2129
Built-in length	Standard length according to ISO 13359
Accuracy ④	Better than $\pm 0,25\%$
Ratio	1:100
Measuring Frequency	1,25-2,5 Hz
Materials	
Housing ⑥	Carbon steel
Flanges ⑥	Carbon steel
Measuring pipe	Steel 1.4301 / AISI 304
Lining	Hard Rubber
Electrodes ③⑤	Steel 1,4571 / AISI 316 TI
Coating	3 layers Polyurethane paint, Thickness $\geq 310 \mu\text{m}$
Temperature Range	
Medium Temperature	-10...80 °C / 15...175 °F
Ambient temperature:	
Compact converter	-10...60 °C / 15...140 °F
Remote converter	-10...80 °C / 15...175 °F
Enclosure	IP 67, NEMA 4, Standard IP 68, NEMA 6P (10m Wc, using the Gel potting kit 579035)
Approvals	MID and MCERTS EN 1092-1 DN 25 to 400 , WRAS
③ Options: Hastelloy C4, platinum, and titanium. See, flow sensor ordering information. ④ Of measured value. ⑤ Incl. built in ground electrode. ⑥ Also available in Steel 304/316 SS. See, Flow sensor Ordering information.	



PENDING



# MagFlux™ Electromagnetic Flow Meter

Sizes, Pressure and Order numbers  
7200 Sensor  
EN 1092-1

EN 1092-1 Flanges		PN6	PN10	PN16	PN25	PN40
Size	PN					
20	¾"					207210-040-00
25	1"					207213-040-00
32	1¼"					207216-040-00
40	1½"					207219-040-00
50	2"			207222-016-00		207222-040-00
65	2½"			207225-016-00		207225-040-00
80	3"			207228-016-00		207228-040-00
100	4"			207231-016-00		207231-040-00
125	5"			207234-016-00		207234-040-00
150	6"			207237-016-00	207237-025-00	207237-040-00
200	8"		207240-010-00	207240-016-00	207240-025-00	207240-040-00
250	10"		207243-010-00	207243-016-00	207243-025-00	207243-040-00
300	12"		207246-010-00	207246-016-00	207246-025-00	207246-040-00
350	14"		207249-010-00	207249-016-00	207249-025-00	207249-040-00
400	16"		207252-010-00	207252-016-00	207252-025-00	207252-040-00
450	18"		207255-010-00	207255-016-00		
500	20"		207258-010-00	207258-016-00		
600	24"		207261-010-00	207261-016-00		
700	28"	207264-006-00	207264-010-00	207264-016-00		
800	32"	207267-006-00	207267-010-00	207267-016-00		
900	36"	207270-006-00	207270-010-00	207270-016-00		
1000	40"	207272-006-00	207272-010-00			
1200	48"	207276-006-00	207276-010-00			
1400		287278-006-00				

Sizes, Pressure and Order numbers  
7200 Sensor  
ANSI & AWWA

Magflux® 7200 Sensor Sizes, Pressure and Order Number			
ANSI B 16.5 Flange			
Size \ PSI	150 [PSI]	300 [PSI]	
½"	297107-150-00	297107-300-00	
¾"	297210-150-00	297110-300-00	
1"	297213-150-00	297113-300-00	
1¼"	297216-150-00	297116-300-00	
1½"	297219-150-00	297119-300-00	
2"	297222-150-00	297222-300-00	
2½"	297225-150-00	297225-300-00	
3"	297228-150-00	297228-300-00	
4"	297231-150-00	297231-300-00	
5"	297234-150-00	297234-300-00	
6"	297237-150-00	297237-300-00	
8"	297240-150-00	297240-300-00	

Magflux® 7200 Sensor Sizes, Pressure and Order Number			
ANSI B 16.5 Flange			
Size \ PSI	150 [PSI]	300 [PSI]	
10"	297243-150-00	297243-300-00	
12"	297246-150-00	297246-300-00	
14"	297249-150-00	297249-300-00	
16"	297252-150-00	297252-300-00	
18"	297255-150-00	297255-300-00	
20"	297258-150-00	297258-300-00	
24"	297261-150-00	297261-300-00	
AWWA C207-01	Class D	Class E	
28"	297264-150-00	297264-300-00	
32"	297267-150-00	297267-300-00	
36"	297270-150-00	297270-300-00	
40"	297273-150-00	297273-300-00	

# MagFlux™ Electromagnetic Flow Meter

Sizes, Pressure and  
Order numbers  
7200 Sensor  
AS 2129 & AS 4087

AS 2129 Flanges			
Size	PN16	PN21	PN35
15	287207-016-00		
20	287210-016-00	287210-021-00	
25	287213-016-00	287213-021-00	
32	287216-016-00	287216-021-00	
40	287219-016-00		
AS 4087 Flanges			
50	287222-016-00	287222-021-00	287222-035-00
65	287225-016-00	287225-021-00	287225-035-00
80	287228-016-00	287228-021-00	287228-035-00
100	287231-016-00	287231-021-00	287231-035-00
125	287234-016-00	287234-021-00	287234-035-00
150	287237-016-00	287237-021-00	287237-035-00
200	287240-016-00	287240-021-00	287240-035-00
225	287241-016-00		
250	287243-016-00	287243-021-00	287243-035-00
300	287246-016-00	287246-021-00	287246-035-00
350	287249-016-00	287249-021-00	287249-035-00
375	287250-016-00		
400	287252-016-00	287252-021-00	287252-035-00
450	287255-016-00	287255-021-00	287255-035-00
500	287258-016-00	287258-021-00	287258-035-00
600	287261-016-00	287261-021-00	287261-035-00
700	287264-016-00	287264-021-00	
750	287265-016-00	287265-021-00	
750*	287266-016-00		
800	287267-016-00		
900	287270-016-00		
1000	287273-016-00		
1200	287276-016-00		

\*) build in length, L=937mm

# MagFlux™ Electromagnetic Flow Meter

General  
Magflux® 7300  
Sensor



The liner of MagFlux® 7300 is PTFE which makes it extremely low degree of friction and at the same time very resistant to chemicals and general abrasion.

Applications

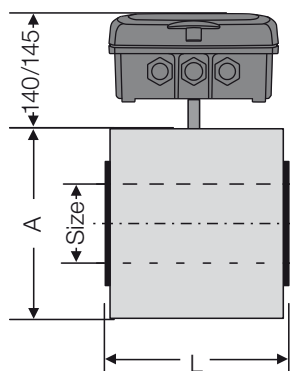
MagFlux® 7300 with Teflon® lining is used typical for chemicals applications.

Specifications  
MagFlux® 7300  
Sensor

MagFlux® 7300 Sensor Specifications	
Mounting	Wafer
Built-in length	Standard length according to ISO 13359
Accuracy ④	Better than $\pm 0,25\%$
Ratio	1:100
Measuring Frequency	2,5 Hz
Materials	
Housing ⑥	Carbon steel
Measuring pipe	Steel 1.4301 / AISI 304
Lining	PTFE (Teflon®) / PFA
Electrodes ③⑤	Steel 1,4571 / AISI 316 Ti
Coating	5 layers Polyurethane paint, Thickness $\geq 310 \mu\text{m}$
Temperature range	
Medium temperature	-20...150 °C / -4...300 °F
Ambient temperature: Compact Converter	-10...60 °C / 15...140 °F
Remote Converter	-20...100 °C / -4...212 °F
Enclosure	IP 67, NEMA 4, Standard IP 68, NEMA 6P (10mWc, using the Gel potting kit 579035)
③ Options: Hastelloy C4, platinum, and titanium. See, flow sensor ordering information.	
④ Of measured value.	
⑤ Incl. built in ground electrode.	
⑥ Also available in Steel 304/316 SS. See, Flow sensor Ordering information.	

# MagFlux™ Electromagnetic Flow Meter

Dimensions  
Magflux® 7300  
Sensor



Dimensions

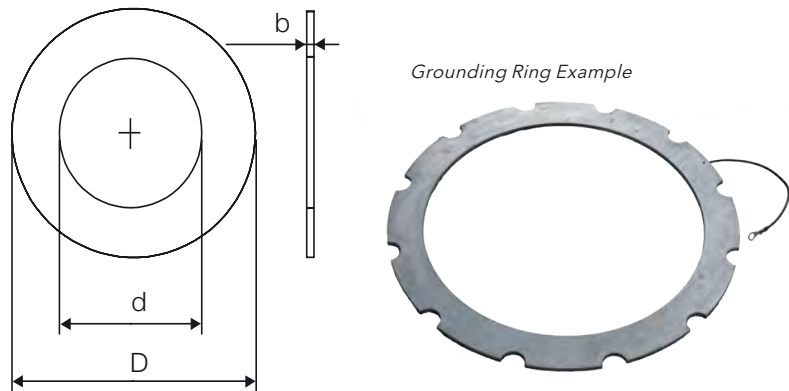
Magflux® 7300 Sensor - Sizes and dimensions information					
Size		Pressure	A	L	Weight
DN	[inch]	PN	[mm]	[mm]	[kg]
15	1/2"	40	62	74	1,1
20	3/4"	40	62	74	1,1
25	1"	40	72	104	1,5
32	1 1/4"	40	82	104	1,8
40	1 1/2"	40	92	104	2,2
50	2"	16	107	104	2,8
65	2 1/2"	16	127	104	3,2
80	3"	16	142	104	3,5
100	4"	16	162	104	4
125	5"	16	192	134	6
150	6"	16	218	134	8
200	8"	16	274	219	10

