REQUIREMENTS and SPECIFICATIONS
TO CONSTRUCT

ARMY AVIATION SUPPORT FACILITY (AASF)
KALAELOA IMPROVEMENTS
JOB NO: CA-1825-C
PROJECT NUMBER (15190024)
TAX MAP KEY: 9-1-013:045
KALAELOA, OAHU, HAWAIʻI

FOR AND BY THE **HAWAII ARMY NATIONAL GUARD**
STATE OF HAWAIʻI

March 2020

Prime / Civil & Mechanical Engineer:	Okahara and Associates, Inc.
Architect:	Bowers + Kubota Consulting
Structural Engineer:	KAI Hawaii, Inc.
Electrical Engineer:	Ronald N.S. Ho & Associates, Inc.
Geotechnical Engineer:	Yogi Kwong Engineers, LLC
Environmental Engineer:	The Benzing Group, LLC
Cost Estimator:	J. Uno & Associates, Inc.
Surveyor:	ControlPoint Surveying, Inc.

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DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01100 - PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of selective demolition work, concrete, asphalt pavement, structural steel, painting, mechanical equipment, controls, electrical work, building construction and all incidental and related work.

B. Perform operations and furnish equipment, fixtures, appliances, tools, materials, related items and labor necessary to execute, complete and deliver the Work as required by the Contract Documents.

C. 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 work specified within each section.

D. Contractor shall not alter the Drawings and Specifications. If an error or discrepancy is found, notify the Project Manager.

E. Specifying of interface and coordination in the various specification sections is provided for information and convenience only. The requirements in the various sections shall complement the requirements of this Section.

1.02 COVID-19 PANDEMIC REQUIREMENT

During the Covid-19 pandemic, Contractor shall follow the guidelines that are put out by the State of Hawaii.

1.03 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated 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. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred, as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates. 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.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood

may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words “shall”, “shall be”, or “shall comply with”, depending on the context, are implied where a colon (:) is used within a sentence or phrase.

3. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research’s “Encyclopedia of Associations” or in Columbia Books’ “National Trade & Professional Associations of the U.S.”.

4. Specific details and notes take precedence over standard details and notes. Where conflicts exist between the drawings, the specifications, and the general notes, specific details shall govern.

B. Terms

1. Directed: Terms such as “directed”, “requested”, “authorized”, “selected”, “approved”, “required”, and “permitted” mean directed by Project Manager, requested by Project Manager, and similar phrases.

2. Indicated: The term “indicated” refers to graphic representations, notes, or schedules on drawings or to other paragraphs or schedules in specifications and similar requirements in the Contract Documents. Terms such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference.

3. Furnish: The term “furnish” means to supply and deliver to project site, ready for unloading, unpacking, assembly, and similar operations.

4. Install: The term “install” describes operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

5. Provide: The terms “provide” or “provides” means to furnish and install, complete and ready for the intended use.

6. Installer: An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-Subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

7. Submit: Terms such as “submit”, “furnish”, “provide”, and “prepare” and similar phrases in the context of a submittal, means to submit to the Project Manager.

8. Contracting Officer: The term “Contracting Officer” shall be replaced with “Project Manager” unless otherwise specified.

C. Industry Standards
   1. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

   2. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

   3. Conflicting Requirements: If compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Project Manager for a decision before proceeding.

1.04 PRODUCT REQUIREMENTS

A. Models and brands listed are for reference or comparison only. All substitute equipment and material must be equal or better than specified models and brands listed.

B. Requests for the approval of “or approved equal” shall be made in writing to the Contracting Office prior to the deadline for questions.

1.05 WORK SEQUENCE

A. See Drawings for Construction Phasing requirements.

1.06 USE OF PREMISES AND WORK RESTRICTIONS

A. General:
   1. Contractor shall have use of construction zone for construction operations, including use of project site, during construction period. Contractor’s use of premises is limited by State’s right to perform work, to retain other Contractors on portions of the project site or to remain operational.

   2. Contractor is notified that the Facility will be operational and accessible to Facility users 7-days a week, Monday through Sunday, including State and Federal Holidays, during the entire period of the project. This continuing operation of the Facility may restrict the Contractor's work. No additional compensation or time will be made to the Contractor for failure to acknowledge and account for the requirements of this Section in his bid.

B. The Contractor is notified that other Facility buildings outside the project limits will generally remain operational during the entire period of the contract. The Contractor shall coordinate, schedule and perform his work with operations in such a manner as to minimize inconvenience, hazards and disturbance upon the Facility's occupants to ensure their safety and to accommodate the Facility's daily operations and activities.
   1. Since portions of the Facility will be operational during the entire period of the project, the Contractor shall consult with the Project Manager and Project Contact Person to review site conditions and factors which affect construction

procedures and the properties which in turn may be affected by the execution of Work.

2. Coordinate and schedule the Work, including shutdowns and utility interruptions, with the Project Manager and Project Contact Person. Work shall be scheduled to conform to the requirements of the Facility.

3. Any and all disruption of access, etc. shall be coordinated in writing with the Project Manager and Project Contact Person and identified in the work schedule.

4. All building systems shall be fully operational throughout the duration of the project during normal business hours except as allowed by the construction phasing notes on Drawings T-2.00.

5. Safe access and egress around the project site shall be maintained at all times. Building corridors, paths and egress and exits shall be kept clear of stored material, dirt and debris. Areas accessible to the public and staff shall be protected from hazardous conditions. Warning signs shall be posted.

6. Confine construction activities, operations, materials, equipment and appliances to the vicinity of the project work area. Do not unreasonably obstruct or interfere with the operation of the garage, users and general public.

7. Any and all construction aids necessary to maintain normal operations of the site and building and to protect the public and the staff shall be the responsibility of the Contractor. Work areas shall be cleaned daily.

8. The Contractor shall relocate construction aids as required by the progress of construction, by storage, or by work requirements, and to accommodate the legitimate requirements of the Facility.

9. No on-site construction work shall be allowed until all materials to be installed are in the possession of the General Contractor or the relevant subcontractor, and prepared and readied for installation. The General Contractor shall provide evidence to the Project Manager that this provision has been satisfied. The project construction schedule shall be developed on this basis.

C. As the buildings within and outside the project limits will be operational during the duration of the project, storage and staging, etc. will be limited and on-site parking may be prohibited. The Contractor shall coordinate closely with the Project Manager for areas for their construction requirements. Restricted and/or limited on-site areas may require the Contractor to provide off-site storage and parking.

D. Contractor’s use of premises is restricted as follows:
   1. Site Access and Parking:
      a. Parking: Parking for the Contractor’s employees (or Subcontractors) will be limited to the available areas within the designated Project Contract Limits or in areas designated by the Project Manager. Do not use parking

stalls in regularly designated parking zones within the Facility grounds. Unauthorized vehicles parked in marked stalls and in any area outside of the designated project construction site will be subject to towing at the Contractor's expense.

b. Maintain access to the Tunnel Entrances, Parking and Driveways through Project Contract Limits.

2. Sanitation:
   a. Use of facility toilet facilities will be as directed by the Project Manager. Facilities shall be kept clean. Abuse of this condition may result in the Contractor providing their own toilet facilities at no additional cost to the State.

3. Noise and Dust Control:
   a. In adjacent locations surrounding the project site, noise, dust and other disrupting activities, resulting from construction operations, are detrimental to the conduct of the Facility activities. Therefore, Contractor shall monitor its construction activities. Exercise precaution when using equipment and machinery to keep the noise and dust levels to a minimum.

   b. To reduce loud disruptive noise levels, ensure mufflers and other devices are provided on equipment, internal combustion engines and compressors.

   c. Schedule construction activities that create excessive noise and dust problems, such as concrete coring, drilling, hammering, trenching, and demolition, for the weekends, holidays or non-business hours. Overtime costs for the Contractor's employees and work force are the Contractor's responsibility.

   d. The Project Manager will require any construction activity that produces excessiveness of noise and dust to be performed during non-business hours. The Project Manager shall make the final determination. Overtime costs for the Contractor's employees and work force are the Contractor's responsibility.

4. Other Conditions:
   a. Arrange for construction debris and trash to be removed from project site daily.

   b. Operate machinery and equipment with discretion and with minimum interference to driveways and walkways. Do not leave machinery and equipment unattended on roads and driveways.

   c. Store materials in the areas as designated by the Project Manager. Locate construction equipment, machinery, equipment and supplies within the Project Contract Limits.

d. Keep access roads and facility roads, to the project site free of dirt and debris. Provide, erect and maintain lights, barriers, signs, etc. when working on facility roads, driveways and walkways to protect pedestrians and moped/bicycle riders. Obey facility traffic and safety regulations.

1.07 WORK UNDER OTHER CONTRACTS

A. Separate Contract: The State may execute a separate contract for certain construction at the project site that was not known at the time Offers were submitted.

B. Cooperate fully with separate Contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract.

1.08 PROPERTY SECURITY

A. The Contractor shall be responsible for the security of the Contractor's property at the site, including construction equipment and materials, tools, vehicles, and including all property of the Contractor, sub-contractors and their employees.

1.09 HAWAII REVISED STATUTES 6E-43.6 & HAWAII ADMINISTRATIVE RULES 13-300

A. Inadvertent burial site and/or human remains shall be handled in accordance with the provisions outlined in HRS 6E-43.6 and HAR 13-300. In the event that human skeletal remains are inadvertently discovered, all activity in the immediate area shall cease and the HIARNG CRS will report the discovery to the SHPD, the appropriate medical examiner or coroner, and the police department. The SHPD will notify the Oahu Island Burial Council and The Office of Hawaiian Affairs (OHA) of the discovery. Within two (2) working days a medical examiner and a qualified archaeologist shall examine the skeletal remains to determine jurisdiction.

B. Inadvertent non-burial finds shall be handled in accordance with the provisions outlined in HAR 13-280. In the event that historic properties are inadvertently discovered, all activity in the immediate area shall cease, no items shall be moved and the HIARNG CRS will notify the SHPD as soon as possible. The find(s) will be secured and protected by the State.

1.10 HIARNG ENVIRONMENTAL CONTRACTOR REQUIREMENTS

A. Compliance: The Contractor shall follow all Federal, State, City and County laws, regulations, and permits, as well as applicable Department of Defense (DOD), Army, and Hawaii Army National Guard (HIARNG) plans and policies. Payment of any fines or penalties resulting from the Contractor's operations is the responsibility of the Contractor. See form attached at end of this Section.

B. Hazardous Materials:

1. Hazardous Materials Inventory**.** In order to facilitate annual Hawaii Emergency Planning and Community Right-to-Know Act (HEPCRA) reporting requirements, prior to project start, Contractor shall submit to the Hawaii Army National Guard (HIARNG) Environmental Office (ENV) a list of hazardous materials and quantities anticipated to be used for the project, including chemical products, fuel, asphalt, etc., and provide actual amounts

within 30 days of project completion. For on-going projects, provide an update no later than 31 January of each calendar year. The log shall include the product name, manufacturer, product identification number, container size, amount used, and maximum number of containers to be stored on-site at any given day during the project (sample form attached). Upon request and site visit, ENV may waive this requirement for containers 5 gallons or less. See Hazardous Material Inventory Log, attached at the end of this Section.

2. Storage. Contractor shall only store hazardous materials for immediate use on-site; no long-term storage shall be permitted. All liquid hazardous materials shall be stored in covered areas and in secondary containment capable of containing the contents of the largest container.

3. Safety Data Sheets (SDSs). SDSs for all chemical products shall be made available to ENV upon request.

C. Regulated Waste. If the Contractor will or may generate hazardous waste, universal waste (batteries, fluorescent lamps and other types of lamps, etc.), other regulated waste (e.g., asbestos, lead paint waste, polychlorinated biphenyl (PCB) light ballasts, etc.), or waste that requires laboratory analyses to determine if the waste is regulated:
   1. Information Required Prior to Project Start. Contractor shall provide to ENV:
      i. An estimate of the maximum amount of each type of waste to be generated per month, and the total amount anticipated to be stored on-site at any given time.

      ii. The names and EPA ID numbers of the disposal/recycling facilities and transporters to be used, which shall be listed on the Defense Logistics Agency (DLA) Disposition Services (DS) lists of Qualified Facilities and Qualified Transporters at http://www.dla.mil/DispositionServices/Offers/Disposal/HazardousWaste/HazWasteDisposal.aspx

   2. Sampling and Analyses. Contractor shall notify ENV prior to any sampling and analyses required to properly characterize the waste, and shall use a NELAC-approved laboratory. Contractor shall provide copies of all test reports within 5 workdays of receipt, along with any associated documents used to characterize the waste.

   3. Waste Management. Contractor shall mark/label, store, manage, and transport all waste in accordance with all applicable Federal, State, and local regulations; and pending shipment, store the waste in a secured area approved by ENV.

   4. Monthly Waste Generation Reports. Contractor shall submit monthly waste generation reports to ENV within 5 days after the end of each month. The reports shall indicate the type of waste and number of pounds of each type generated in the month being reported and totals stored on-site. See Waste Generation Reports, attached at the end of this Section.

5. Waste Manifests. Contractor shall submit draft copies of waste manifests to ENV for review at least 5 workdays prior to shipment off-site. The applicable HIARNG EPA ID Number shall be used on waste manifests, and manifests shall only be signed by authorized ENV staff personnel.

6. Waste Disposal Costs. Contractor shall pay for all disposal/recycling costs for waste generated from this project, including sampling and analyses and other associated costs.

D. Spill Prevention and Response:
   1. Contractors shall establish and implement spill preventive measures, including frequent preventive maintenance checks of vehicles and equipment to prevent leaks, avoid parking equipment on unpaved areas, use of drip pans, and storing all liquid chemicals under cover and in secondary containment capable of containing the contents of the largest container.