Sizes, Pressure and  
Order numbers  
7300 Sensor

Magflux® 7300 Sensor - Sizes, Pressure and Order Number			
	PN10	PN16	PN40
DN 15		207307-016-00	207307-040-00
DN 20		207310-016-00	
DN 25		207313-016-00	
DN 32		207316-016-00	
DN 40		207319-016-00	
DN 50		207322-016-00	
DN 65		207325-016-00	
DN 80		207328-016-00	
DN 100		207331-016-00	
DN 125		207334-016-00	
DN 150		207337-016-00	
DN 200	207340-010-00	207340-016-00	

# MagFlux™ Electromagnetic Flow Meter

## Grounding rings



## Sizes and Ordering Information

Grounding Rings Sizes and Ordering Information						
Size			D <sup>ⓐ</sup>	d	b	Weight
DN	[inch]	Order no.	[mm]			[kg]
15	½"	207807	50	22	6	0,08
20	¾"	207810	58	28	6	0,08
25	1"	207813	68	35	6	0,12
32	1¼"	207816	79	43	6	0,16
40	1½"	207819	91	49	6	0,20
50	2"	207822	106	61	6	0,26
65	2½"	207825	126	77	6	0,40
80	3"	207828	141	90	6	0,44
100	4"	207831	170	115	6	0,56
125	5"	207834	191	141	6	0,60
150	6"	207837	237	170	6	0,90
200	8"	807840	272	220	6	0,96
250	10"	207843	333	274	6	1,30
300	12"	807846	405	325	6	2,00
350	14"	207849	443	360	6	2,48
400	16"	207852	521	411	6	3,60
450	18"	207855	546	463	6	3,20
500	20"	207858	602	514	6	3,64
600	24"	207861	713	615	6	4,70
700	28"	207864				
750	30"	207863				
800	32"	207867				

ⓐ maximum measurement

## Specifications

Grounding Rings Specifications	
Material	AISI 316 SS
Wire	2,5 mm <sup>2</sup> / AWG 13

# MagFlux™ Electromagnetic Flow Meter



## Flow Sensor Sizing

Min. / Max. Flow and Default mA Settings				
Size		Qmin = 0,2 m/s	Qmin = 0,2 m/s	20 mA
DN	[inch]	[l/h]		
15	½"	127	6362	5000
20	¾"	226	11304	10000
25	1"	353	17676	20000
32	1 ¼"	578	28944	30000
40	1 ½"	905	45360	50000
50	2"	1414	70560	75000
-	-	[m³/h]	[m³/h]	[m³/h]
65	2 ½"	2,39	119	100
80	3"	3,62	181	200
100	4"	5,65	283	300
125	5"	8,84	442	400
150	6"	12,7	636	600
200	8"	22,6	1131	1000
250	10"	35,3	1767	2000
300	12"	50,9	2545	2500
350	14"	69,3	3464	3000
400	16"	90,5	4524	4500
450	18"	115	5726	6000
500	20"	141	7069	7000
600	24"	204	10179	10000
700	28"	277	13854	15000
800	32"	362	18095	20000
900	36"	458	22902	25000
1000	40"	565	28274	30000
1200	48"	814	40715	40000

Min and max flow Imperial		
Size	Qmin 0.6 ft./s	Qmax 30 ft./s
[inch]	[GPM]	
½"	0.559	28.0
¾"	0.995	49.76
1"	1.550	77.82
1 ¼"	2.549	127.4
1 ½"	3.984	199.7
2"	6.226	310.7
2 ½"	10.52	523.9
3"	15.93	796.9
4"	24.87	1246
5"	38.92	1946
6"	55.91	2800
8"	99.50	4,979
10"	155.4	7,780
12"	224.1	11,205
14"	305.1	15,258
16"	398.5	19,919
18"	506.3	25,210
20"	620.8	31,120
24"	999.1	44,910
28"	1220	74,920
32"	1594	79,620
36"	2017	100,800
40"	2497	124,500
48"	3584	179,300

20mA output is factory preset to Qmax

To calculate the correct size of the Flow Sensor the recommended flow velocity should be between 1 and 3 m/s (3 and 10 ft/s) to achieve high accuracy at low velocities (down to 0,2 m/s equal to 0.66 ft/s), to ensure safe operation of the tube system and to minimize pressure losses.

The flow curves and graphs on the following page illustrate how the size of the Flow Sensor is calculated to get the required measuring accuracy.

### Example:

A volume of 50 m³/h (220 GPM) is running through a DN100 pipe that measures 4" in internal diameter. To select the correct MagFlux® Flow Sensor, the liquid velocity should be in the range 1 - 3 m/s for 50 m³/hr (3 ft/s - 10 ft/s for 220 GPM.)

If a MagFlux® Flow Sensor with the same inner diameter as the DN100 pipe is selected (4"), the flow velocity will be 1.5 m/s (4.9 ft/s) at a flow rate of 42 m³/h (200 GPM). The diagram and the table below also shows that a flow between 5.65 m³/h and 283 m³/h (24.87 and 1.246 kGPM) can be measured.

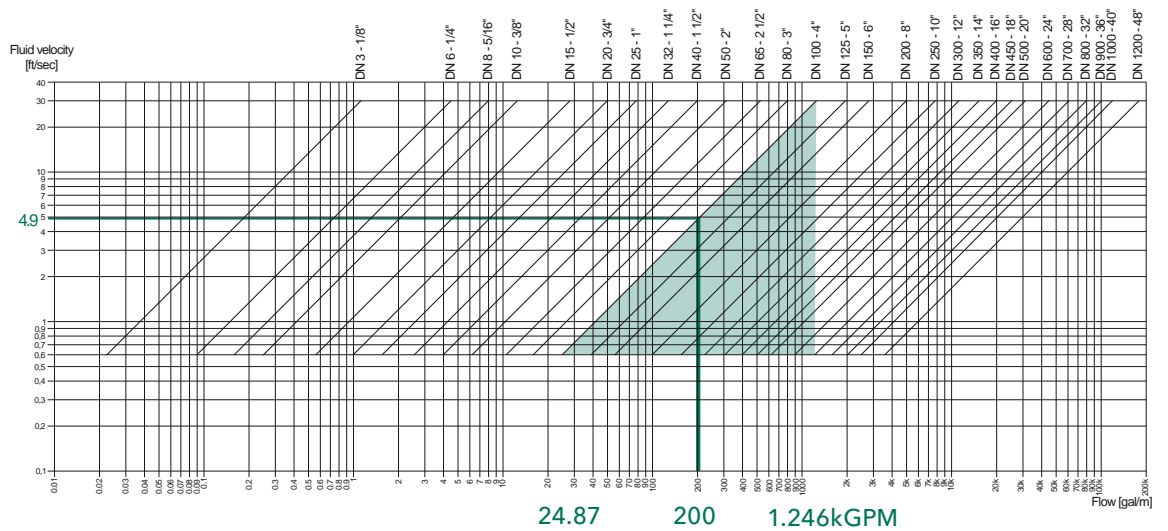
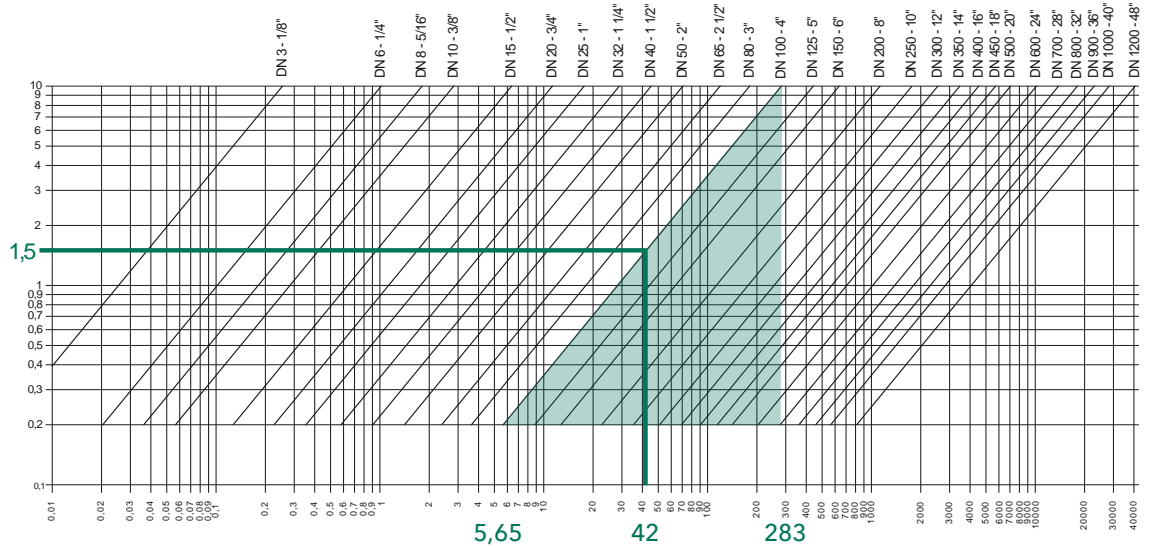


# MagFlux™ Electromagnetic Flow Meter

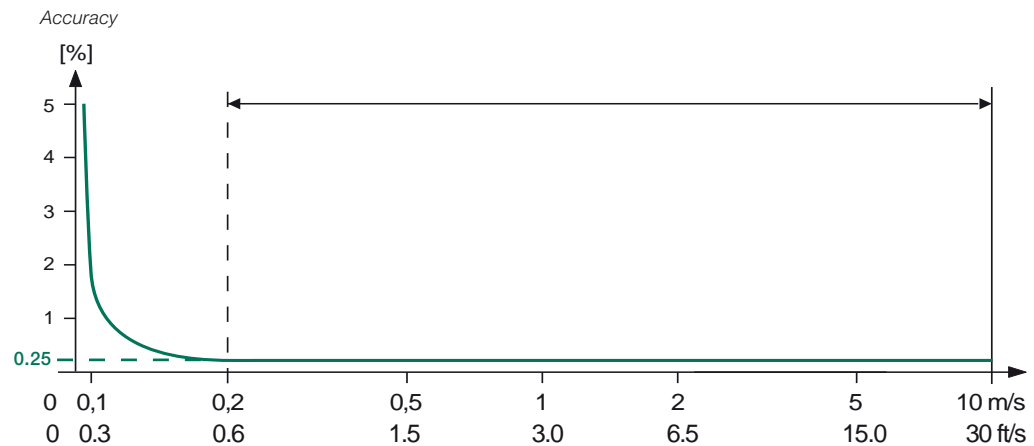


## Flow / Velocity Graph (metric)

Nominal diameter of MagFlux® flow sensor



## Measurement Accuracy

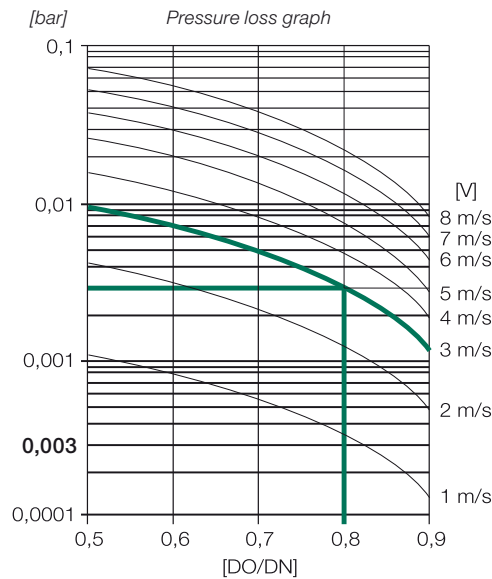


### Example:

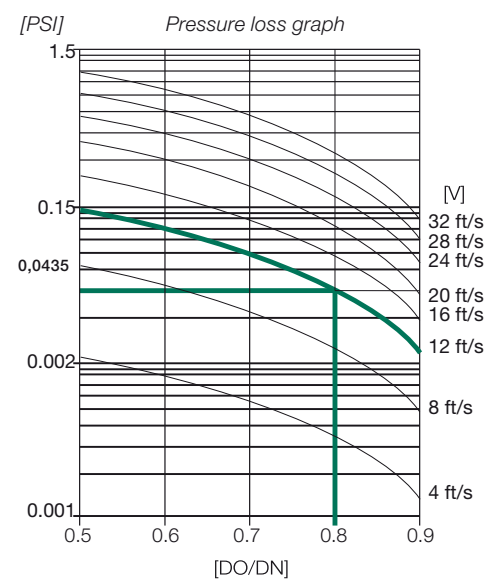
If a 100 mm MagFlux Flow Sensor is selected, the diagram shows the available measuring accuracy between 0.2 - 10 m/s or 0.6 - 30 ft/s (here: 0.25%).

# MagFlux™ Electromagnetic Flow Meter

## Reducing the Flow Meter Size

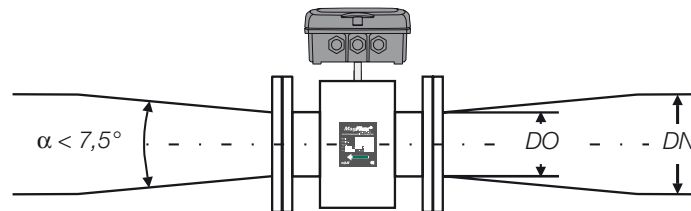


When the size of the Flow Meter is reduced to cause the flow to reach a sufficient velocity, the pipe size has to be reduced. This will cause a pressure loss which can be calculated using the pressure loss chart at the right.



When the MagFlux® Sensor is smaller than nominal pipe diameter, the pressure loss can be checked, using the pressure loss chart.

## Reducing the Flow Meter Size



A MagFlux® Flow Sensor with an internal diameter of 80 mm is selected and the pipe size is 100 mm. Consequently the fluid velocity for a flow of approximately 50m<sup>3</sup>/h will increase to approximately 3 m/s.

Using a DN80 mm MagFlux® flow sensor also leads to a smaller measurement range (3.62 m<sup>3</sup>/h - 181 m<sup>3</sup>/h).

The diagram on the right shows that reducing the pipe size from 100 to 80 mm will cause a pressure loss of 3 mbar (0.003 bar).

A MagFlux Flow Sensor with an internal diameter of 3 in. is selected and the pipe size is 4 in., the fluid velocity for a flow of approximately 220 GPM will increase to about 10 ft/s.

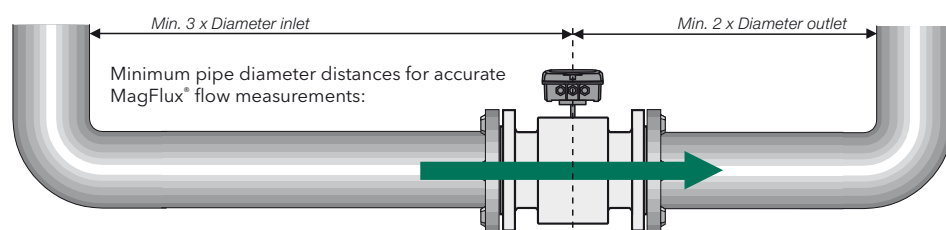
Using a 3 in. MagFlux flow sensor, a smaller measurement range (from 15.93 GPM to 796.9 GPM) will be available.

The diagram shows that reducing the pipe size 4 in. to 3 in. will cause a pressure loss of 0.0435psi.

## Mounting Data

Accurate flow measurement requires a minimum of three (3) pipe diameters of straight pipe upstream and two (2) pipe diameters of straight

pipe downstream from the center of the Flow Sensor.



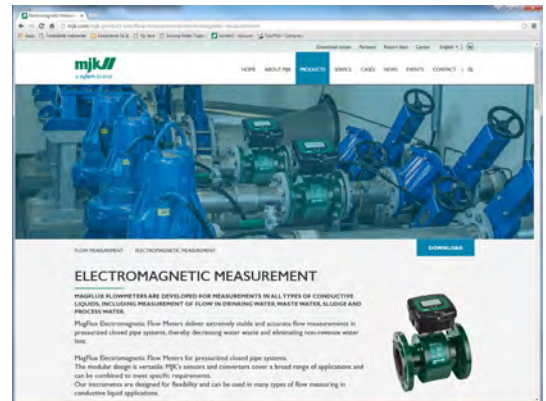
# MagFlux™ Electromagnetic Flow Meter



## Online Information

Find the latest updated product information, video tutorials and a lot more on the website.

Use the QR code to find the website, if you use the digital version of the datasheet, just click to go straight to the electromagnetic flow measurement area.