   2. No fueling on-site is permitted without approval from ENV. Contractors storing oil or fuel on-site in containers with aggregate shell capacity totaling greater than 1,320 gallons (regardless of actual amount stored) shall prepare Spill Prevention, Control, and Countermeasures (SPCC) Plan in accordance with 40 CFR 112 *Oil Pollution Prevention* and shall submit a copy of the plan to ENV prior to project start.

   3. Contractors shall ensure adequate spill supplies are maintained on-site and readily available near areas with potential for spills or leaks.

   4. Contractor shall post emergency contact sign at project site indicating the name and phone number for the government Project Manager, the contractor emergency contact, police/fire department 911, and HIARNG ENV 672-1013. See sample attached at end of Section.

   5. Contractor shall report all spills immediately to the HIARNG Project Manager and ENV at 672-1013, and shall complete and submit the HIARNG Spill Incident Report Form to ENV within 72 hours. See form attached at end of Section.

   6. Contractor shall immediately clean up all spills IAW Federal and State guidelines, and to the satisfaction of ENV. Contractor shall accomplish all regulatory verbal and written notifications to the Hawaii Department of Health (DOH), Local Emergency Planning Committee (LEPC), National Response Center (NRC), and/or the Environmental Protection Agency (EPA), as applicable, and provide ENV copies of all spill reports submitted.

E. Storm Water. Contractors shall initiate and maintain practices and measures to prevent contamination of storm water throughout all phases of work regardless of project size, and shall comply with HIARNG Construction, Repair, and Maintenance Storm Water Best Management Practices Manual, HIARNG Storm Water Management Plan.

F. Permits. Contractor shall be responsible for assessing whether the project and/or project activities require environmental governmental permits/approvals

(e.g., for oil/water separators, grease traps, septic tanks, underground injection control (UIC) wells, industrial storm water discharge, etc.) and are responsible for obtaining, implementing and complying with all applicable permit requirements.

1. Contractor shall provide to ENV prior to project start, copies of all permit applications, permits, approvals, and associated required plans.

2. Projects that disturb more than 1 acre of soil, including projects that, considered with other related projects, cumulatively disturb more than 1 acre of soil, are required to obtain an applicable National Pollutant Discharge Elimination System (NPDES) storm water discharge permit from DOH, and comply with all permit requirements, including preparation of plans and conducting inspections. Sites less than 1 acre are required to implement best management practices (BMPs) to prevent contaminated storm water from leaving the site. See Construction Site Best Management Practices Checklist attached at the end of the Section.

G. Solid Waste. Contractor shall submit to HIARNG Project Manager data for construction and demolition non-hazardous recycled/diverted waste (i.e., waste that does not go into the landfill or H-POWER) and non-hazardous disposed waste (waste that goes to landfill or H-POWER). Include the weight with its individual associated ticket number. Data can be provided by any means (e.g. receipt copies, Excel table, email message) Data should include:

REQUIRED DATA	RECYCLED/DIVERTED WASTE	DISPOSED WASTE
Ticket #		
Type of Material		
Net Weight		
Recycle/Disposal Facility		
Cost(C)/(R)Revenue Amount	C ☐ R ☐	N/A

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

HIARNG ENVIRONMENTAL CONTRACTOR REQUIREMENTS

PROJECT NAME:	
PROJECT NUMBER:	**SUBMISSION DATE:**
REVIEWER: HIARNG Environmental Compliance Office (ENV), ng.hi.hiarng.list.nghi-env-comp@mail.mil	**DATE REVIEWED:**
	DATE RECEIVED:

NO.	REQUIREMENT
1	**Compliance.** The Contractor shall follow all Federal, State, City and County laws, regulations, and permits, as well as applicable Department of Defense (DOD), Army, and Hawaii Army National Guard (HIARNG) plans and policies. Payment of any fines or penalties resulting from the Contractor's operations is the responsibility of the Contractor.
2	**Hazardous Materials.** a. **Hazardous Materials Inventory.** In order to facilitate annual Hawaii Emergency Planning and Community Right-to-Know Act (HEPCRA) reporting requirements, prior to project start, Contractor shall submit to the Hawaii Army National Guard (HIARNG) Environmental Office (ENV) a list of hazardous materials and quantities anticipated to be used for the project, including chemical products, fuel, asphalt, etc., and provide actual amounts within 30 days of project completion. For on-going projects, provide an update no later than 31 January of each calendar year. The log shall include the product name, manufacturer, product identification number, container size, amount used, and maximum number of containers to be stored on-site at any given day during the project (sample form attached). Upon request and site visit, ENV may waive this requirement for containers 5 gallons or less. b. **Storage.** Contractor shall only store hazardous materials for immediate use on-site; no long-term storage shall be permitted. All liquid hazardous materials shall be stored in covered areas and in secondary containment capable of containing the contents of the largest container. c. **Safety Data Sheets (SDSs).** SDSs for all chemical products shall be made available to ENV upon request.
3	**Regulated Waste.** If the Contractor will or may generate hazardous waste, universal waste (batteries, fluorescent lamps and other types of lamps, etc.), other regulated waste (e.g., asbestos, lead paint waste, polychlorinated biphenyl (PCB) light ballasts, etc.), or waste that requires laboratory analyses to determine if the waste is regulated: a. **Information Required Prior to Project Start**. Contractor shall provide to ENV: i. An estimate of the maximum amount of each type of waste to be generated per month, and the total amount anticipated to be stored on-site at any given time. ii. The names and EPA ID numbers of the disposal/recycling facilities and transporters to be used, which shall be listed on the Defense Logistics Agency (DLA) Disposition Services (DS) lists of Qualified Facilities and Qualified Transporters at http://www.dla.mil/DispositionServices/Offers/Disposal/HazardousWaste/HazWasteDisposal.aspx b. **Sampling and Analyses.** Contractor shall notify ENV prior to any sampling and analyses required to properly characterize the waste, and shall use a NELAC-approved laboratory. Contractor shall provide copies of all test reports within 5 workdays of receipt, along with any associated documents used to characterize the waste. **c. Waste Management.** Contractor shall mark/label, store, manage, and transport all waste in accordance with all applicable Federal, State, and local regulations; and pending shipment, store the waste in a secured area approved by ENV. **d. Monthly Waste Generation Reports**. Contractor shall submit monthly waste generation reports to ENV within 5 days after the end of each month. The reports shall indicate the type of waste and number of pounds of each type generated in the month being reported and totals stored on-site (sample form attached). **e. Waste Manifests.** Contractor shall submit draft copies of waste manifests to ENV for review at least 5 workdays prior to shipment off-site. The applicable HIARNG EPA ID Number shall be used on waste manifests, and manifests shall only be signed by authorized ENV staff personnel.

	f. Waste Disposal Costs. Contractor shall pay for all disposal/recycling costs for waste generated from this project, including sampling and analyses and other associated costs**.**
4	**Spill Prevention and Response.** a. Contractors shall establish and implement spill preventive measures, including frequent preventive maintenance checks of vehicles and equipment to prevent leaks, avoid parking equipment on unpaved areas, use of drip pans, and storing all liquid chemicals under cover and in secondary containment capable of containing the contents of the largest container. b. No fueling on-site is permitted without approval from ENV. Contractors storing oil or fuel on-site in containers with aggregate shell capacity totaling greater than 1,320 gallons (regardless of actual amount stored) shall prepare Spill Prevention, Control, and Countermeasures (SPCC) Plan in accordance with 40 CFR 112 *Oil Pollution Prevention* and shall submit a copy of the plan to ENV prior to project start. c. Contractors shall ensure adequate spill supplies are maintained on-site and readily available near areas with potential for spills or leaks. d. Contractor shall post emergency contact sign at project site indicating the name and phone number for the government Project Manager, the contractor emergency contact, police/fire department 911, and HIARNG ENV 672-1013. e. Contractor shall report all spills immediately to the HIARNG Project Manager and ENV at 672-1013, and shall complete and submit the HIARNG Spill Incident Report Form to ENV within 72 hours. f. Contractor shall immediately clean up all spills IAW Federal and State guidelines, and to the satisfaction of ENV. Contractor shall accomplish all regulatory verbal and written notifications to the Hawaii Department of Health (DOH), Local Emergency Planning Committee (LEPC), National Response Center (NRC), and/or the Environmental Protection Agency (EPA), as applicable, and provide ENV copies of all spill reports submitted.
5	**Storm Water.** Contractors shall initiate and maintain practices and measures to prevent contamination of storm water throughout all phases of work regardless of project size, and shall comply with HIARNG Construction, Repair, and Maintenance Storm Water Best Management Practices Manual, and HIARNG Storm Water Management Plan.
6	**Permits.** Contractor shall be responsible for assessing whether the project and/or project activities require environmental governmental permits/approvals (e.g., for oil/water separators, grease traps, septic tanks, underground injection control (UIC) wells, industrial storm water discharge, etc.) and are responsible for obtaining, implementing and complying with all applicable permit requirements. a. Contractor shall provide to ENV prior to project start, copies of all permit applications, permits, approvals, and associated required plans. b. Projects that disturb more than 1 acre of soil, including projects that, considered with other related projects, cumulatively disturb more than 1 acre of soil, are required to obtain an applicable National Pollutant Discharge Elimination System (NPDES) storm water discharge permit from DOH, and comply with all permit requirements, including preparation of plans and conducting inspections. Sites less than 1 acre are required to implement best management practices (BMPs) to prevent contaminated storm water from leaving the site.
7	**Solid Waste.** Contractor shall submit to HIARNG Project Manager data for construction and demolition non-hazardous recycled/diverted waste (i.e., waste that does not go into the landfill or H-POWER) and non-hazardous disposed waste (waste that goes to landfill or H-POWER). Include the weight with its individual associated ticket number. Data can be provided by any means (e.g. receipt copies, Excel table, email message) Data should include:

REQUIRED DATA	RECYCLED/DIVERTED WASTE	DISPOSED WASTE
Ticket #		
Type of Material		
Net Weight		
Recycle/Disposal Facility		
Cost(C)/(R)Revenue Amount	C ☐ R ☐	N/A

MONTHLY WASTE GENERATION REPORT

REPORTING MONTH/YEAR (MM/YYYY): DATE SUBMITTED:
CONTRACTOR NAME:
PROJECT NUMBER & NAME
PROJECT LOCATION:
GOVERNMENT PROJECT MANGER NAME AND PHONE:

Submit to HIARNG Environmental Office within 5 days of end of the reporting month.

Accumulation Start Date	Accumulation End Date	Container ID Number	Contents	Category[1]	Beginning Weight (lbs.)	End-of-Month Weight (lbs.)	Waste Picked Up (lbs.)	Monthly Generation (lbs.)	NOTES

[1] HW - Hazardous Waste (e.g., lead paint chips); UW - Universal Waste (e.g., fluorescent lamps); PCB - Polychlorinated Biphenyls (e.g., light ballasts; Asbestos -ASB (e.g., asbestos tiles)

HAZARDOUS MATERAL INVENTORY LOG

CONTRACTOR NAME:	DATE SUBMITTED:
PROJECT NUMBER & NAME:	
PROJECT DESCRIPTION:	
PROJECT LOCATION:	
PROJECT START DATE:	PROJECT END DATE:
GOVERNMENT PROJECT MANAGER NAME AND PHONE:	REPORT PERIOD *(circle)* : Start Annual End

Submit to HIARNG Environmental Office prior to start of project, within 30 days of completion, and update by 31 January.

PRODUCT NAME AND IDENTIFICATION NUMBER	MANUFACTURER	SIZE OF CONTAINER	ESTIMATED NUMBER OF CONTAINERS FOR PROJECT	MAXIMUM NUMBER OF CONTAINERS STORED ON SITE AT ANY ONE TIME	ACTUAL NUMBER OF CONTAINERS USED	FOR ENV USE

HAZARDOUS MATERAL INVENTORY LOG

Continuation Page

PRODUCT NAME AND IDENTIFICATION NUMBER	MANUFACTURER	SIZE OF CONTAINER	ESTIMATED NUMBER OF CONTAINERS FOR PROJECT	MAXIMUM NUMBER OF CONTAINERS STORED ON SITE AT ANY ONE TIME	ACTUAL NUMBER OF CONTAINERS USED	FOR ENV USE

EMERGENCY CONTACTS

Contractor: [Company Name]
  Site Supervisor: [Name, Phone]
  Spill/Emergency: [Name, Phone]
  After Hours:[Name, Phone]
Police/Fire: 911
Government POC: [Name, Phone]

HIARNG Environmental Office
Spill Notification Hotline: 672-1013

Construction Site Best Management Practices Checklist

Sites < 1 acre are exempt from needed an NPDES permit, however they still need to implement Best Management Practices and Good housekeeping to prevent a harm to human health and the environment.

Best Management Practices	Yes	No	N/A
Do all containers of POL have secondary containment?			
Are storm drains and UIC protected from sediment and contaminated runoff?			
Are all containers of hazardous material and waste labeled and stored in accordance with applicable federal and state regulations?			
Are spill kits positioned in high risk locations?			
Are all stockpiles covered and/or protected from erosion			
Is the silt fence intact and effective at preventing illicit discharges?			
Are slopes stabilized to prevent erosion?			
Are dip pans being used under leaking equipment?			
Have all spills been cleaned up?			
Is the site free of trash and debris? Good housekeeping?			
Are all metal objects stored on pallets			
Is the entrance to the site stabilized to prevent tracking sediment off site?			
Are tires being washed prior to leaving the site?			

Comments

HIARNG Spill Incident Report Form

REPORT SPILLS IMMEDIATELY TO HIARNG-ENV AT 672-1013.
Fax this form to 672-1262 or e-mail ng.hi.hiarng.list.nghi-env-comp@mail.mil within 72 hours of the spill.