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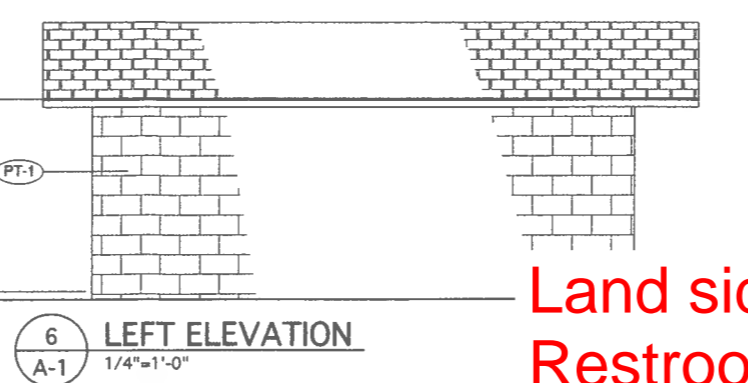
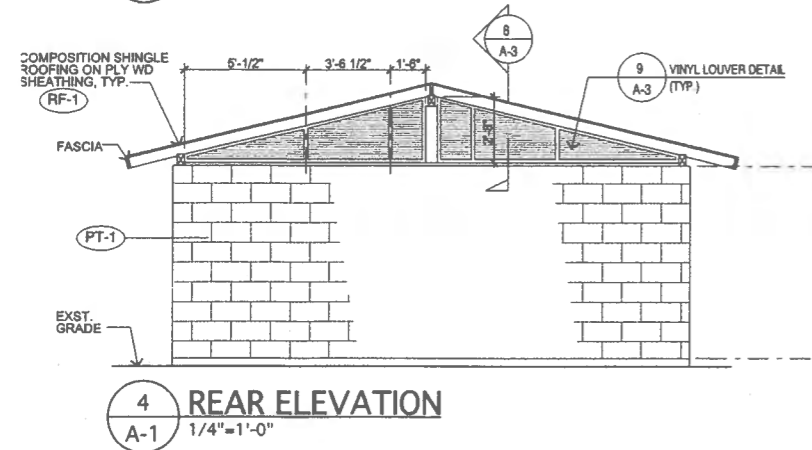
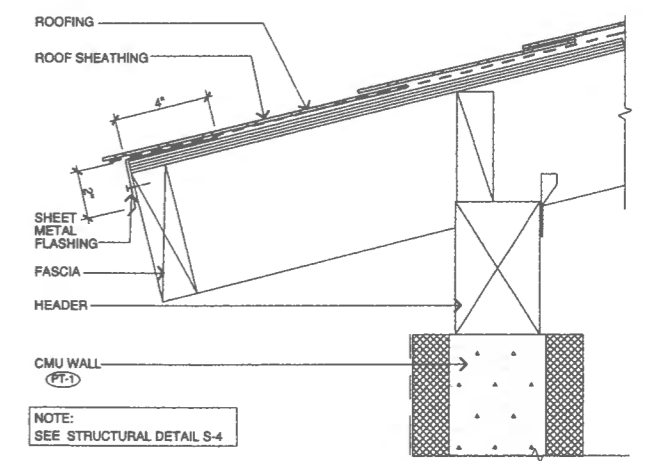
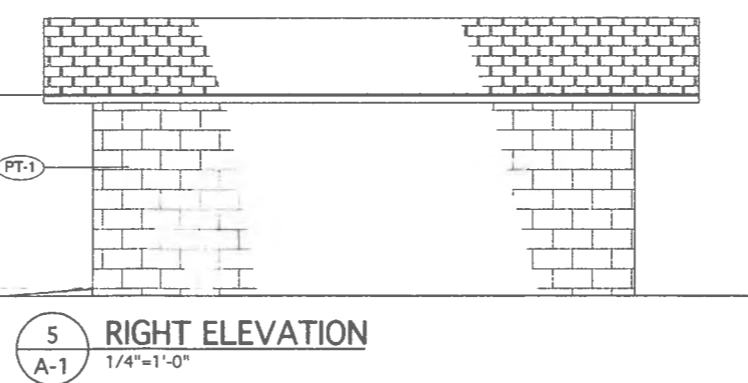
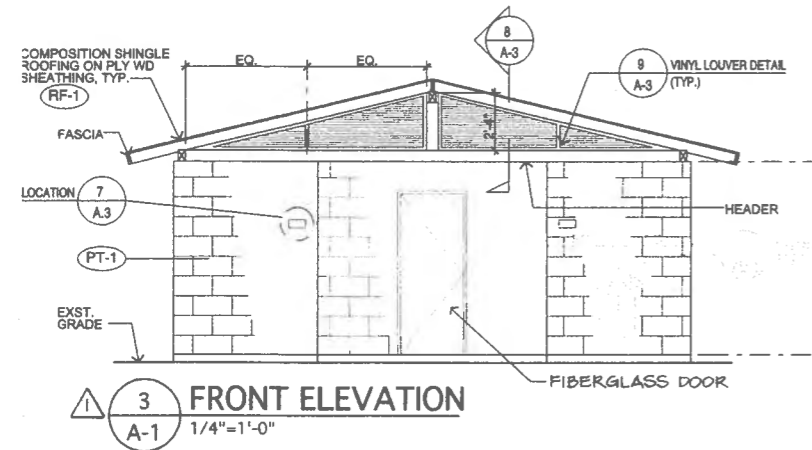
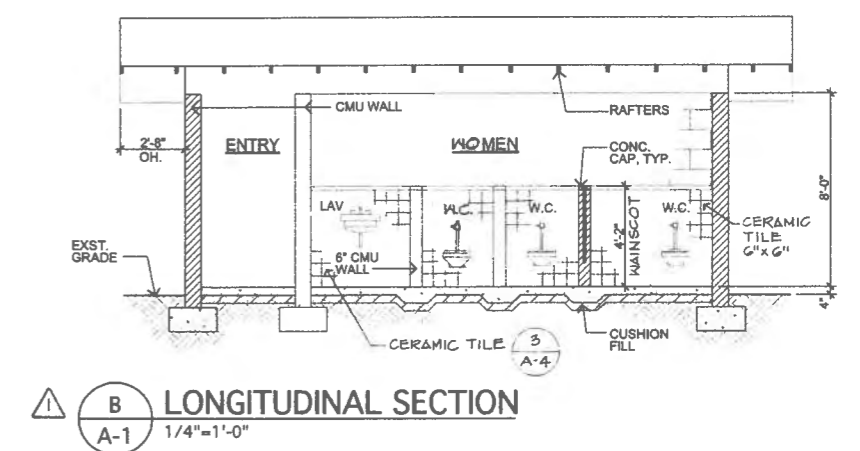
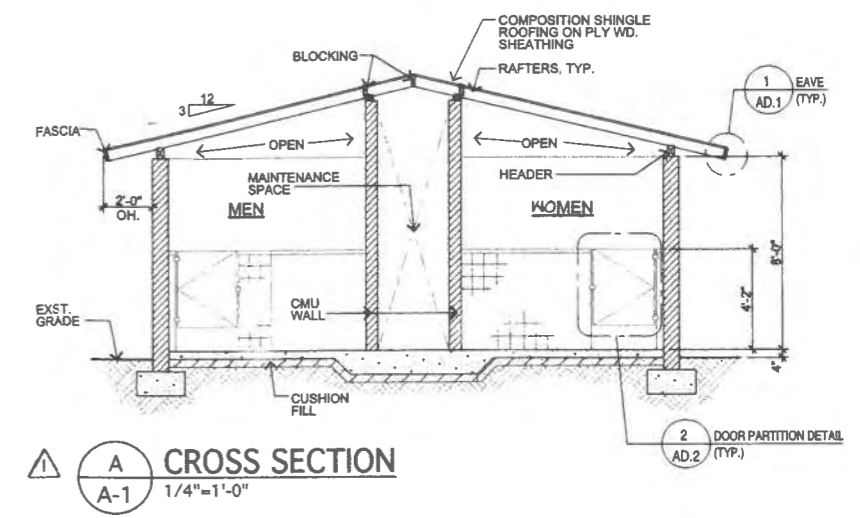
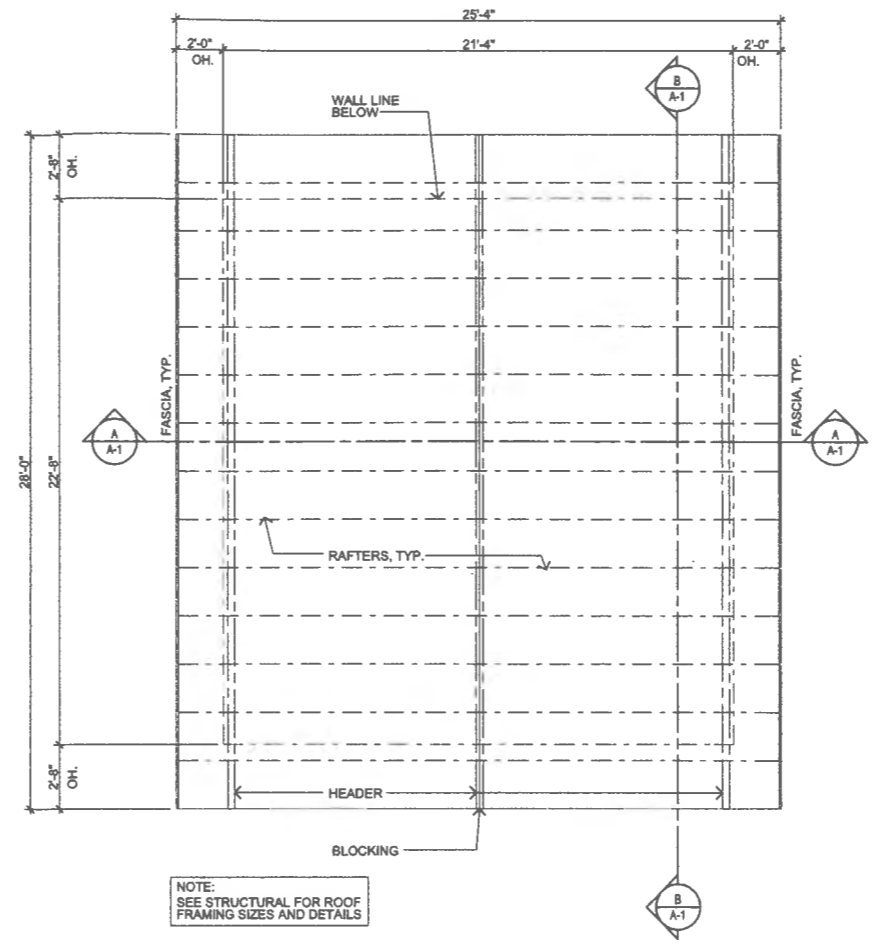
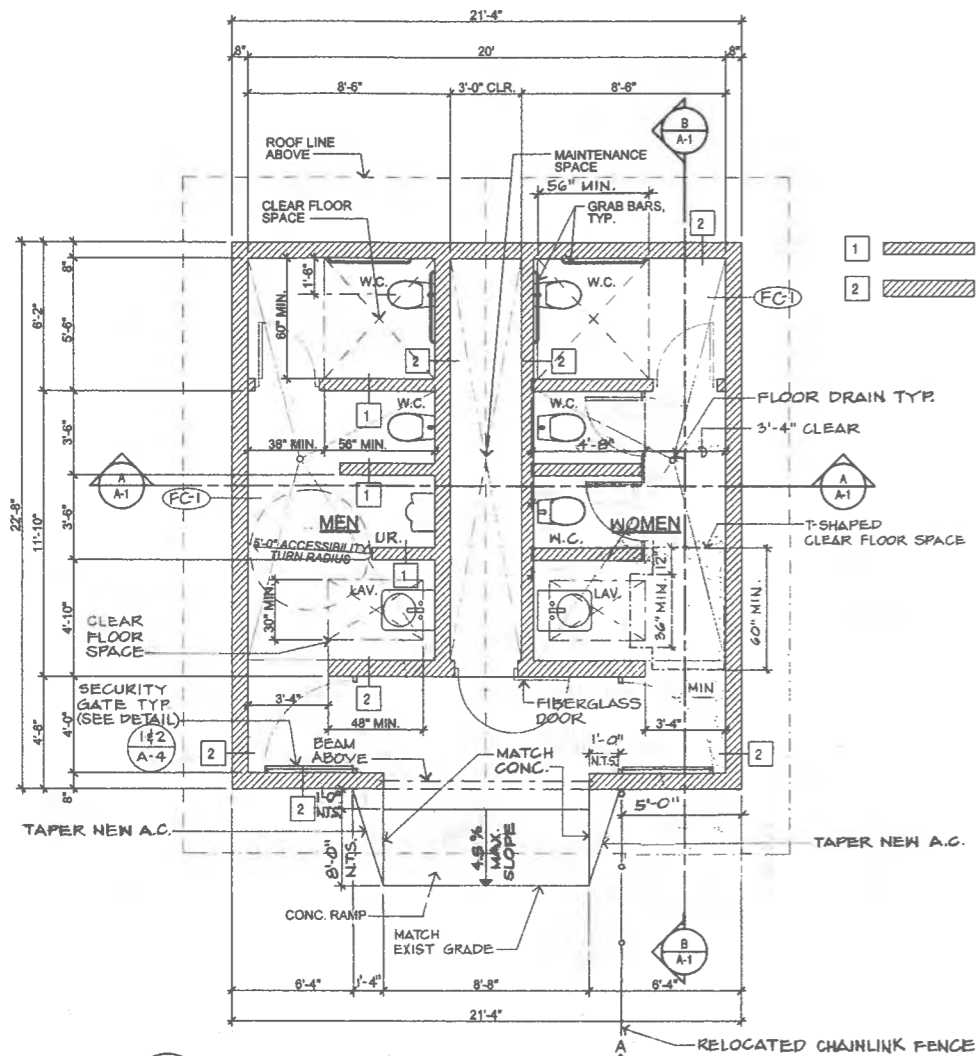
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## **APPENDIX I**