1	LOCATION OF SPILL (Facility/Address/Bldg):	DATE & TIME OF SPILL:	
2	CALLER NAME & PHONE NUMBER:	OSC NAME & PHONE NUMBER:	
3	ORGANIZATION REPORTING:		
4	DATE AND TIME OF DISCOVERY:	DURATION OF THE SPILL:	
5	TIME & DATE HIARNG ENV NOTIFIED (672-1013):	PERSON NOTIFIED:	
6	SUBSTANCE SPILLED *(Attach SDS):*	AMOUNT SPILLED:	SIZE OF AREA IMPACTED:
7	CAUSE AND SOURCE OF THE SPILL:		
8	EXTENT AND SEVERITY OF SPILL: Potential Dangers: ☐ Fire ☐ Explosion ☐ Toxic Fumes/Fluid ☐ Evacuation Needed ☐ Damage or Injuries *(Specify):*		
	Media into Which the Release Occurred or is Likely to Occur (Check all applicable): ☐ Soil ☐ Concrete ☐ Asphalt ☐ UIC ☐ Storm Drain ☐ Swale ☐ Sewer ☐ Stream ☐ Other *(Specify):* Raining? ☐ No ☐ Yes Raining Imminent? ☐ No ☐ Yes Direction of Flow:		
9	RESPONSE ACTIONS TAKEN TO STOP, REMOVE, AND MITIGATE EFFECTS OF THE SPILL:		
10	ADDITIONAL ASSISTANCE REQURIED? ☐ No ☐ Yes *(Specify):*		
11	OTHER HIARNG OR EXTERNAL AGENCIES NOTIFIED *(Agency, Individual, Date, Time, and Incident Number Assigned by Agency):* ☐ Fire Dept. ☐ Ambulance ☐ Other *(Specify):*		
12	PREVENTIVE ACTIONS TO BE TAKEN: *(NOTE: This incident is required to be covered in the next unit/activity spill training.)*		
13	SUBMITTED BY *(Name, Title, Phone)*		

For Environmental Office Use Only.

1	REPORTABLE? ☐ No ☐ Yes	REPORTABLE QTY:	Samples Taken? ☐ No ☐ Yes
2	VERBAL NOTIFICATIONS MADE *(Indicate Agency, Individual, Date, and Time Notified, and any Incident Number Assigned)* ☐ SERC (HEER): ☐ LEPC: ☐ NRC (800) 424-8801: ☐ Other (Specify): DATE WRITTEN NOTIFICATIONS MADE:		
3	CORRECTIVE ACTIONS TAKEN/ RECOMMENDED TO PRECLUDE RECURRENCE:		

SECTION 01230 - ALTERNATES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

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

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

1.02 DEFINITIONS

A. Alternate: An amount proposed by Bidders (Offerors) and stated on the Bid Form for certain work defined herein that may be added to or deducted from the Total Lump Sum Bid Price amount if State decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Total Lump Sum Bid Price.

1.03 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into the Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following Notice to Proceed of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

A. Alternate No. 1 Additive: Photovoltaic with Battery Storage – Install duct line from handhole to PV Array, including trenching, backfill, restoration, and all incidental items, in place complete.

B. Alternate No. 2 Additive: Photovoltaic with Battery Storage – Install PV panel and Array 1A, including required portions of structural canopy, lighting, and all incidental items, in place complete.

C. Alternate No. 3 Additive: Photovoltaic with Battery Storage – Install PV panel and Array 1B, including required portions of structural canopy, lighting, and all incidental items, in place complete.

D. Alternate No. 4 Additive: Photovoltaic with Battery Storage – Install PV panel and Array 1C, including required portions of structural canopy, lighting, and all incidental items, in place complete.

E. Alternate No. 5 Deductive: Soap Solution Dispenser (Foamer) System. Deletion of foamer system, inclusive of soap solution dispenser, hose reel (at wash station 3), compressed air piping to hose reel, soap solution piping, detergent, spill containment pallet, valves, controls, electrical equipment connections, feeders, and circuit breaker for soap solution dispenser control panel, and all other appurtenances. Air compressor, compressed air stations, and compressed air piping to remain.

F. Alternate No. 6 Deductive: Fencing. Deletion of all chain link fencing and gates.

G. Alternate No. 7 Deductive: Wash Station 1 and 2. Deletion of wash rack amenities northwest of the Equipment Room, inclusive of Wash Stations 1 and 2, demolition, clearing, grading, concrete, asphalt pavement, trench drain, compressed air station, pressure washer hose reel, control panels, water cannon reels, supporting piping, electrical equipment connections, double-headed light poles, waterproofing receptacles, and all other appurtenances. Relocation of one pressure washer hose reel to Wash Station 4, including all supporting piping and appurtenances, in place complete. Alternative does not include deletion of fencing as described in Alternate No. 6.

END OF SECTION

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.

   2. Project meetings.

1.02 PERFORMANCE AND COORDINATION

A. Contractor is in charge of the Work within the Project Contract Limits, and shall direct and schedule the Work. Include general supervision, management and control of the Work of this project, in addition to other areas more specifically noted throughout the Specifications. Final responsibility for performance, interface, and completion of the Work and the Project is the Contractor's.

B. The Contractor is responsible for jobsite Administration. Provide a competent superintendent on the job and provide an adequate staff to execute the Work. The superintendent shall have at least five (5) years of construction and project management experience. In addition, all workers shall dress appropriately and conduct themselves properly at all times. Loud abusive behavior, sexual harassment and misconduct will not be tolerated. Workers found in violation of the above shall be removed from the job site as directed by the Project Manager.

C. 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.

D. Coordination: Provide project interface and coordination to properly and accurately bring together the several parts, components, systems, and assemblies as required to complete the Work pursuant to the GENERAL CONDITIONS and SPECIAL CONDITIONS.
   1. Provide interface and coordination of all trades, crafts and subcontracts. Ensure and make correct and accurate connections of abutting, adjoining, overlapping, and related work. Provide anchors, fasteners, accessories, appurtenances, and incidental items needed to complete the Work, fully, and correctly in accordance with the Contract Documents.

   2. Provide additional structural components, bracing, blocking, miscellaneous metal, backing, anchors, fasteners, and installation accessories required to properly anchor, fasten, or attach material, equipment, hardware, systems and assemblies to the structure.

   3. Provide excavation, backfilling, trenching and drilling for trades to install their work.

   4. Provide concrete foundations, pads, supports, bases, and grouting for trades as needed to install their work.

5. Provide caulking, sealing, and flashing as required to waterproof the building complete and as required to insulate the building thermally and acoustically. Include sealing, flashing, and related work as required to prevent moisture intrusion, air infiltration, and light leakage.

6. Equipment, appliances, fixtures, and systems requiring plumbing and mechanical services, rough-in, and connections, or other utilities and services shall be provided with such services, rough-in, and final connections.

7. Equipment, appliances, fixtures, hardware, and systems requiring electrical services shall be provided with such electrical services, including outlets, switches, overload protection, interlocks, panelboard space, disconnects, circuit breakers, and connections.

8. Materials, equipment, component parts, accessories, incidental items, connections, and services required to complete the Work which are not provided by Subcontractors shall be provided by the Contractor.

9. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1.03 COOPERATION WITH OTHER CONTRACTORS

A. The State reserves the right at any time to contract for or otherwise perform other or additional work within the Project Contract Limits. The Contractor of this project shall to the extent ordered by the Project Manager, conduct its work so as not to interfere with or hinder the progress or completion of the work performed by the State or other Contractors.

1.04 COORDINATION WITH OTHER PRIME CONTRACTORS

A. Multiple prime Contractors performing work under separate agreements with the State may be present near the project location, adjacent to and abutting the Project Contract Limits. This Contractor shall coordinate activities, sequence of work, protective barriers and any and all areas of work interfacing with other Prime Contractor’s work. Contractor shall provide a continuity of finishes, walks, landscape, etc. at abutting Contract Limits so no additional work will be required. Any damage to other Prime Contractor’s Work committed by this Contractor (or its Subcontractor) shall be repaired promptly at no additional cost to the State.

B. Coordinate Subcontractors and keep them informed of any work from the other Projects that may affect the site or the Subcontractor’s work. If the Contractor has any questions regarding its coordination responsibilities or needs clarification as to the impact in scheduling of its work and the work of other projects, this Contractor shall notify the Project Manager in writing.

C. Subject to approval by the Project Manager, this Contractor shall amend and schedule its work and operations to minimize disruptions to the work and operations of other projects.
   1. Relocate or remove and replace temporary barriers, fencing supports or bracing to allow work by others to proceed unimpeded. Do not remove

required barriers supporting work until specified time or as approved by the Project Manager. This does not relieve the Contractor of the responsibility of proper coordination of the work. If directed by the Project Manager, leave in place any temporary barriers.

2. Coordinate work that abuts or overlaps work of the other projects with the Project Manager and other Prime Contractors to mutual agreement so that work is 100 percent complete with continuity of all materials, systems and finishes.

3. When directed by the Project Manager, provide access into the construction zone to allow the other project's Contractor(s) to perform their Work and work that must be interfaced.

4. Contractor shall adjust and coordinate its Work and operations as required by the other projects as part of the Work of this contract without additional cost or delay to the State.

5. When directed by the Project Manager provide a combined Contractor's construction schedule.

D. Other Contracts: If known, they are listed in SECTION 01100 - PROJECT REQUIREMENTS.

1.05 SUBMITTALS

A. Photo Documentation: Prior to the start of jobsite work, the Contractor shall photo document the existing conditions at the site and file with the Project Manager one (1) complete set of documents.

1.06 PROJECT MEETINGS AND TRAINING

A. General: Schedule and conduct meetings and conferences as directed by the Project Manager unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Project Manager of scheduled meeting dates and times.

   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

   3. Minutes: Contractor shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Project Manager, within seven (7) days of the meeting.

B. Preconstruction Conference: Project Manager shall schedule a preconstruction conference before the start of construction, at a time convenient to the Project Manager, but no later than seven (7) days before the Project start date or jobsite start date whichever is later. Conference will be held at the Project site or another convenient location. The Project Manager shall conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Project Manager; Facility Users; Contractor and its superintendent; major Subcontractors; manufacturers; suppliers; and other

concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.

   b. Phasing.

   c. Critical work sequencing and coordination.

   d. Designation of responsible personnel.

   e. Use of the premises.

   f. Responsibility for temporary facilities and controls.

   g. Parking availability.

   h. Office, work, and storage areas.

   i. Equipment deliveries and priorities.

   j. First aid.

   k. Security.

   l. Progress cleaning.

   m. Working hours.

C. Progress Meetings: Conduct progress meetings at monthly or other intervals as determined by the Project Manager. Coordinate dates of meetings with preparation of payment requests.
   1. Attendees: In addition to the Project Manager, each Contractor, Subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Review present and future needs of each entity present, including the following:
   1) Outstanding Requests for information (clarification).
   2) Interface requirements.
   3) Sequence of operations.
   4) Status of outstanding submittals.
   5) Deliveries.
   6) Off-site fabrication.
   7) Access.
   8) Site utilization.
   9) Temporary facilities and controls.
   10) Work hours.
   11) Hazards and risks.
   12) Progress cleaning.
   13) Quality and work standards.
   14) Force Account work.
   15) Change Orders and Change Proposals.
   16) Documentation of information for payment requests.

c. Corrective Action Plan: Contractor shall provide a plan of corrective action for any item which is delayed or expected to be delayed, then that item impacts the contractual dates.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Schedule of Prices.
   4. Payment Application.

B. Related Sections include the following:
   1. SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION for preparing a combined Contractor's Construction Schedule.
   2. SECTION 01330 - SUBMITTAL PROCEDURES for submitting schedules and reports.

1.02 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path and control the total length of the project. They must start and finish on the planned early start and finish times.
   2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either the Department or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Schedule of Prices: A statement furnished by Contractor allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Payment Applications.

1.03 SUBMITTALS

A. Required Submittals: Submit eight (8) sets of the list of the required submittals, by Specification Section, within fifteen (15) days after Notice to Proceed. A general listing is provided under SECTION 01330 - SUBMITTAL PROCEDURES.
   1. The listing shall indicate and include the following:
      a. The number of copies required for submittal.

      b. Planned submittal date.

      c. Approval date required by the Contractor.

      d. A space where the "date of submittal" can be inserted.

      e. A space where the "date of approval" can be inserted.

      f. A space where an "action code" can be inserted.

B. Construction Schedule: Submit eight (8) sets of the Construction Schedule for review within fifteen (15) days after Notice to Proceed.

C. Schedule of Prices: Submit three (3) sets of the Schedule of Prices integrated with the Construction Schedule for review within fifteen (15) days after Notice to Proceed.
   1. Use the Department's forms for Payment applications.

D. Payment Application: Submit the payment application at earliest possible date and no sooner than the last day of the month after all payroll affidavits, updated submittal registers, and schedules have been submitted.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate Contractors.

B. Construction Schedule: Coordinate Contractor's Construction Schedule with the Schedule of Prices, Submittals Schedule, loaded monthly event activity, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Schedule of Prices: Coordinate preparation of the schedule with preparation of Contractor's Construction Schedule.
   1. Correlate line items in the Schedule of Prices with other required administrative forms and schedules, including the following:
      a. The Department's Payment Application form and the Construction Progress Report continuation sheet for the event cost estimate per time period.

      b. Submittals Schedule.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Comply with the GENERAL CONDITIONS "SHOP DRAWINGS AND OTHER SUBMITTALS" Article. Furnish required submittals specified in this Section and in the Technical Sections. Submittals include one or more of the following: shop drawings, color samples, material samples, technical data, material safety data information, schedules of materials, schedules of operations, guarantees, certifications, operating and maintenance manuals, and field posted as-built drawings.

B. Preparation: Furnish a schedule of submittals per Project Manager.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Prices, and Contractor's Construction Schedule.