### Floor Plans for Buildings at the Heeia Kea Small Boat Harbor

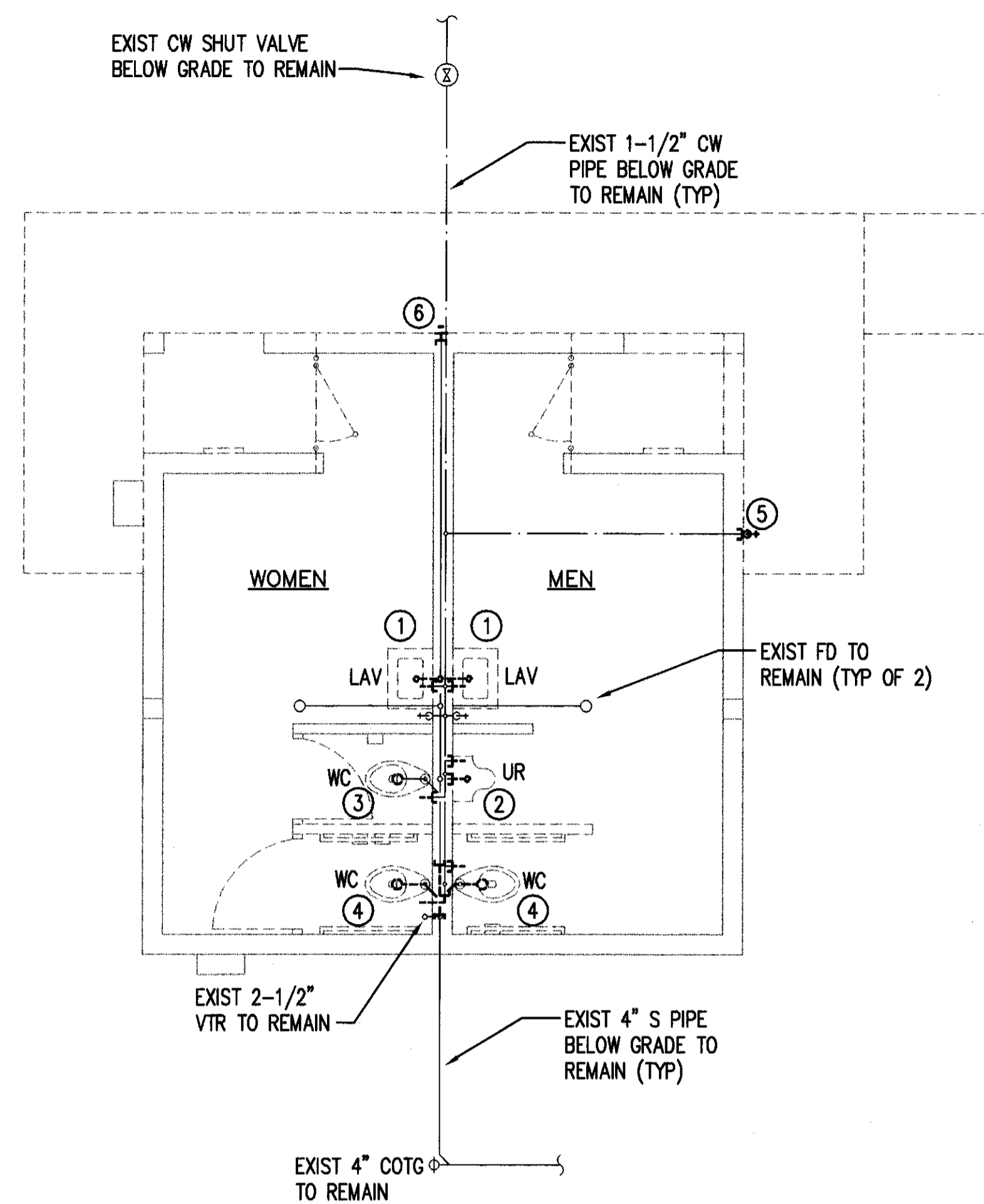


Land side  
Restroom Floor Plan

REVISION NO.	SYMBOL	DESCRIPTION	SHT. OF	DATE	APPROVED
1	DLNR REVISIONS		1/1		

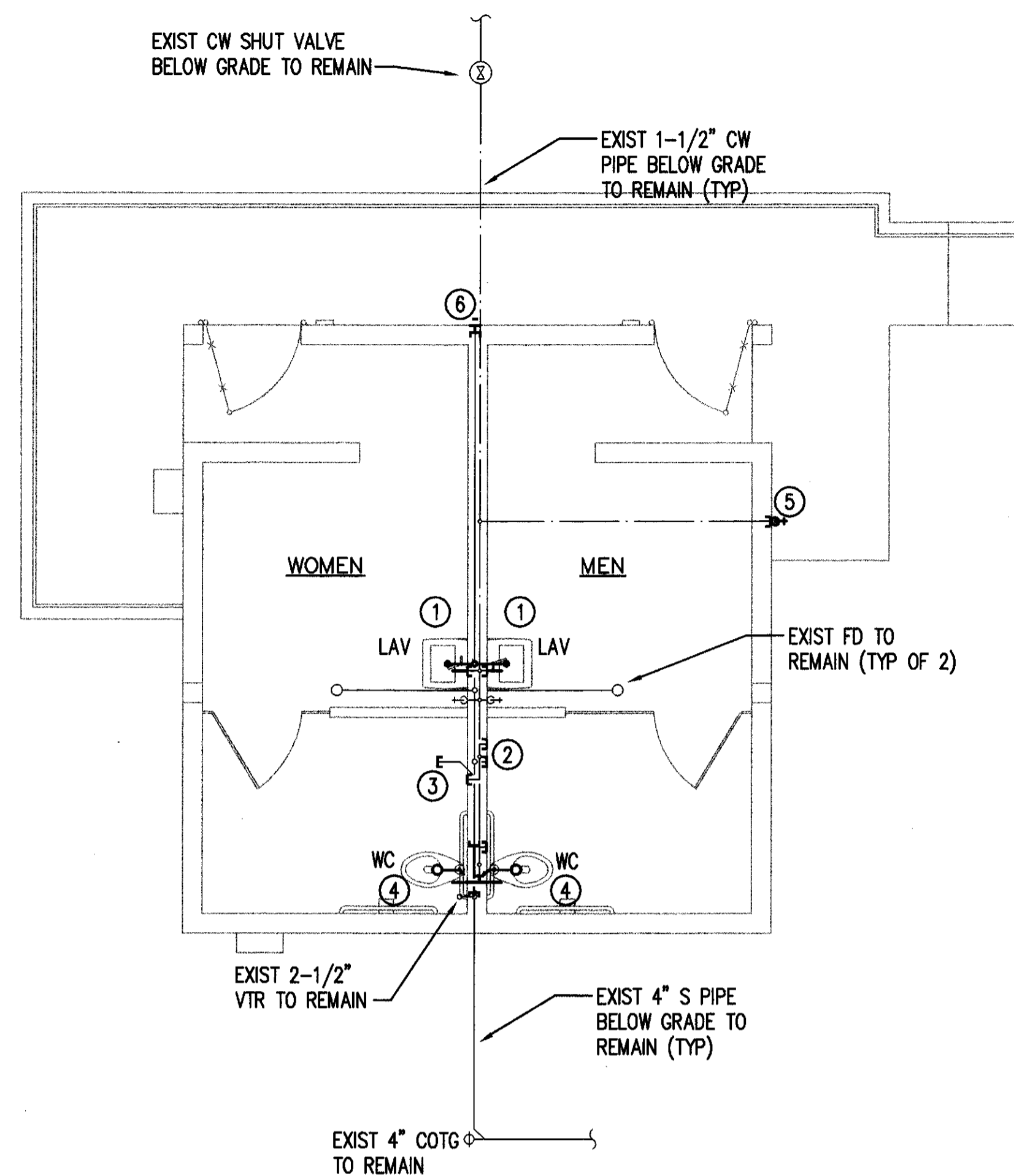
		STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING BRANCH, LAND DIVISION HEEIA-KEA SMALL BOAT HARBOR COMFORT STATION HEEIA, OAHU, HAWAII	
		<b>PLANS, SECTIONS, AND ELEVATIONS</b>	
DESIGNED: E.Y.	SUBMITTED: FINAL		
DRAWN: A.Y.	DATE: JUNE 2000		
CHECKED:	SCALE: AS SHOWN		
APPROVED:		DATE: 6/6/00	DRAWING NO.: <b>Δ-1</b>