   2. The schedule shall accommodate a minimum of twenty-one (21) calendar days for the State's review, as applicable for the Island the project is located.

   3. Prepare and submit an updated list to the Project Manager at monthly intervals or as directed by the Project Manager. The listing shall reflect all approvals received since the last update.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE - PERT CHART CRITICAL PATH METHOD (CPM)

A. The construction schedule shall address the entire project, to the extent required by the Contract Documents, and shall show an expedient and practical execution of work. If requested by the Project Manager, the Contractor shall participate in a preliminary meeting to discuss the proposed schedule and requirements prior to submitting the schedule.

B. The Construction Schedule shall indicate the following:
   1. Elements of the Project in detail time scaled by month or by week, and a project summary.

   2. The order and interdependence of activities and the sequence in which the work is to be accomplished.

3. How the start of a given activity is dependent upon the completion of preceding activities and how its completion restricts the start of following activities.

4. The submittal and approval of shop drawings, samples, procurement of critical materials and equipment, receipt of materials with estimated costs of major items for which payment will be requested in advance of installation, fabrication of special materials and equipment, and their installation and testing.

5. Activities of the State that have an effect on the progress schedule, such as the required delivery dates for State furnished materials and equipment and other similar items.

6. Provide a separate report with the following:
   a. The description of the activity.

   b. The duration of time in calendar days.

   c. For each activity indicate the early start date.

   d. For each activity indicate the early finish date.

   e. For each activity indicate the late start date.

   f. For each activity indicate the late finish date.

   g. Total float time.

   h. Cost of event.

   i. Contract-required dates for completion of all or parts of the Work.

   j. Events are to be used on “Monthly Progress Report” for monthly payment request.

C. Upon completion of the Project Manager’s review, the Contractor shall amend the schedule to reflect the comments. If necessary, the Contractor shall participate in a meeting with the Project Manager to discuss the proposed schedule and changes required. Submit the revised schedule for review within seven (7) calendar days after receipt of the comments.

D. Use the reviewed schedule for planning, organizing and directing the work, for reporting progress, and for requesting payment for the work completed. Unless providing an update, do not make changes to the reviewed schedule without the Project Manager’s approval.

E. Should changes to the schedule be desired, submit a request in writing to the Project Manager and indicate the reasons for the proposed change. If the changes are major, the Project Manager may require the Contractor to revise and resubmit the schedule at no additional cost to the State. Contractor shall

mitigate the impact of all changes by readjusting the sequence of activities, duration of time, or resources utilizing available float.

1. A change is major if, in the opinion of the Project Manager, the change affects the substantial completion date or other contractual and milestone dates.

2. Minor changes are those that only affect activities with adequate float time.

F. Once the schedule is reviewed by the Project Manager, the Contractor shall submit six (6) sets of the revised schedule within fourteen (14) calendar days.

G. Throughout the duration of the project, the Project Manager may require more detailed breakdowns of activities, logic, and schedule submittals from the Contractor.

H. Updated Schedules: Submit at monthly intervals or as directed by the Project Manager. The schedule shall reflect all changes occurring since the last update including the following:

1. Activities started and completed during the previous period.

2. The estimated duration to complete each activity that was started but not completed.

3. Percentage of cost payable for each activity.

4. Modifications and pending proposed changes.

5. Narrative report describing current and anticipated problem areas or delaying factors with their impact together with an explanation of corrective actions taken or proposed.

I. Failure on the part of the Contractor to submit updated schedules may be grounds for the Project Manager to withhold progress payments for items noted on the schedule.

J. Contractor shall prosecute the work according to the CPM Schedule. The Project Manager shall rely on the reviewed Contractor’s CPM Schedule and regular updates for planning and coordination. The Project Manager’s review of the Contractor’s CPM Construction Schedule does not relieve the Contractor of its obligation to complete the work within the allotted contract time. Nor does the review grant, reject or in any other way act on the Contractor’s request for adjustments to complete remaining contract work, or for claims of additional compensation. These requests shall be processed in accordance with other relevant provisions of the contract.

K. If the Project Manager issues a field order or change order or other directive that affects the sequence or duration of work activities noted on the construction progress schedule, the Contractor shall promptly update the schedule. To accomplish this update, add, delete or revise the work activities noted or change the logic in the schedule to show the Contractor’s plan to incorporate the change into the flow of work. All change orders and time extension requests that affect

the construction schedule shall be evaluated based on their impact on the approved Construction Schedule.

L. If the current work is behind schedule or projected to be behind schedule, such as negative float on a critical activity or inability to meet the Contract Completion Date, the Project Manager may require the Contractor, at the Contractor's cost, to take remedial measures to get the project back on schedule. This may require increasing the work force, working overtime and weekends, air freighting materials, or other similar actions.

M. If at any time the Project Manager determines that any critical activity has fallen behind the CPM schedule by fifteen (15) calendar days or more, the Contractor shall submit a remedial plan to recapture the lost scheduled time. Include a revised schedule. Furnish the remedial plan no later than seven (7) calendar days from Project Manager's notification.

N. If an accelerated schedule is proposed, refer to GENERAL CONDITIONS Section 7.22 "CONSTRUCTION SCHEDULE".

2.03 SCHEDULE OF PRICES

A. Furnish a schedule of prices per Project Manager.

B. Provide a breakdown of the Contract Sum in enough detail to facilitate developing and the continued evaluation of Payment Applications. Provide several line items for principal subcontract amounts, or for materials or equipment purchased or fabricated and stored, but not yet installed, where appropriate. Round amounts to nearest whole dollar; total shall equal the Contract Price.

C. Each item in the Schedule of Prices and Payment Application shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

2.04 PAYMENT APPLICATION

A. Use the Schedule of Prices as the Monthly Construction Progress Report. Each Payment Application shall be consistent with previous applications and payments. The Project Manager shall determine the appropriateness of each payment application item.

B. Payment Application Times: The date for each progress payment is the last day of each month. The period covered by each Payment Application starts on the first day of the month or following the end of the preceding period and ends on the last day of the month.

C. Updating: Update the schedule of prices listed in the Payment application when Change Orders or Contract Modifications result in a change in the Contract Price.

D. Provide a separate line item for each part of the Work where Payment Application may include materials or equipment purchased or fabricated and stored, but not yet installed.

E. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing if required.

F. Provide separate line items for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

G. Payment Application Forms: Use and submit copies of the Payment Application and Construction Progress forms provided by Department. Forms are available at the Department's office. Furnish three (3) copies.

H. Application Preparation: Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of the Contractor.
   1. Entries shall match data on the Schedule of Prices and Contractor's Construction Schedule. Use updated schedules if revisions were made. Include amounts of Change Orders and Contract Modifications issued before last day of construction period covered by application.

I. No payment will be made until the following are submitted each month:
   1. Monthly Estimate, seven (7) copies.
   2. Monthly Progress Report, seven (7) copies.
   3. Statement of Contract Time, seven (7) copies.
   4. Updated Submittal Register, one (1) copy.
   5. Updated Progress Schedule, one (1) copy.
   6. All Daily Reports, one (1) copy.
   7. All Payroll Affidavits for work done, one (1) copy.

J. Retainage: The Department will withhold retainage in compliance with the GENERAL CONDITIONS.

K. Transmittal: Submit the signed original and six (6) copies of each Payment Application for processing.

2.05 CONTRACTOR DAILY PROGRESS REPORTS

A. The General Contractor and all Subcontractors shall keep a daily report of report events.

B. The form of the Contractor Daily Progress Report shall be as directed by the Project Manager.

C. Submit copies of the previous week's reports on Monday morning at 10:00 a.m.

D. Submit copies of the reports with the monthly payment request for the whole period since the last payment request submittal.

E. Deliver the reports in hard copy or by e-mail as directed by the Project Manager.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Comply with the GENERAL CONDITIONS “Shop Drawings and Other Submittals” section and “Material Samples” section.

B. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

C. Related Sections include the following:
   1. SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION for submitting schedules and reports, including Contractor’s Construction Schedule and the Submittals Schedule.

   2. SECTION 01770 - CLOSEOUT PROCEDURES for submitting warranties, project record documents and operation and maintenance manuals.

1.02 SUBMITTAL PROCEDURES

A. Coordinate Work and Submittals: Contractor shall certify the submittals were reviewed and coordinated.

B. Submittal Certification: Provide in MS Word when submitting electronically. Project Manager will provide an electronic copy of the Submittal Certification. Provide a reproduction (or stamp) of the “Submittal Certification” and furnish the required information with all submittals. Include the certification on:
   1. The title sheet of each shop drawing, or on

   2. The cover sheet of submittals in 8-1/2 inch x 11-inch format, or on

   3. One face of a cardstock tag (minimum size 3-inch x 6-inch) tied to each sample. On the sample tag, identify the sample to ensure sample can be matched to the tag if accidentally separated. The opposite face of the tag will be used by the Project Manager to receive, review, log stamp and include comments.

C. Variances: The Contractor shall request approval for a variance. Clearly note any proposed deviations or variances from the Specifications, Drawings, and other Contract Documents on the submittal and also in a separately written letter accompanying the submittal.

D. Submittal Certification Form (stamp or digital)

CONTRACTOR'S NAME: _____

PROJECT: _____

JOB NO: _____

As the General Contractor, we checked this submittal and we certify it is 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.

SUBMITTAL NUMBER _____ DATE RECEIVED _____

REVISION NUMBER _____ DATE RECEIVED _____

SPECIFICATION SECTION NUMBER /PARAGRAPH NUMBER _____

DRAWING NUMBER _____

SUBCONTRACTOR'S NAME _____

SUPPLIER'S NAME _____

MANUFACTURER'S NAME _____

NOTE: DEVIATIONS FROM THE CONTRACT DOCUMENTS ARE PROPOSED AS FOLLOWS (Indicate "NONE" if there are no deviations)

_____

_____

_____

CERTIFIED BY	

Note: Form can be combined with Design Consultant's Review stamp. This is available from the Project Manager.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SUBMITTAL REGISTER AND TRANSMITTAL FORM

A. Contractor shall use submittal register and transmittal forms as directed by the Project Manager.

B. The listing of required submittals within this Section is provided for the Contractor's convenience. Review the specification technical sections and prepare a comprehensive listing of required submittals. Furnish submittals to the Project Manager for review.

C. Contractor shall separate each submittal item by listing all submittals in the following groups with the items in each group sequentially listed by the specification section they come from:
   1. Administrative

   2. Data

3. Tests

4. Closing

D. Contractor shall separate all different types of data as separate line items all with the column requirements.

E. Contractor shall send monthly updates and reconciled copies electronically to the Project Manager and the Design Consultant in MS Word or MS Excel or other format as accepted by the Project Manager.

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer' s Technical Literature and Brochures	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer' s Guaranty or Warranty (Greater than one year)
01310 - Project Management and Coordination											■			■		
01320 - Construction Progress Documenta-tion											■			■		
01330 - Submittal Procedures			■											■		
01400 - Quality Requirements			■				■							■		
01500 - Temporary Facilities and Controls							■							■		
01700 - Execution Requirements														■		
01770 - Closeout Procedures	■								■				■	■	■	

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer' s Technical Literature and Brochures	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer' s Guaranty or Warranty (Greater than one year)
02220 – Selective Demolition	■										■					
02224 – Contaminated Soil Management	■		■				■	■			■			■		
02300 - Earthwork			■	■							■		■			
02315 – Utility Trench Excavation			■											■		
02370 – Sediment and Erosion Control	■		■	■												
02513 – Asphalt Concrete Pavement	■		■	■			■							■		
02630 – Storm Drainage	■		■	■												
02731 – Water System	■		■	■												
02731 – Sewer System	■		■	■												
02770 – Concrete Sidewalks	■		■	■		■	■						■	■		
03113 – Cast-in-Place Concrete Forming	■		■	■												
03200 – Reinforcing Steel	■		■	■												

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer' s Technical Literature and Brochures	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer' s Guaranty or Warranty (Greater than one year)
03300 - Cast-in-Place Concrete	■		■	■			■									
04200 – Unit Masonry	■		■	■			■									
05120 – Structural Steel	■		■	■			■									
05400 - Cold-Formed Metal Framing	■		■	■			■									
07600 – Flashing and Sheet Metal	■		■	■			■									
07611 – Standard Seam Roofing	■	■	■	■		■	■	■						■		
07900 - Sealants		■	■	■	■										■	
08100 – Steel Door and Frames	■			■												
08710 – Finish Hardware			■	■						■					■	
089119 – Fixed Louvers	■	■		■			■			■						
09101 - Painting		■		■											■	
10140 - Signage		■		■												
13650 – Photovoltaic Systems	■			■		■				■	■		■		■	■
15011 – General Mechanical Provisions	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Section No. – Title	Shop Drawings & Diagrams	Samples	Certificates (Material, Treatment, Applicator, etc.)	Product Data, Manufacturer's Technical Literature and Brochures	MSDS Sheets	Calculations	Reports (Testing, Maintenance, Inspection, etc.)	Test Plan	O & M Manual	Equipment or Fixture Listing	Schedules (Project Installation)	Maintenance Service Contract	Field Posted As-Built Drawings	Others	Guaranty or Warranty	Manufacturer's Guaranty or Warranty (Greater than one year)
15400 - Plumbing	■	■	■	■	■	■				■			■	■	■	■
16050 - Basic Materials and Methods				■							■		■		■	
16301 – Underground Electrical Work				■	■						■		■		■	
16500 - Lighting				■						■	■		■		■	■

END OF SECTION

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and for Contractor's Quality Control responsibilities and duties.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

   2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.

   3. Requirements of this Section or by the Department or authorities having jurisdiction, do not limit the Contractor's responsibility to provide quality-control services.

1.02 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Project Manager.

C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.03 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Contracting Officer.

1.04 SUBMITTALS

A. Qualification Data: For QC Manager (alternate QC Manager), inspection and testing agencies, furnish evidence to demonstrate their capabilities and experience. Include proof of qualifications in the form of education, certifications, and license. For the testing agencies, include a recent report on the inspection of the testing agency by a recognized authority.

1. The Project Manager may disapprove any QC Manager (alternate QC Manager), inspection or testing agency or individual employed by the agency when the Project Manager determines it is in the best interest of the State. The Contractor is not entitled to any claim or cost increase or time extension due to the Project Manager's disapproval of an agency or individual.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional. Indicate that the products and systems are in compliance with performance and design criteria required. Include list of codes, loads, and other factors used in performing these services.

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Ambient conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.
   14. Combined Contractor Production and Contractor Quality Control Report, (one sheet): By 10:00 AM the next working day after each day that work is performed.

D. Permits, Licenses, and Certificates: Submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.05 SCHEDULE FOR SUBMITTING INFORMATION AND REPORTS

A. Deliver the original and two (2) copies each of the following to the Department:
   1. Combined Contractor Production and Contractor Quality Control Report, (one (1) sheet): By 10:00 AM the next working day after each day that work is performed.

   2. Field Test Reports: Within two (2) working days after the test is performed, attached to the Contractor Quality Control Report;

   3. Monthly Summary Report of Tests: Two (2) copies attached to the Contractor Quality Control Report;

   4. Testing Plan and Log: Two (2) copies, at the end of each month;

   5. Rework Items List: Two (2) copies, by the last working day of the month;

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Professional Architect or Engineer Qualifications: A professional architect or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing architect or engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

D. Inspection and Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E-548, and that specializes in types of tests and inspections to be performed.

1.07 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Engage qualified inspection or testing agencies to perform quality-control services, unless services are indicated as the Department’s responsibility.

   2. Notify Project Manager and the inspection or testing agencies at least seven (7) calendar days in advance of time when Work that requires testing or inspecting will be performed.

   3. Submit certified written reports of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Retesting and Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with the Department and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify the Project Manager and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

   2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

   3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

   4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.

   5. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.

   2. Incidental labor and facilities necessary to facilitate tests and inspections.

   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

   4. Facilities for storage and field-curing of test samples.

   5. Preliminary design mix proposed for use for material mixes that require control by testing agency.

   6. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.08 QUALITY CONTROL MANAGER

A. Duties: Provide a Quality Control Manager at the work site to implement and manage the QC Program. In addition to implementing and managing the QC Program, the QC Manager may perform the duties of the Project Superintendent. The QC Manager is required to; conduct the QC meetings, perform submittal review, ensure testing is performed and provide QC certifications and documentation required in this Contact. The QC Manager is responsible for managing and coordinating Testing Laboratory personnel and any other inspection and testing personnel required by this Contract.

B. Qualifications: An individual with a minimum of ten (10) years experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have experience in the areas of hazard identification and safety compliance. It is desirable that the QC Manager completed the course “Construction Quality Management for Contractors” offered by the Navy or the Army Corps of Engineers or other similar course.

C. Approval: QC Manager shall be subject to the approval of the Project Manager. Unless the Contractor has a QC Manager on staff, the Contractor shall provide the names of at least three (3) individuals, and shall rank the individuals based on the Contractor’s preference to work with or hire. The Project Manager may approve all or any one of the individuals. If any individual is presently working for the Contractor as a QC Manager, the Contractor may choose to submit only one individual, and that individual is subject to approval.
   1. Furnish evidence showing the individual(s) meets the qualifications, experience, training and other criteria required by this Section.

1.09 RECORD (As-Builts) DRAWINGS

A. The QC Manager is required to ensure the record drawings and jobsite record sets are kept current on a daily basis in accordance with SECTION 01770 - CLOSEOUT PROCEDURES.

1.10 NOTIFICATION OF NON-COMPLIANCE

A. Contractor will be notified of any detected non-compliance items. Take immediate corrective action after receipt of such notice.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. General: On completion testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.02 DEPARTMENT'S AUTHORITY

A. Review and removal of Quality Control Personnel:
   1. All Quality Control organization personnel are subject to review by Project Manager; and the Project Manager may interview any member of the Quality Control organization at any time in order to verify the submitted qualifications.

   2. The Project Manager has the authority to have the QC Manager replaced at any time for cause. Justifications may include, but are not limited to: not being on site when QC Manager's duties are required, or wrongfully approving substandard and noncompliant work.

   3. The Contractor is not entitled to any claim or cost increase or time extension due to the Project Manager's disapproval of an agency or individual.

END OF SECTION

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include but are not limited to, the following:
   1. Water service and distribution.
   2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
   3. Electric power service.
   4. Lighting.

C. Support facilities include, but are not limited to, the following:
   1. Temporary signs.
   2. Storage and fabrication sheds.
   3. Trash, refuse disposal.
   4. Lifts and hoists.
   5. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities and measures include, but are not limited to, the following:
   1. Environmental protection.
   2. Stormwater control.
   3. Site enclosure fence.
   4. Barricades, warning signs, and lights.

E. Related Sections: Refer to Divisions 2 through 16 for other temporary requirements.

1.02 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to the State and shall be included in the Contract Price. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Other Contractors with agreements with the State working within the contract limits.

2. Occupants of Project.

3. Testing agencies.

4. Project Manager and personnel of authorities having jurisdiction.

1.03 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, and similar procedures performed on temporary utilities.

B. Landfill Disposal Receipts: Submit copies of receipts issued by a landfill facility. Include receipts with Contractor Daily Progress Report

1.04 QUALITY ASSURANCE

A. Standards: Comply with UBC Chapter 33, “Site Work, Demolition and Construction”, ANSI A10.6, NECA’s “Temporary Electrical Facilities”, and NFPA 241, "Construction, Alteration, and Demolition Operations".
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.

   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70, “National Electrical Code”.
      a. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to the Project Manager, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Project Manager’s acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.

   2. Relocate temporary services and facilities as required by progress of the Work.

1.06 PREPARATION AND PROTECTION

A. Protection of Property: Continually maintain adequate protection of the Work from damage and protect all property, including but not limited to buildings, equipment, furniture, grounds, vegetation, material, utility systems located at and adjoining the job site. Repair, replace or pay the expense to repair damages resulting from Contractor’s fault or negligence.

B. Before starting work to be applied to previously erected constructions, make a thorough and complete investigation of the recipient surfaces and determine their suitability to receive required additional construction and finishes. Make any repair that is required to properly prepare surfaces, and coordinate the Work to provide a suitable surface to receive following Work.

C. Commencing work by any trade implies acceptance of existing conditions and surfaces as satisfactory for the application of subsequent work, and full responsibility for finished results and assumption of warranty obligations under the Contract.

D. Protect existing (including interiors) work to prevent damage by vandals or the elements. Provide temporary protection. Use curtains, barricades, or other appropriate methods. Take positive measures to prevent breakage of glass and damage to plastic, aluminum and other finishes.

E. Repairs and Replacements: Promptly replace and repair damages to the approval of the Project Manager. Additional time required to secure replacements and to make repairs does not justify a time extension.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Project Manager. Provide materials suitable for use intended.

B. Plastic Enclosure Fence: Industry standard 4-feet high plastic fencing with metal (or wood) post supports at 10-feet on center connected with a top and bottom 12-gage soft annealed galvanized tie wires securely connected to posts. Posts shall be capable of resisting a lateral load of 100 pounds measured at the top of the post.

C. Tarpaulins: Fire resistive labeled with flame spread rating of 15 or less.

D. Water: Potable.

2.02 EQUIPMENT

A. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent or a combination of extinguishers of NFPA recommended classes for exposures. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

B. Self Contained Combination Toilet and Urinal Units: Single occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. One quarter of, or at least one unit shall contain a handwash sink with potable water storage.

C. Drinking Water Fixtures: Drinking water fountains or containerized, tap dispenser, bottled water drinking water units, or water cooler dispensing water at 45 - 55 degree F available at project site including paper cup supply.

D. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110 to 120 V plugs into higher voltage outlets; equipped with ground fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125 VAC, 20 A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Connect to existing service where directed by the Project Manager.
   1. Arrange with utility company, the Department, and existing Users for time when service can be interrupted, if necessary, to make connections for temporary services.

   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked in services.

B. Water Service: A temporary tap into the Facility's existing water system is allowed, subject to the following conditions:
   1. Comply with the Department of Health's and County water provider's requirements when tapping into the existing water system.

   2. Reasonable amounts of water will be available without charge.

   3. Should the Contractor at any time fail to comply with any or all of the above conditions, the Department may terminate the use of water. The Contractor shall remove the hookup within forty-eight (48) hours of notification of such termination.

C. Storm Drainage: Drainage due to construction related activities into any storm drain and any major water runoff from the project site is generally prohibited. Drainage ditches, ponds or similar facilities capable of holding drainage water is recommended if possible. NPDES (National Pollutant Discharge Elimination

System) permit is required for a project site one acre or more of land area (depending on configuration of a project site, it is possible that land area assumed to be less than one acre could be determined to be one acre or more and require a NPDES permit). Supporting documents such as Storm Water Pollution Control Plan, Spill Prevention and Response Plan, Storm Water Monitoring Plan, Best Management Practices Plan and other possible documents may be required for the permit application. The State Department of Health, Clean Water Branch should be contacted to determine all submission requirements for the permit application.

D. Water Service: Make arrangements with the utility company for temporary use of water, and pay for all expenses.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.

   2. Toilets: Use of Facility’s existing toilet facilities will be permitted where and when directed by the Project Manager, as long as facilities are cleaned and maintained in a condition acceptable to User. At Substantial Completion, restore these facilities to condition existing before initial use.

   3. Toilets: Install self contained toilet units when use of User's existing toilet facilities are prohibited. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.

   4. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
      a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

   5. Locate toilets and drinking water fixtures so personnel need not walk more than 200-feet horizontally to facilities.

F. Electric Power Service: Use of Facility's electrical power services will be permitted as long as equipment is maintained in a condition acceptable to the Project Manager.

G. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment. Protect wiring, in conduits or other, measures when exposed to possible damage or traffic areas.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Locate storage sheds, sanitary facilities, and other temporary construction and support facilities as directed by the Project Manager.

   2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion.

   3. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to State.

B. Temporary Sign(s):
   1. Provide and install signs as listed. Sign designs are attached to Part 3 of this Section:
      a. Warning Sign

   2. Install signs where directed by the Project Manager or where indicated to inform public and persons seeking entrance to the Project. Do not permit installation of unauthorized signs.

   3. Provide temporary signs to provide directional information to constructional personnel and visitors.

   4. Construct signs with durable materials, properly supported or mounted, and visible.

C. Trash, Refuse Disposal:
   1. Department of Health - Illegal Dumping Notice. See attachment to Part 3 of this Section.
      a. This Notice to be printed out on 8.5"x11" paper.

      b. This Notice to be posted at the job site field office and/or in locations visible to all contractors, subcontractors, suppliers, vendors, etc. throughout the duration of the project.

   2. Illegal Dumping of solid waste could subject the Contractor to fines and could lead to felony prosecution in accordance with Chapter 342H, HRS. For more information, see the following web site: http://health.hawaii.gov/shwb/files/2013/06/illdump2011.pdf

   3. Provide waste collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.

   4. Do not burn debris or waste materials on the project site.

   5. Do not bury debris or waste material on the project site unless specifically allowed elsewhere in these specifications as backfill material.

6. Haul unusable debris and waste material to an appropriate off site dump area.
   a. Water down debris and waste materials during loading operations or provide other measures to prevent dust or other airborne contaminants.

   b. Vacuum, wet mop, or damp sweep when cleaning rubbish and fines which can become airborne from floors or other paved areas. Do not dry sweep.

   c. Use enclosed chutes or containers to conveying debris from above the ground floor level.

7. 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.

D. Janitorial Services: Provide janitorial services on a weekly basis for first aid stations, toilets, wash facilities, and similar areas.

3.04 ENVIRONMENTAL CONTROLS

A. General: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Comply with all applicable federal, state, local, and HIARNG environmental requirements.

B. Dust Control:
   1. 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 60.1 Air Pollution Control.

   2. Contractor is responsible for and shall determine the method of dust control. Subject to the Contractor's choice, the use of water or environmentally friendly chemicals may be used over surfaces that create airborne dust.

   3. Contractor is responsible for all damage claims due to their negligence to control dust.

C. Noise Control
   1. Keep noise within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 Community Noise Control. Obtain and pay for the Community Noise Permit when construction equipment or other devices emit noise at levels exceeding the allowable limits.

   2. Ensure mufflers and other devices are provided on equipment, internal combustion engines and compressors to reduce loud disruptive noise levels and maintain equipment to reduce noise to acceptable levels.

3. Unless specified elsewhere, do not start construction equipment that meet allowable noise limits prior to 6:45 A.M. or equipment exceeding allowable noise levels prior to 7:00 A.M.

3.05 VIOLATION OF ENVIRONMENTAL PROVISIONS

A. Violations of any of the above environmental control requirements or any other pollution control requirements; which may also be specified in the other Specification Sections, shall be resolved under the SUSPENSION and CORRECTIVE WORK Section of the GENERAL CONDITIONS.

3.06 BARRICADES AND ENCLOSURES

A. Barricades: Before construction operations begin, erect temporary construction barricade(s) to prevent unauthorized persons from entering the project area and to the extent required by the Project Manager.
   1. Maintain temporary construction barricade(s) throughout the duration of the Work. During the course of the project, the Project Manager may require additional barricades be provided for the safety of the public. Contractor shall erect the additional barricade(s) at its own expense.

   2. Construction
      a. plastic fencing

B. Opening Protection
   1. Vertical Openings: Close openings with plywood or similar materials.

   2. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load bearing, wood framed construction.

C. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

3.07 TEMPORARY FIRE PROTECTION

A. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      a. Class ABC dry chemical extinguishers or a combination of extinguishers of NFPA recommended classes for exposures.

      b. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one (1) extinguisher on each floor at or near each usable stairwell.

   2. Store combustible materials in containers in fire safe locations.

   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire exposure areas.

4. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition.

5. Develop and supervise an overall fire prevention and first aid fire protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

6. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.08 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by high temperatures and similar elements.

B. Termination and Removal: Remove each temporary facility when need for its service has ended, or when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the property of Contractor.

3.09 ATTACHMENTS

A. Warning Sign: Requirements for Warning Sign.

B. Department of Health - Illegal Dumping Notice

END OF SECTION

REQUIREMENTS FOR WARNING SIGN

1. General Requirements: Furnish all labor, materials and equipments necessary to construct and install warning signs as specified hereinafter.
2. Materials
    a. Backing: Backing shall be 6061-T6 aluminum 0.032-inch minimum thickness.
    b. Paint: Paint shall be satin finish, exterior grade or factory baked enamel or a combination thereof.
3. Colors: Signs shall have white background. Remaining items shall be similar to Rust-Oleum Federal Safety Red.
4. Requirements for Warning Sign: Message configuration and dimensions shall be in accordance with the attached illustration.
5. Installation
    a. Signs shall be located at 50-foot intervals around roped off work area or at all entrances in the case of interior work.
    b. Signs shall be attached to the rope barrier, rope barrier supports, individual sign supports or buildings. Do not use nails to attach signs to building(s).
6. Clean-up: Remove all signs upon completion of project. Repair any damages caused by sign mounting and removal.

DEPARTMENT OF HEALTH
ILLEGAL DUMPING NOTICE

The law requires you to dispose solid waste only at recycling or disposal facilities permitted by the Department of Health.

"Solid waste" includes municipal refuse, construction and demolition waste, household waste, tires, car batteries, derelict vehicles, green wastes, furniture, and appliances.

Illegal dumping of solid waste or allowing illegal disposal of solid waste on your property even if contractual or other arrangements are made could subject you to fines from $10,000 to $25,000 per occurrence and could lead to felony prosecution in accordance with Chapter 342H, HRS.

Contact the Department of Health, Solid Waste Section at 586-4226 to report illegal dumping activities or if you have further questions.

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including the following:
   1. Construction layout. Field engineering and surveying
   2. General installation of products.
   3. Progress cleaning.
   4. Starting and adjusting.
   5. Protection of installed construction.
   6. Correction of the Work.

B. Related Sections
   1. SECTION 01770 - CLOSEOUT PROCEDURES.

1.02 SUBMITTALS

A. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.03 NOTIFICATION

A. Contact the Project Manager and the Project Contact Person at least three (3) working days prior to starting any onsite work.

1.04 PROJECT AND SITE CONDITIONS

A. Project Contract Limits (Contract Zone Limits) indicate only in general the limits of the work involved. Perform necessary and incidental work, which may fall outside of these demarcation lines. Confine construction activities within the Project Contract Limits and do not spread equipment and materials indiscriminately about the area.

B. Disruption of Utility Services: Prearrange work related to the temporary disconnection of electrical and other utility systems with the Project Manager. Unless a longer notification period is required elsewhere in the Contract Documents, notify the Project Manager at least thirty (30) days in advance of any interruption of existing utility service. Time and duration of interruptions are subject to the Project Manager’s approval. Keep the utility interruptions and duration to a minimum so as not to cause inconvenience or hardship to the facility. If temporary electrical or other utility system hook-up is required, provide the necessary services. Pay for temporary services as part of the contract, unless specifically noted otherwise.

C. Disruption of Air Conditioning Services: Coordinate and arrange work related to the temporary disconnection of the air conditioning system with the Project

Manager. Keep disruptions to a minimum. If temporary power is required, provide services and pay the cost as part of the contract. See Drawings for disruption restrictions. Pay for overtime cost as part of the contract.

D. Contractor's Operations: Provide means and methods to execute the Work and minimize interruption or interference to the Facility's operations. Rearrange the construction schedule when construction activities result in interruptions that hamper the operations of the Facility.

E. Maintain safe passageway to and from the Facility's occupied buildings, rooms and other occupied spaces for the User agency personnel and the public at all times.

F. Contractor, Subcontractor(s) and their employees will not be allowed to park in zones assigned to Users or Facility personnel. Subject to availability, the Project Manager may designate areas outside of the Contract Zone Limits to be used by the Contractor. Restore any lawn area damaged by construction activities.

1.05 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor with a license to practice in Hawaii.

B. Professional Engineer Qualifications: A professional engineer with a license to practice in Hawaii.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINING THE SITE

A. Contractor and Subcontractors are expected to visit the site and make due allowances for difficulties and contingencies to be encountered. Compare contract documents with work in place. Become familiar, with existing conditions, the conditions to be encountered in performing the Work, and the requirements of the Drawings and Specifications.

B. Verify construction lines, grades, dimensions and elevations indicated on the Drawings before any construction begins. Bring any discrepancy to the attention of the Project Manager, and make any change in accordance with the Project Manager instruction.

C. Obtain all field measurements required for the accurate fabrication and installation of the Work included in this Contract. Verify governing dimensions and examine adjoining work on which the Contractor or Subcontractor's work is in any way dependent. Submit differences discovered during the verification work to the Project Manager for interpretation before proceeding with the associated work. Exact measurements are the Contractor's responsibility.

D. Furnish or obtain templates, patterns, and setting instructions as required for the installation of all Work. Verify dimensions in the field.

E. Contractor shall accept the site and the existing Facility in the condition that exists at the time access is granted to begin the Work. Verify existing conditions and dimensions shown and other dimensions not indicated but necessary to accomplish the Work.

F. Locate all general reference points and take action to prevent their destruction. Lay out work and be responsible for lines, elevations and measurements and the work executed. Exercise precautions to verify figures and conditions shown on Drawings before layout of work.

3.02 SITE UTILITIES AND TONING

A. Cooperate, coordinate and schedule work to maintain construction progress, and accommodate the operations and work of the owners of underground or overhead utility lines or other property in removing or altering the lines or providing new services.

B. Contact all the various utility companies before the start of the work to ascertain any existing utilities and to develop a full understanding of the utility requirements with respect to this Project. Furnish the Project Manager with evidence that the utility companies were contacted.

C. Should the Contractor discover the existence and location of utilities in the contract Drawings are not correct, do not disturb the utilities and immediately notify the Project Manager.

D. Do not disturb or modify any utilities encountered, whether shown or not on the Contract Drawings, unless otherwise instructed in the Drawings and Specifications or as directed by the Project Manager. Repair and restore to pre-damaged condition any utilities or any other property damaged by construction activities.

E. Transfer to “Field Posted As-Built” drawings the location(s) of new and existing utilities that differ from the Contract Drawings. Locate by distance from fixed referenced points.

F. Toning: Prior to the start of grading, or excavation or trenching work verify and confirm the presence, location and depth of existing underground utility lines in the area affected by the project, by “toning” or by other appropriate means acceptable to the Contracting Officer. The intent of this advanced toning is to afford the Contracting Officer an opportunity to identify utility lines that may or may not be shown on the drawings and issue a directive to address the existing conditions.
   1. Perform toning using instruments specifically developed and designed for the detection of underground pipes and cable utilities.

2. Notify the Contracting Officer 48 hours in advance before toning operations. Provide information on the proposed toning method and other pertinent information.

G. Recording Toning Information: Upon completion of the toning operation, submit drawings that show the location and approximate depth of the existing and newly discovered utility lines. Identify the type of utility lines. Also, identify where utility lines indicated on the drawings are not shown in their approximate location or where new utility lines are found or pointed out in the field.

H. After ascertaining the exact location of utilities within the project area, mark and protect the locations.
   1. Acquaint personnel working near utilities with the type, size, location of the utilities, and the consequences that might result from disturbances.

   2. Do not start construction until reasonable and appropriate precautions to protect the utilities are taken.

I. For newly identified utility lines, if directed by the Contracting Officer, manually excavate within 2-feet of the utility line to avoid damage. Under this directive, manual excavation is considered additional work.

3.03 FIELD MEASUREMENTS

A. Take field measurements to fit and install the Work properly. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Submit a Request For Information (RFI) immediately upon discovery of the need for clarification of the Contract Documents. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.04 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to existing conditions. If discrepancies are discovered, notify the Project Manager promptly.

B. General: Engage a licensed land surveyor to lay out the Work using accepted surveying practices.
   1. Establish benchmarks, control points, lines and levels at each story or level of construction and elsewhere as needed to locate each element of Project.

   2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

   3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify the Contracting Officer when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level the foundations and piers from 2 or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by the Contracting Officer.

3.05 FIELD ENGINEERING

A. Reference Points: Locate existing permanent or temporary benchmarks, control points and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without the Contracting Officer's approval. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to the Contracting Officer before proceeding.

   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base all replacements on the original survey control points.

3.06 INSTALLATION

A. Install materials, items, fixtures required by the various Divisions and Sections of the Specifications in accordance with Contract Documents, by workers specially trained and skilled in performance of the particular type of work, to meet guarantee and regulatory agency requirements. Should the Drawings or Specifications be void of installation requirements, install the materials, items, and fixtures in accordance with the manufacturer's current specifications, recommendations, instructions and directions.

3.07 CUTTING AND PATCHING

A. Oversee cutting and patching of concrete, masonry, structural members and other materials where indicated on Drawings and as required by job conditions.

Unless noted elsewhere in the contract documents, do not cut or patch existing or new structural members without previously notifying the Project Manager.

B. Provide patch materials and workmanship of equal quality to that indicated on the Drawings or specified for new work.

3.08 CLEANING

A. General: Clean the Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

   2. Do not hold waste more than seven (7) days unless approved otherwise by the Project Manager.

   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.

   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use only cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.09 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions to provide proper temperature and relative humidity conditions.

3.11 CORRECTION OF THE WORK

A. Repair or replace defective construction. Restore damaged substrates and finishes. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair defective components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including the following:
   1. Project Record Documents.
   2. Operation and Maintenance Manuals.
   3. Warranties.
   4. Instruction for the State's personnel.

B. Related documents include the following:
   1. SECTION 01700 - EXECUTION REQUIREMENTS.

1.02 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting a Final Inspection to determine Substantial Completion, complete the following items in addition to requirements of Article 7 of the GENERAL CONDITIONS.
   1. Advise the Project Manager of pending insurance changeover requirements.
   2. Submit specific warranties, final certifications, and similar documents.
   3. Obtain and submit occupancy permits, operating certificates, and similar releases and access to services and utilities, unless waived by the Project Manager.
   4. Arrange to deliver tools, spare parts, extra materials, and similar items to a location designated by the Project Manager. Label with manufacturer's name and model number where applicable.
   5. Make final changeover of permanent locks and deliver keys to the Project Manager. Advise the State's personnel of changeover in security provisions.
   6. Complete startup testing of systems.
   7. Submit test, adjust, and balance records.
   8. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
   9. Advise the Project Manager of changeover in other utilities.
   10. Submit changeover information related to the State's occupancy, use, operation, and maintenance.
   11. Complete final cleaning requirements, including touch up painting.

12. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

13. Submit O&M Manual(s) for review.

1.03 FINAL COMPLETION

A. Preliminary Procedures: Within ten (10) days from the Project Acceptance Date, complete the following items in addition to requirements of GENERAL CONDITIONS Article 7 PROSECUTION AND PROGRESS:
   1. Instruct the State's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training media materials.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit two (2) copies of any updated and action taken list. In addition to requirements of GENERAL CONDITIONS Article 7 PROSECUTION AND PROGRESS, include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

   3. Include the following information at the top of each page:
      a. Project Name and Title.

      b. Job No.

      c. Date and page number.

      d. Name of Contractor.

1.05 PROJECT RECORD DOCUMENTS AND REQUIREMENTS

A. General:
   1. Definition: "Project Record Documents", including Record Drawings, shall fulfill the requirements of "Field-Posted As-Built Drawings" listed in the GENERAL CONDITIONS.

   2. Do not use Project Record Documents for daily construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Project Manager's reference during normal working hours. Maintain these documents as specified in paragraph entitled "Record Drawings" hereinafter.

3. The Designer, under contract with the State, will update the drawings to show all addendum, PCD, and sketch changes. The Project Manager will transmit these drawings (mylar or vellum) to the Contractor who will make all “red-line” corrections to these drawings to record the changes depicted on the Contractor’s Field Posted Record (“As-Builts”) by accepted drafting practices as approved by the Project Manager.

4. Where the recorded changes depicted on the Contractor’s Field Posted Record (“As-Builts”) are in the form of shop drawings, the Contractor shall provide those shop drawings on mylar or vellum sheets in the same material and sheet size as the drawings transmitted to the Contractor. The new drawing sheets shall be titled and numbered to conform to the construction drawings and clearly indicate what information they supercede in the actual construction drawings. For example a new drawing that replaces drawing M-3, could be numbered M3a.

5. The Contractor shall bring to the attention of the Project Manager any discrepancy between the changes made by the Designer and those depicted on addendum, PCD, and sketch changes. The Project Manager will resolve any conflicts.

6. Submit final Record Documents (Field Posted Record Drawings) before the Final Inspection Date and no later than the Contract Completion Date, unless the GENERAL CONDITIONS require otherwise.

7. The Contractor shall guarantee the accuracy of its final Record Documents. The State will hold the Contractor liable for costs the State incurs as a result of inaccuracies in the Contractor’s Record Documents.

8. Prepare and submit construction photographs and electronic files, damage or settlement surveys, property surveys, and similar final record information as required by the Project Manager.

9. Deliver tools, spare parts, extra materials, and similar items to a location designated by the Project Manager. Label with manufacturer’s name and model number where applicable.