**(A) DEMOLITION PLUMBING FLOOR PLAN**  
 M-1 SCALE: 1/4"=1'-0"

**DEMOLITION NOTES:**

- ① REMOVE EXISTING LAV COMPLETELY INCLUDING ALL TRIM AND ACCESSORIES CUT DISCONNECT AND REMOVE EXISTING CW PIPE AT WALL. CAP PIPE END UNTIL RECONNECTED. CUT, DISCONNECT AND REMOVE EXISTING S AND V PIPES IN THE WALL IN ORDER TO INSTALL NEW WORK AND LAVS ACCORDING TO ADAAG STANDARDS.
- ② REMOVE EXISTING UR COMPLETELY INCLUDING ALL TRIM AND ACCESSORIES CUT DISCONNECT AND REMOVE EXISTING CW PIPE AT WALL. CAP, SEAL AND ABANDON CW, S AND V PIPING IN THE WALL.
- ③ REMOVE EXISTING WC COMPLETELY INCLUDING ALL TRIM AND ACCESSORIES CUT DISCONNECT AND REMOVE EXISTING CW PIPE AT WALL. CAP, SEAL AND ABANDON CW, S AND V PIPING IN THE WALL AND BELOW FLOOR.
- ④ REMOVE EXISTING WC COMPLETELY INCLUDING ALL TRIM AND ACCESSORIES CUT DISCONNECT AND REMOVE EXISTING CW PIPE AT WALL. CAP PIPE END UNTIL RECONNECTED. CUT, DISCONNECT AND REMOVE EXISTING S AND V PIPES IN THE WALL IN ORDER TO INSTALL NEW WORK AND WC ACCORDING TO ADAAG STANDARDS. REMOVE EXIST S PIPES BELOW FLOOR.
- ⑤ REMOVE EXISTING HB COMPLETELY. CUT, DISCONNECT AND REMOVE EXIST CW AT GRADE. CAP PIPE END AT GRADE UNTIL RECONNECTED
- ⑥ REMOVE EXISTING CLEANOUT PLUG.. CUT, DISCONNECT AND REMOVE EXIST PIPE IN WALL (AT GRADE). CAP PIPE END AT GRADE UNTIL RECONNECTED CUT, DISCONNECT AND REMOVE EXIST 2" S PIPE STUBOUT IN WALL. CAP, SEAL AND ABANDON 2" S PIPE IN WALL



**(B) PLUMBING FLOOR PLAN**  
 M-1 SCALE: 1/4"=1'-0"



**PLUMBING NOTES:**

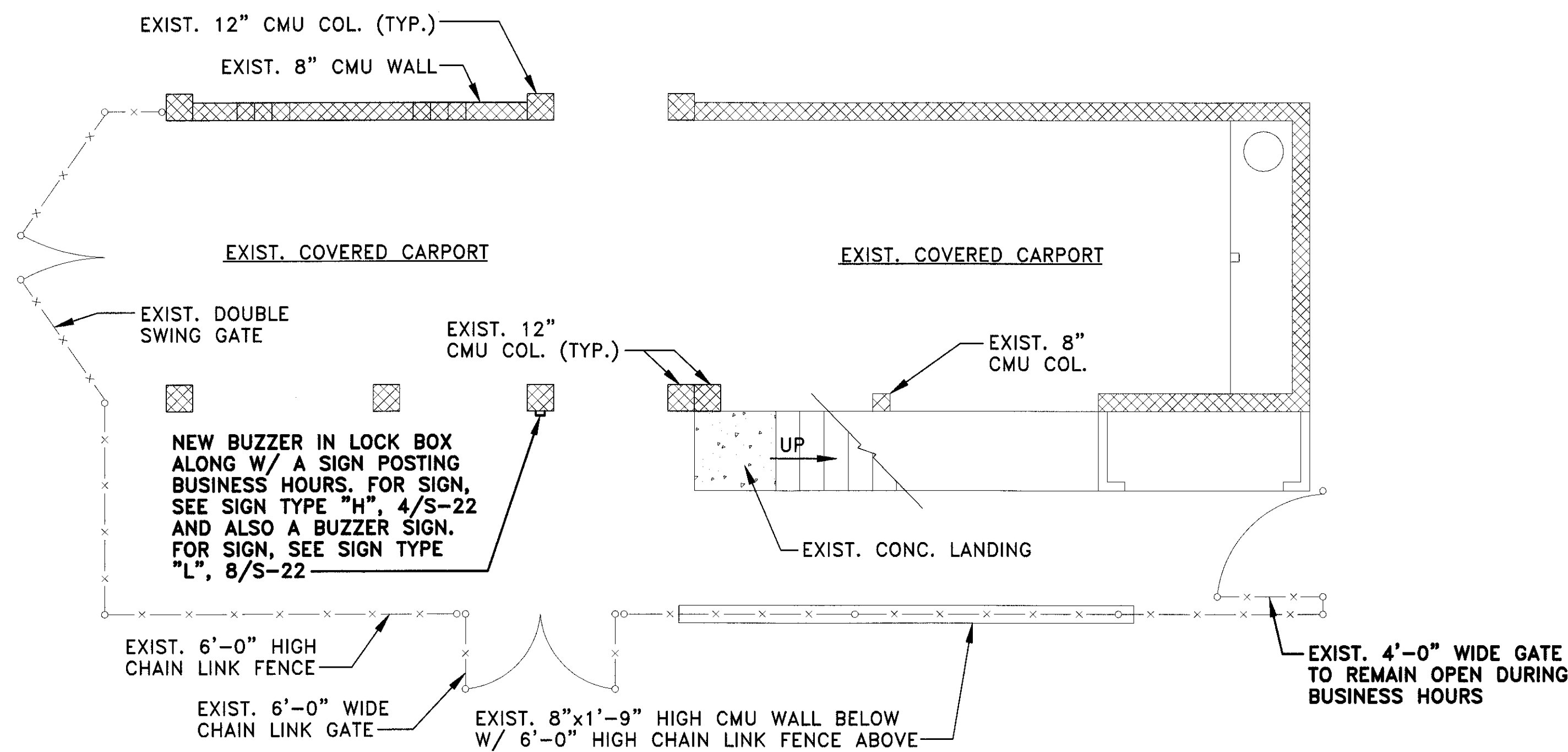
- ① INSTALL NEW LAV CONFORMING TO ADAAG STANDARDS. CONNECT 1-1/2" S AND V PIPE TO EXIST PIPES IN WALL. CONN 1/2" CW PIPE TO EXIST CW PIPE AT WALL.
- ② CAP AND SEAL EXISTING CW PIPE IN WALL AND ABANDON. CAP AND SEAL EXISTING S PIPE IN WALL AND ABANDON
- ③ CAP AND SEAL EXISTING CW PIPE IN WALL AND ABANDON. CAP AND SEAL EXISTING S PIPE BELOW FLOOR AND ABANDON
- ④ INSTALL NEW WC CONFORMING TO ADAAG STANDARDS. CONNECT 4" S AND V PIPE TO EXIST PIPES BELOW FLOOR AND IN WALL. CONN 1" CW TO EXIST CW PIPE IN WALL. INSTALL CW PIPING AND FLUSH VALVE SUCH THAT FLUSH VALVE LEVER IS TO THE WIDE SIDE OF STALL.
- ⑤ CONNECT 3/4" CW PIPE TO EXIST CW PIPE AT GRADE. INSTALL NEW HB WITH VACUUM BREAKER.
- ⑥ PROVIDE 4" WALL CLEANOUT WITH STAINLESS STEEL COVER PLATE AT WALL. CUT, SEAL AND ABANDON 2" S PIPE IN WALL (APPROX 3'0" ABOVE GRADE).