10. Submit pest-control final inspection report and warranty.

11. Submit Final, corrected O&M Manual(s).

B. Record Drawings:
   1. Maintain a duplicate full-size set as the Field Posted Record (“As-Builts”) Drawings at the job site. Clearly and accurately record all deviations from alignments, elevations and dimensions, which are stipulated on the drawings and for changes directed by the Project Manager that deviate from the drawings.

   2. Record changes immediately after they are constructed in place and where applicable, refer to the authorizing document (Field Order, Change Order, or

Contract Modification). Use red pencil to record changes. Make Field Posted Record Drawings available to the Project Manager at any time so that its clarity and accuracy can be monitored and can be countersigned for validity.

a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.

b. Accurately record information in an understandable drawing technique.

c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

d. Mark the contract drawings or the shop drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on contract drawings.

e. Mark important additional information that was either shown schematically or omitted from original Drawings.

f. Locate concealed building utilities by dimension from permanent structures. Locate site utilities by dimensions from permanent structures.

g. Note field order numbers, Change Order numbers, Contract Modification numbers, Alternate numbers, post-construction drawing numbers (PCD) and similar identification (RFI numbers) where applicable.

h. The Contractor shall initial each deviation and each revision marking.

3. Use the final updated Contract Drawing set (including all addenda, PCD, and sketches) plus applicable shop drawings for making the final Field Posted Record Drawings submittal.

4. Certify drawing accuracy and completeness. Label and sign the record drawings.

5. Label the title sheet and on all sheets in the margin space to the right of the sheet number, written from the bottom upward, with the title “FIELD POSTED RECORD DRAWINGS” and certification information as shown below. Provide a signature line and company name line for each subcontractor that will also certify the respective drawing. Adjust size to fit margin space.

   FIELD POSTED RECORD DRAWINGS Certified By: _____ Date: _____
   [Contractor’s Company Name]

6. Revise the Drawing Index and label the set “FIELD POSTED RECORD DRAWINGS”. Include the label “A COMPLETE SET CONTAINS [_____] SHEETS” in the margin at the bottom right corner of each sheet. Quantify the total number of sheets comprising the set.

7. If the Project Manager determines a drawing does not accurately record a deviation or omits relevant information, the State will correct any FIELD POSTED RECORD DRAWINGS sheet. Contractor will be charged for the State's cost to correct the error or omission.

8. Use the final Field Posted Record Drawings sheets and create one electronic version of the set. The set shall be recorded in Adobe Acrobat PDF (Portable Document Format). Create a single indexed, bookmarked PDF file of the entire set of drawings and record on the CD. Submit one set of the final Field Posted Record Drawings sheets and the complete electronic CD set(s).

1.06 WARRANTIES

A. Submittal Time: Submit written manufacturer's warranties at request of the Project Manager for designated portions of the Work where commencement of warranties other than Project Acceptance date is indicated.

B. Partial Occupancy: Submit properly executed manufacturer's warranties within forty-five (45) days of completion of designated portions of the Work that are completed and occupied or used by the State during construction period by separate agreement with Contractor.

C. Organize manufacturer's warranty documents into an orderly sequence based on the table of contents of the Specifications.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-inch x 11-inch paper.

   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer and prime contractor.

   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES", Project Name and Title, Job Number, and name of Contractor.

   4. Use the final submittal of the warranties to create an electronic Adobe Acrobat PDF version of the bound warranty documents files. Each sheet shall be separately scanned, at 600 DPI or better into a PDF file, indexed and recorded on a recordable compact disc (CD).

D. Provide two (2) sets of manufacturer's warranties that exceed one (1) year and one (1) CD as part of the closing document submittals. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Assemble complete sets of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment

not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data:
   a. Emergency instructions and procedures.

   b. System, subsystem, and equipment descriptions, including operating standards.

   c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.

   d. Description of controls and sequence of operations.

   e. Piping diagrams.

2. Maintenance Data:
   a. Manufacturer's information, Material Safety Data Sheets, and a list of spare parts.

   b. Name, address, and telephone number of installer or supplier.

   c. Maintenance procedures.

   d. Maintenance and service schedules for preventive and routine maintenance.

   e. Maintenance record forms.

   f. Sources of spare parts and maintenance materials.

   g. Copies of maintenance service agreements.

   h. Copies of warranties and bonds.

B. Use the following 3 paragraph headings, "Notes, Cautions and Warnings", to emphasize important and critical instructions and procedures. Place the words "Notes", "Cautions", or "Warnings" immediately before the applicable instructions or procedures. Notes, Cautions and Warnings are defined as follows:

1. Note: highlights an essential operating or maintenance procedure, condition or statement.

2. Caution: highlights an operating or maintenance procedure, practice, condition or statement which if not strictly observed, could result in damage to or destruction of equipment, loss of designed effectiveness, or health hazards to personnel.

3. Warning: highlights an operating or maintenance procedure, practice, condition, or statement that if not strictly observed, could result in injury to or death of personnel.

C. Organize the Operation and Maintenance Manuals into suitable sets of manageable size. Bind and index data in heavy-duty, “D” type 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Binder color shall be maroon, or if not available red. Identify each binder on front and spine with the printed title “OPERATION AND MAINTENANCE MANUAL”, Project Name and Title include building number when appropriate, Job Number, Prepared For: HIARNG*,* Prepared By*:* [Contractor] and Volume Number. Each binder is a single volume.

D. Electronic Format
   1. Provide all information (narratives, drawings and manual) on a Compact Disc (CD). Provide drawings and plans prepared for the O&M Manuals drawn electronically and saved as a PDF file. Name and index the files for ease of identification and updates.

   2. Provide the complete O&M Manual using Adobe Acrobat PDF files. Each sheet shall be separately scanned into a PDF file, indexed, bookmarked, hyperlinked to the table of contents and recorded on a compact disc (CD). Scanned documents shall be scanned at 600 DPI or better. Indexes and bookmarks may be highlighted or colored text. The final submittal shall include written instructions for installing, accessing and retrieving information from the compact disc.

E. Pre-Final Submittal: Submit two (2) printed sets of Pre-Final Operation and Maintenance Manual, for review by the Project Manager, at least five (5) days prior to scheduled final inspection. Manuals shall be marked as Pre-Final. Make any correction noted before submitting the final Operation and Maintenance Manuals.
   1. The User and the Department will each keep one copy of the Pre-Final submittal to operate and maintain the Facility from the Project Acceptance Date through submission of the final submittal. Therefore, the submittal shall contain all the required information that is available at the time of submission.

   2. One (1) set will be returned with comments. Additional review comments may include problems discovered during the O&M Manual’s review, site validation, and facility start up and will be provided to the Contractor after facility Project Acceptance Date.

F. Final Submittal: Use the final submittal of the manuals to create the electronic PDF file version of the bound Operation and Maintenance Manuals documents. Include the Submittal (100 percent) review comments along with a response to each item. Provide one (1) Final set of the printed manuals and six (6) Final compact discs, (CDs) as part of the closing document submittal. Final printed manual and disks shall be marked as Final and sent to the Project Manager.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 DEMONSTRATION AND TRAINING

A. Instruction: Instruct the State's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Provide instructors experienced in operation and maintenance procedures.
   2. Provide instruction at mutually accepted times.
   3. Schedule training with the State's users, through the Project Manager with at least seven (7) days advanced notice.
   4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
   1. System design and operational philosophy.
   2. Review of documentation.
   3. Operations.
   4. Adjustments.
   5. Troubleshooting.
   6. Maintenance.
   7. Repair.

3.02 FINAL CLEANING

A. General: Provide final cleaning. In addition to requirements of the GENERAL CONDITIONS conduct cleaning and waste-removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturers written instructions unless noted otherwise. Complete the

following cleaning operations before requesting final inspection for entire Project or for a portion of Project:

1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits resulting from construction activities.

3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

4. Remove tools, construction equipment, machinery, and surplus material from Project site.

5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

6. Remove debris and surface dust from limited access spaces, including: roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

7. Sweep concrete floors broom clean in unoccupied spaces.

8. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

9. Remove labels that are not permanent.

10. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.

11. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and other foreign substances.

12. Replace parts subject to unusual operating conditions.

13. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

14. Replace disposable air filters and clean permanent air filters. Clean the exposed surfaces of diffusers, registers, and grills.

15. Clean ducts, blowers, and coils if units were operated without filters during construction.

16. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

17. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the State's property. Do not discharge volatile, harmful, or dangerous materials into drainage and sewer systems or onto State property. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

DIVISION 2 - SITEWORK

SECTION 02220 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. The work to be performed under this section includes the furnishing of all labor, tools, equipment and incidentals necessary to perform all demolition and removal work indicated on the drawings or required for the reception of the new construction specified. This includes, but is not limited to, demolition and removal of existing concrete pavements, drainage structures, landscape bushes, and drain lines and appurtenances, and demolition and removal required for any adjustment, extension or protection of existing utilities.

1.02 JOB CONDITIONS

A. Condition of Existing Improvements: The Owner assumes no responsibility for the actual condition of items or portions of structures to be removed.

B. Interference with Adjacent Occupied Spaces: Maintain free and safe passage to and from occupied spaces. Provide temporary barricades and other forms of protection as required to protect the users from injury due to demolition and/or removal work.

C. Storage or sale of removed items on site will not be permitted.

D. Protection: Provide barricades, warning signs and lighting, and other forms of protection and maintenance and supervision thereof, in accordance with applicable Federal, State and local codes, or as may be directed from time to time as required to protect the users from injury due to selective removal work and to maintain security.
   1. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

   2. Life safety procedures and provisions shall be in conformance with all applicable Federal, State, and City and County regulations, including OSHA.

E. Damages: Promptly repair damages caused to adjacent facilities or areas by removal work at no cost to the Owner.

F. Use of explosives will not be permitted.

1.03 SUBMITTALS

A. Submit a demolition work plan to coordinate the work with the Contracting Officer.

1.04 PERMIT AND FEES

A. Obtain and pay for all necessary permits for removal work prior to commencement of work.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

A. Existing Conditions
   1. The Drawings show general information only. Examine the site to determine the exact existing conditions, character, extent of the work to be performed and demolition operations required to complete the new work.

B. Existing Utilities
   1. The existence of underground utility lines other than those shown on the Drawings is not definitely known. Verify all utility line locations prior to the start of any work.

   2. It is understood and agreed that certain lines cannot be or have not been located and no indication is contained on any of the Drawings or referred to in the specifications (i.e. storm drainage, electrical, plumbing, sewer, water, or telephone); therefore, exercise extreme caution during demolition and like work. Should any such lines be encountered, written notice shall be given to the Contracting Officer, and no further work in the area shall proceed until adequate investigation has been made, the line identified, and instructions are issued as to how to proceed.

   3. The Contractor shall remove all disconnected utilities from the site and provide as-built demolition plans indicating locations of utility caps.

   4. The Contractor shall salvage and return any water meters from demolished laterals to HIARNG.

   5. The Contractor is liable for any and all damages associated with his activities, which may disrupt services as a result of any utility line damage.

C. Equipment: The use of proper equipment is the responsibility of the Contractor.

D. Protection of Utilities: Preserve in operating condition all active utilities traversing or within and about the site; protect all such property and items, including but not limited to power pole, light pole, and other appurtenances and structures. Promptly repair and notify the affected utility facilitator of any damage to such utility or work caused by work under this Contract.

E. Protection of Plant Materials to Remain
   1. Carefully protect existing shrubs and plants, where indicated in demolition plan, within the areas of work and site access during the course of the construction period.

2. The Contractor shall be responsible for maintaining all landscaping within the limits of work for the duration of construction. Maintaining landscape includes watering as well as protection.

3.02 DEMOLITION

A. All work shall be executed as indicated on the plans, with due consideration for all items to remain.

B. Limits of pavement removal shall be as shown on the plans or as directed by the Contracting Officer. Saw cut along the excavation line to produce a uniform break line both vertically and horizontally. Remove paving so as to prevent spalling, cracking or other damage to adjacent paving which is to remain. The Contractor shall at his own expense remove and replace damaged pavement outside the limits of removal. Reuse of demolished concrete pavement as rubble fill shall not be permitted.

C. Cover any open trenches, holes, depressions and pits left open at the end of the working day with steel plates.

D. Plug or cap all existing utilities to be abandoned and not interfering with the work. Remove and dispose of existing piping within the limits of new work. Exercise care and protect the existing earth drainage tunnel during construction.

E. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Contracting Officer in written, accurate detail. Pending receipt of directive from Contracting Officer rearrange selective demolition schedule as necessary to continue overall job progress without delay.

3.03 DISPOSITION OF MATERIAL

A. All materials resulting from removal work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of the project site. Remove rubbish and debris from the jobsite daily, unless otherwise directed; do not allow accumulations inside or outside any buildings or roadways. Transport and legally dispose of materials off site. Remove and transport debris and rubbish in a manner that will prevent spillage on streets or adjacent areas. The Contractor shall comply with all applicable government regulations in disposing of said waste material and shall target 50% of the non-hazardous construction and demolition debris for salvage and recycling.

B. If hazardous materials are encountered during demolition operations, comply with applicable State, Federal and local regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials is not permitted on project site.

3.04 CLEAN-UP AND REPAIR

A. Any disturbance to roadbeds, landscaped areas, brick pavers, etc., shall be restored to original condition. The Contractor shall take care to avoid damage to immediate and surrounding areas and protect property and vehicles.

B. In landscaped areas, remove grass in a manner that will allow replacement close to its original condition. Use a drop cloth or similar ground cover at all times to contain and hold removal of earth and plantings, whether on concrete, asphalt, lawn, and/or landscaped areas.

C. Any concrete, asphalt, or brick pavers removed shall be replaced in as close to original condition as possible, and within the limits of generally accepted trade standards. When regrassing is required, the grass used shall match the surrounding area.