**GENERAL MECHANICAL NOTES:**

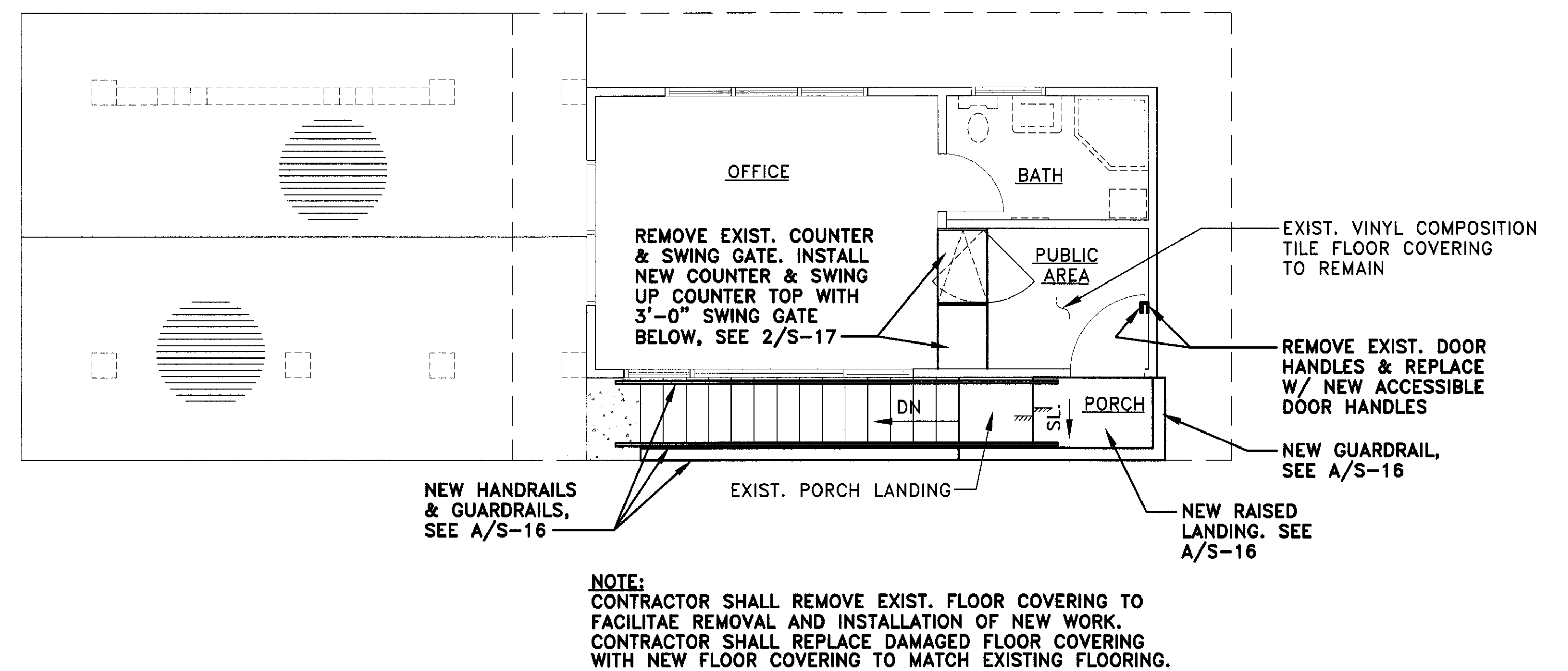
1. CONTRACTOR SHALL VISIT THE JOB SITE TO VERIFY ALL EXISTING FIELD CONDITIONS, DIMENSIONS AND OBSTRUCTIONS.
2. THE CONTRACTOR SHALL COORDINATE ALL WORK WITH WORK OF ALL OTHER TRADES. SHOULD ANY DISCREPANCIES BE DISCOVERED IN THE BID DOCUMENTS (ARCHITECTURAL, STRUCTURAL, ELECTRICAL, MECHANICAL), THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER BEFORE PROCEEDING ANY FURTHER WITH THE WORK, OTHERWISE THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR ALL COST INVOLVED IN THE CORRECTION OF THE CONSTRUCTION INSTALLATION.
3. ALL MECHANICAL, AND PLUMBING WORK SHALL BE IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL AUTHORITIES HAVING JURISDICTION AND ALL APPLICABLE CODES IN EFFECT; UBC, UMC, UFC, UPC, NFPA, OSHA AND THE STATE OF HAWAII DEPT. OF HEALTH
4. ALL WORKMANSHIP SHALL BE OF THE HIGHEST STANDARDS. INSTALL ALL WORK IN A NEAT, SYSTEMATIC AND ORDERLY ARRANGEMENT. ALL MATERIALS SHALL BE NEW AND OF THE BEST QUALITY AVAILABLE, FREE FROM ALL DEFECTS.
5. ALL WORK SHALL BE NEW UNLESS OTHERWISE NOTED AS EXISTING.
6. THE CONTRACTOR SHALL GUARANTEE THE MATERIALS AND INSTALLATION FOR ONE YEAR FROM THE PROJECT ACCEPTANCE DATE AGAINST ANY DEFECTS DUE TO THE FAULTY MATERIALS, EQUIPMENT, WORKMANSHIP OR INSTALLATION. UPON NOTICE OF THE DEFECT THE CONTRACTOR SHALL REPLACE OR REPAIR DEFECTIVE ITEM AT NO ADDITIONAL COST.
7. THE CONTRACTOR SHALL PERFORM TEST ON ALL OF THE MECHANICAL SYSTEMS AS REQUIRED BY FEDERAL, STATE AND LOCAL CODES AND REGULATIONS. ALL TEST SHALL BE WITNESSED AND ACCEPTED BY THE AUTHORITY HAVING JURISDICTION. THE CONTRACTOR SHALL PROVIDE ALL SERVICES AND MATERIALS REQUIRED BY THE TEST AND CERTIFY IN WRITING THAT ALL WORK HAS PASSED ALL REQUIRED TESTS.
8. THE CONTRACTOR SHALL VERIFY THAT THERE ARE NO UTILITIES PRESENT BEFORE DEMOLITION OF ANY SORT. SHOULD ANY UTILITIES BE DAMAGED IN THE PROCESS OF DEMOLITION, THE CONTRACTOR SHALL REPAIR THE UTILITIES AT NO COST TO THE OWNER. ANY CLAIMS FILED DUE TO THE DISRUPTION OF THE UTILITY SERVICE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR
9. PROVIDE SEALANT AROUND ALL PIPE PENETRATIONS THROUGH FLOORS, WALLS, STRUCTURAL MEMBERS, ETC.
10. PROVIDE FIRE STOPS FOR ALL PIPE PENETRATIONS. THE SEALS SHALL HAVE A FIRE RATING GREATER THAN OR EQUAL TO THE RATING OF THE WALL, FLOOR AND/OR ENCLOSURE.
11. ALL PATCH WORK SHALL MATCH EXISTING ADJACENT SURFACE, TEXTURE, COLOR UNLESS INDICATED OTHERWISE.
12. PAINT ALL EXPOSED WORK, COLOR TO MATCH ADJACENT AREAS. COAT ALL EXTERIOR SURFACES WITH CORROSION PROTECTION AS INDICATED IN THE SPECIFICATIONS.
13. CONCEAL ALL PIPING IN PUBLIC SPACES. WHERE IMPRACTICAL TO CONCEAL PIPING, ROUTE PIPING AS HIGH AS POSSIBLE. NO TRAPS IN PIPING ARE ALLOWED.
14. ALL PLUMBING FIXTURES SHALL CONFORM TO UPC SECTION 402.3 WATER CONSERVATION
15. ADJUST FIXTURE HEIGHTS AND ROUGH-INS AS REQUIRED. ACCESSIBLE FIXTURE HEIGHTS, CLEARANCES, ETC. SHALL BE MAINTAINED, CONFORMING TO THE REQUIREMENTS OF HRS SECTION 103-50.
16. COORDINATE ALL PIPE PENETRATIONS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.

Dock side Restroom Floor Plan

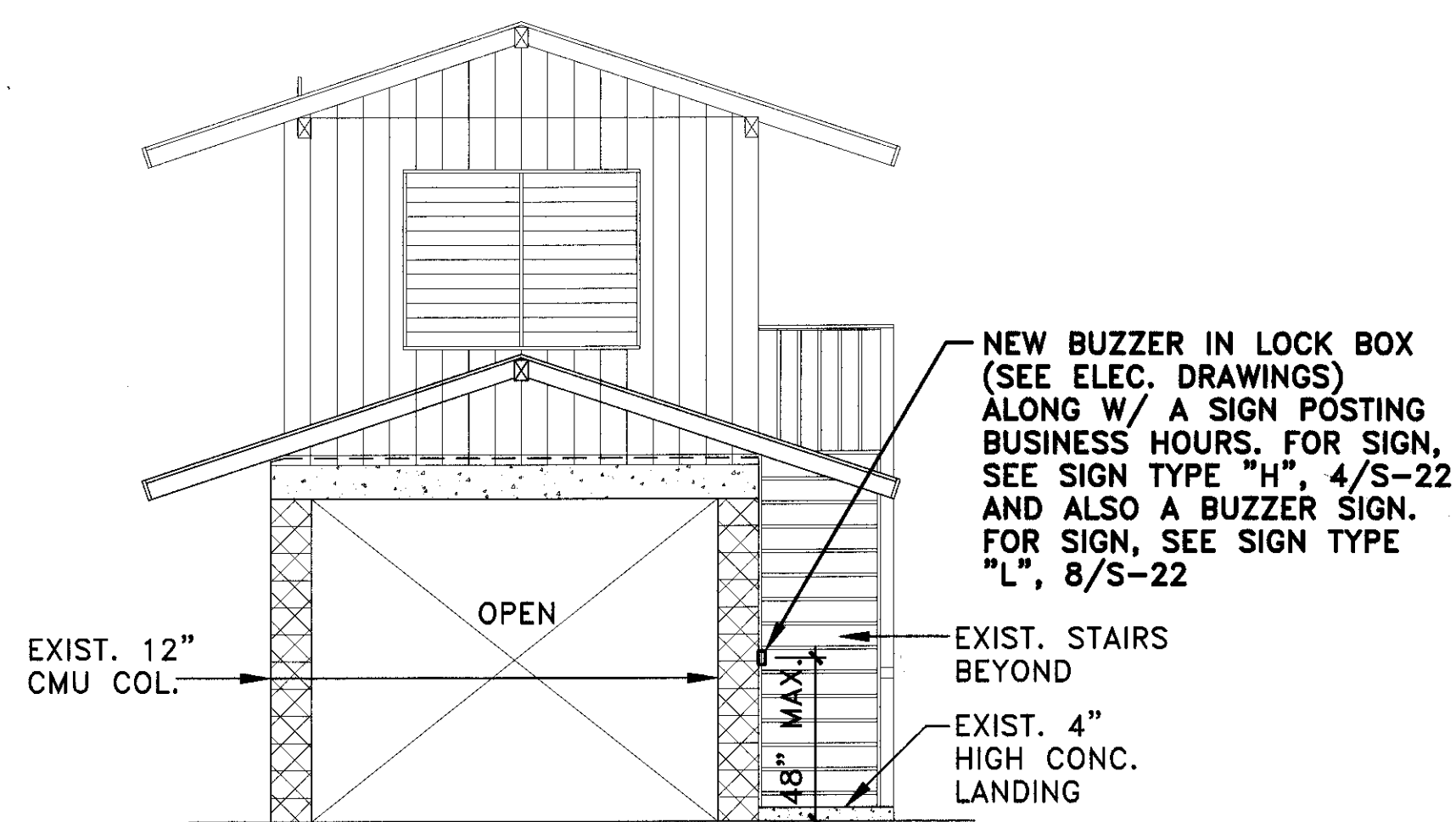
REVISION NO.	SYM.	DESCRIPTION	SHT./OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION  <b>ADA BARRIER REMOVAL</b> <b>HEEIA KEA SMALL BOAT HARBOR</b>  DEMOLITION FLOOR PLAN, DEMOLITION NOTES PLUMBING FLOOR PLAN, PLUMBING NOTES GENERAL MECHANICAL NOTES					
DESIGNED: CC		SUBMITTED:			
DRAWN: CC		DATE: OCTOBER, 2003			
CHECKED: KK		SCALE: AS NOTED			
APPROVED:		DATE: 3/9/04		DRAWING NO. M-1	
 SIGNATURE		 CHIEF ENGINEER			



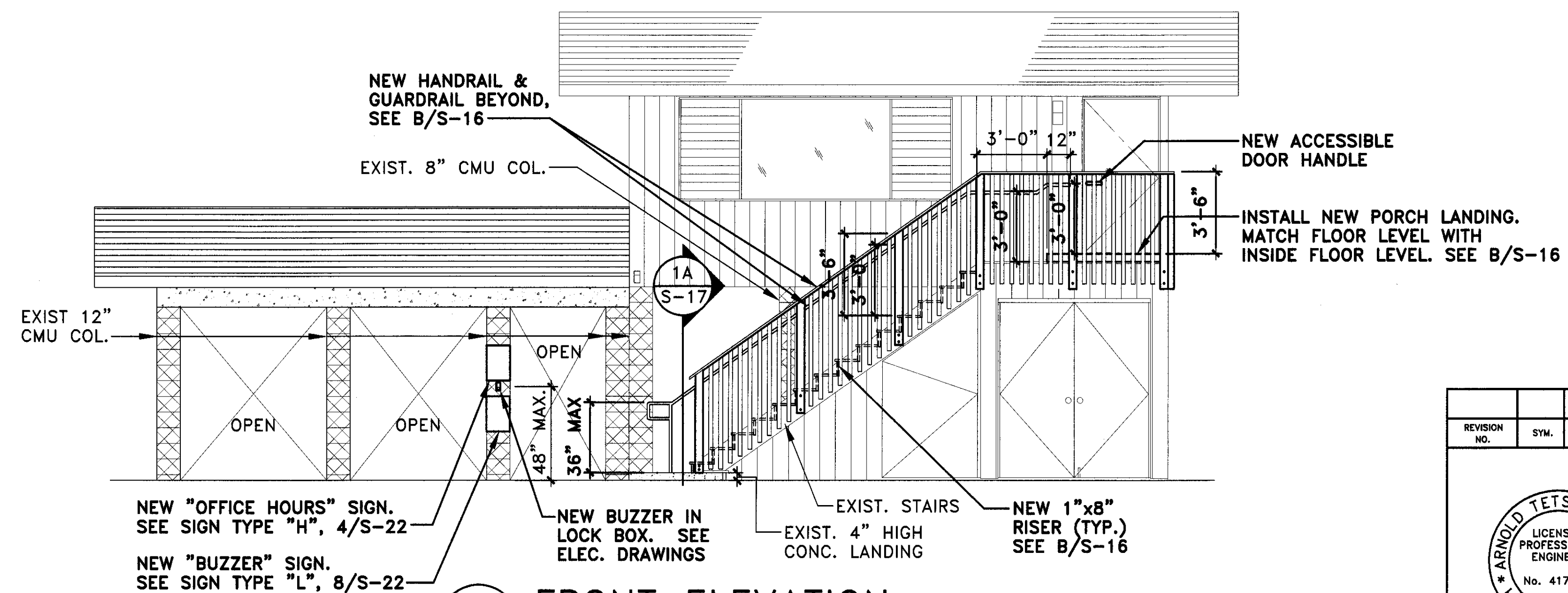
**A**  
**S-15** EXISTING HARBOR'S OFFICE  
 GROUND FLOOR PLAN  
 SCALE: 1/4" = 1'-0"



**B**  
**S-15** EXISTING HARBOR'S OFFICE SECOND FLOOR PLAN  
 SCALE: 1/4" = 1'-0"



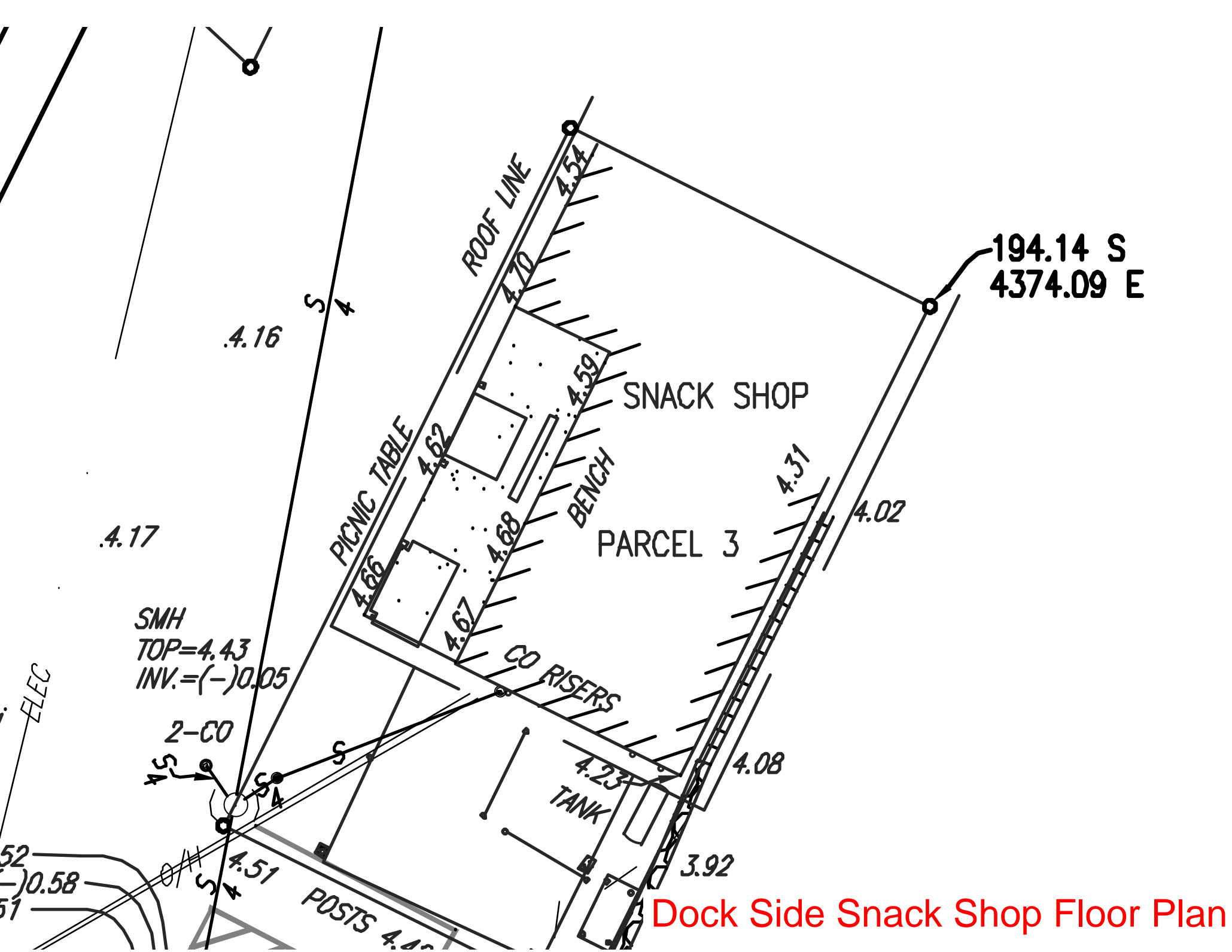
**C**  
**S-15** LEFT-SIDE ELEVATION  
 SCALE: 1/4" = 1'-0"



**D**  
**S-15** FRONT ELEVATION  
 SCALE: 1/4" = 1'-0"

Harbor Master Office Floor Plan

REVISION NO.	SYM.	DESCRIPTION	SHT./OF	DATE	APPROVED
STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES ENGINEERING DIVISION					
<b>ADA BARRIER REMOVAL HEEIA KEA SMALL BOAT HARBOR</b>					
EXISTING HARBOR'S OFFICE - GROUND FLOOR & SECOND FLOOR PLAN & ELEVATIONS					
DESIGNED:	ATO	SUBMITTED:	✓		
DRAWN:	RMA/LC	DATE:	10/2003		
CHECKED:	ATO	SCALE:	AS SHOWN		
APPROVED:	<i>Carl T. Hein</i> SIGNATURE		DATE:	3/10/04	
CHIEF ENGINEER			DRAWING NO.:	<b>S - 15</b>	



Dock Side Snack Shop Floor Plan