D. The Contractor at his/her expense shall repair damage resulting from removal work. The condition of all existing exposed surfaces shall be equal to or better than that which existed before the removal work. Where the method of repair work is not indicated or specified, the Contractor shall perform the repair work in accordance with the limits of generally accepted trade standards.

E. Remove all evidence of demolition work and leave areas impacted by demolition work in clean and debris-free condition.

END OF SECTION

SECTION 02224 - CONTAMINATED SOIL MANAGEMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS: The GENERAL CONDITIONS, SPECIAL PROVISIONS and SECTION 01010 - GENERAL REQUIREMENTS preceding these specifications shall govern this Section of the work.

1.02 SUMMARY

A. Contaminated soil management shall be carried out in accordance with the State of Hawaii, Department of Health (DOH) Hazard Evaluation and Emergency Response (HEER) Technical Guidance Manual (TGM) and the United States Environmental Protection Agency (USEPA) Land Disposal Restriction regulations. All waste materials shall be transported and disposed of in accordance with applicable State regulations.

B. The Contractor's Environmental Project Coordinator or Geologist will be responsible for documentation of proper soil management (including disposal), and will rely in part on the submittals provided by the Contractor as detailed herein. The Environmental Project Coordinator shall be responsible for collection or analysis of environmental soil samples.

C. The Contractor shall be responsible for the segregation and disposal of petroleum contaminated soil. Petroleum contaminated soil shall be segregated into separate stockpiles.

D. Upon direction from the Environmental Project Coordinator, the Contractor shall excavate contaminated soil from the excavation. Though this contract is not a remedial action project, some limited amount of excavation may allow rapid assessment and closure of the site without requiring a separate mobilization and will be performed under this contract.

C. Excavated contaminated soil shall be placed on and covered by 6-mil plastic sheeting that is secured against wind and rain, and circled with a soil berm. The Environmental Project Coordinator will characterize the soil for disposal and provide documentation of such to the Contractor. The Contractor shall then load the soil into trucks for transport and appropriate disposal.

1.03 HEALTH & SAFETY REQUIREMENTS

A. All work performed under this contract shall comply with Occupational Safety and Health Administration (OSHA) requirements in 29 CFR 1910 and 29 CFR 1926, especially OSHA Standards 29 CFR 1926.65 and 29 CFR 1910.120. In addition, the Contractor shall also follow the requirements of USACE Safety and Health Requirements EM 385-1-1. Matters of interpretation of standards shall be submitted to the Officer-in-Charge for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

B. The Contractor shall develop and implement a site Health and Safety Plan (HASP). The HASP shall address all occupational safety and health hazards (traditional construction as well as contaminant-related hazards) associated with UST removal operations.

C. The Contractor shall designate a primary onsite person as Site Safety Officer (SSO), with responsibility for all health and safety-related aspects of this work. The SSO may also serve other duties, but must have authority to stop work in the event that unsafe conditions occur and to take necessary actions to rectify unsafe conditions so that work can proceed. The

SSO shall have a minimum of two years' experience in the general construction industry with at least one year experience overseeing health and safety oversight with subsurface investigations for contaminated sites. The Contractor shall also appoint an alternate SSO who shall assume SSO duties when the primary SSO is not present on the project site. If operations are performed during more than one work shift per day, an SSO shall be present for each shift.

D. At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Blood Borne Pathogens Standard of 29 CFR 1910, Section 1910.1030. These persons may perform other duties but shall be immediately available to render first aid when needed.

E. Onsite personnel exposed to contaminants shall be provided with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be appropriate for site-specific conditions, including heat and cold stress potential and safety hazards. Only respirators approved by NIOSH shall be used. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the HASP shall include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

F. In the event that contaminated soil is encountered, the Contractor shall immediately notify the Officer-in-Charge and, if human health or the environment is threatened, the National Response Center and the DOH HEER Office.

G. The following items, at a minimum, shall be maintained on site and available for immediate use:

1. First aid equipment and supplies.
2. An emergency eyewash station.
3. Emergency-use respirators (if confined space entry is anticipated or performed.
4. Fire extinguishers of sufficient size and type at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

H. The Contractor’s onsite foreman or superintendent shall have a minimum of two years of contaminated soil remediation experience. The Contractor shall faithfully execute the work with properly trained, qualified, and experienced personnel. At a minimum, the following requirements shall apply for soil excavation work at the site(s):

1. 40-hour OSHA HAZWOPER in accordance with 40 CFR 1910.120
2. Confined Space Entry training, where applicable
3. Heavy Equipment Operator certification, where applicable

I. The Contractor will retain the services of an Environmental Project Coordinator or Geologist from an environmental consulting firm who has signatory authority and responsibility to provide contaminated soil management. The Project Coordinator shall have a minimum of two years of contaminated soil management experience and knowledge of the requirements of the State of Hawaii, DOH HEER Technical Guidance Manual (TGM). The Project Coordinator shall collect soil samples for proper analysis and manage the contaminated soil until it is removed from the project site.

1.04 SUBMITTALS

A. Before starting work, the Contractor shall submit and gain approval for the use of all items to be utilized in the work of this section.

B. Contractor shall submit Contractor's Health & Safety Plan (including applicable worker certifications).

PART 2 PRODUCTS

2.01 MATERIALS

A. Plastic Sheeting: Minimum thickness of 6-mil polyethylene film.

B. Plastic Bags: Minimum thickness 6-mil polyethylene film labeled as specified hereinafter.

C. Tapes: Tape shall be capable of sealing joints of adjacent sheets of polyethylene and for attaching polyethylene sheets to finished or unfinished surfaces of dissimilar materials and capable of adhering under both dry and wet conditions.

D. Warning Labels and Signs: As required by OSHA and HIOSH regulations.

E. Other Materials: Provide all other materials, which may be required to properly prepare and complete this project.

2.02 TOOLS

A. General: Provide and fabricate suitable tools for contaminated soil removal procedures.

B. Other tools and equipment as necessary.

PART 3 EXECUTION

3.01 COMTAININATION SOIL MANAGEMENT: The Contractor shall carry out the work in accordance with the means and methods described in the Contractors bid/proposal and in accordance with the DOH HEER TGM. Deviations therefrom may be acceptable if approved in advance by the Officer-in-Charge, but in no case may the Contractor alter the methods without prior notification and approval.

3.01 SITE RESTORATION: The Contractor shall restore the site in accordance with the design plans and to match existing surrounding conditions at the conclusion of work.

3.02 SPILLS: Immediate containment actions shall be taken as necessary to minimize the effects of any spill or leak. Cleanup shall be in accordance with applicable federal, state, local laws and regulations at no additional cost.

END OF SECTION

January 27, 2020

Mr. Charles L. Jury, P.E,
Senior Associate/Senior Civil Engineer
OKAHARA AND ASSOCIATES, INC.
677 Ala Moana Boulevard
Honolulu, Hawaii 96813

Project No.: TBG-190030

Subject: Environmental Consultation Services for the Hawaii Air National Guard Army Aviation Support Facility, Kalaeloa Improvements (Job No. CA-1825D) at Building 30, Located at Kalaeloa, Kapolei, Hawaii

Dear Mr. Jury:

The Benzing Group LLC, (TBG), provided environmental consultation services for the Hawaii Air National Guard Army Aviation Support Facility (HIARNG), Kalaeloa Improvements (Job No. CA-1825D) Project at Building 30 located at Kalaeloa, Kapolei, Hawaii For this project, environmental services was provided for the: Task 1 - New Wash Station and Task 3 - New Photovoltaic Station with Battery Storage.

Background

In the scoping meeting minutes dated January 31, 2019, under Action Item Section 5, HIARNG commented that there is a stratified layer of contaminated soil approximately 3 feet below grade at the project sites. The soil is contaminated with petroleum oils and lubricants (POLS). Based on this comment, TBG collected grab soil samples during geotechnical drilling activities for the new wash station and the new photovoltaic station with battery storage. The purpose was to identify if the soil in the vicinity of the reported stratified layer was contaminated with POLS.

Soil Sample Collection

On November 12, 2019, TBG conducted soil sampling in areas where geotechnical borings were performed. Yogi Kwon Engineers performed the drilling at locations toned for underground utilities for the new Wash Station and Photovoltaic Station. TBG collected soil samples from augers where drilling was performed from 2.0 to 6.5 feet below grade. Grab samples were collected from the augers at 30 incremental areas using a hand shovel and plastic gloves for placement into a labelled plastic bag. The composite soil sample was placed into a portable cooler with frozen gel ice. One composite soil

The Benzing Group, LLC
329 Auwinala Road, Kailua, Hawaii 96734
(808) 261-7982 office (808) 725-7814 cell ray@thebenzinggroup.com

sample was collected from the wash station (Borehole 3) and a second composite soil sample was collected in the area for the photovoltaic station (Borehole 2).

The two soil samples were delivered to Advanced Analytical Laboratory an Environmental Protection Agency (EPA) and State of Hawaii accredited laboratory located in Honolulu, Hawaii.

Soil Sample Results

The soil samples were analyzed for total petroleum hydrocarbons (TPH) diesel and TPH oil using EPA Method 8015M. Soil Sample HIARNG-BH3-SS1 was collected from the Wash Station and Sample HIARNG-BH2-SS2 was collected from the photovoltaic station. The laboratory reported concentrations of TPH diesel and TPH oil in both samples below the laboratory limits of detection. A copy of the laboratory report is included as an attachment to this report.

Summary and Recommendations

TBG collected soil samples during geotechnical drilling in the areas where the new wash station and photovoltaic station will be constructed at HIARNG. The soil samples were collected from 2.0 to 6.5 feet below grade at the reported stratified layer of suspected petroleum contamination. The laboratory reported TPH diesel and TPH oil at concentrations below the laboratory limits of detection. Based on historical data of the underlying soil, TBG recommends that soil be separated during construction activities by an onsite Geologist into clean soil and suspect contaminated soil piles. The suspect soil pile should be sampled and analyzed to determine soil disposal alternatives.

This report has been prepared by:

Raymond Benzing, M.P.H.
Principal
The Benzing Group, LLC

Attachment: Laboratory Report

ADVANCED ANALYTICAL LABORATORY INC

November 26, 2019

The Benzing Group LLC
329 Auwinala Road
Kailua,HI 96734

Dear Ray Benzing:

Please find enclosed the analytical report for:

Project Name:	Hawaii Air National Guard Improvements
AAL Project #:	U870
Date Received:	11/19/2019
MIS Prep:	Yes

The results, applicable reporting limits, QA/QC data, invoice, and copy of COC are included. If Multi-incremental preparation was needed for this project, it was completed by Advanced Analytical Laboratory, Honolulu, HI.

Advanced Analytical Laboratory appreciates the opportunity to provide analytical services for this project. If you have any questions regarding this project, please don't hesitate to contact AAL.

Thank you for your business and continuing support.

Sincerely,

Uwe Baumgartner, Ph.D
Owner

Elisa M. Young
Owner

544 Ohohia Street #10 HONOLULU HAWAII 96819
tel (808) 836-2252 fax (808) 836-2250

AAL Project #U870

The Benzing Group, LLC.

Client Project #: TBG-190030 Method 8015M

Client Project Name: Hawaii Air National Guard-Improvements Matrix: Soil

CLIENT SAMPLE ID	TPH-DIESEL [mg/kg]	TPH-OIL [mg/kg]	SURROGATE RECOVERY	FLAGS	DATE ANALYZED
Blank	nd	nd	117%		11/25/2019
HIARNG-BH3-SS1	nd	nd	99%		11/25/2019
HIARNG-BH2-SS2	nd	nd	92%		11/25/2019
PQL	50	100	Acceptable Range		
MDL	20	35	70%-130%		

QA/QC DATA

QC BATCH # 112519	TPH-DIESEL [mg/kg]	TPH-OIL [mg/kg]	Acceptable Range
Lab Control Spike (LCS)	552	521	350-650
Matrix Spike (MS)	540	539	350-650
Matrix Spike Dup (MSD)	584	600	350-650
Recovery LCS	110%	104%	70%-130%
Recovery MS	108%	108%	70%-130%
Recovery MSD	117%	120%	70%-130%
RPD of MS/MSD	7.8%	10.7%	20%

Analyst: U. Baumgartner, Ph.D.

Data review: E. Young

ADVANCED ANALYTICAL LABORATORY-CHAIN OF CUSTODY RECORD

Phone: (808) 836 2252 Fax:(808) 836 2250 Address: 544 Ohohia St., unit 10 Honolulu, HI 96819

TURNAROUND TIME: 5day AAL PROJECT#: U870

CLIENT: THE BENZING GROUP, LLC	PROJECT NAME: HAWAII AIR NATIONAL GUARD Improvements
ADDRESS: 329 AUWINALA ROAD, KAILUA, HI. 96734	COLLECTOR: RAY Benzing
PHONE: 725-7814 EMAIL: ray@thebenzinggroup.com	DATE OF COLLECTION: 11/12/2019
CLIENT PROJECT#: TBG-190030	PROJECT MANAGER: 11/19/2019

Sample Number	Time	Sample type	Container Type	Multi-Incremental Volatile	Multi-Incremental Non Volatile	8015M TPH Fuel Scan	8015M TPH Gasoline	8015M TPH Diesel	8015M TPH Oil	8260B Volatiles	8260 BTEX	8270 PAH DOH 4	8270 PAH 17 analytes	8270 Semi Volatiles	8082 PCB	TCLP 8081 OrganoChlorind Pe	8081 Organochlorine Pesticides	Total Lead	Total Cadmium	TCLP RCRA 8 Metals	Total RCRA 8 Metals	Field Notes	Number of containers	Number containers received
HIARNG-BH3-SS1		SOIL	BAG					X	X														1	1
HIARNG-BH2-SS2		SOIL	BAG					X	X														1	1

RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)	DATE/TIME
Raymond Benzing	11/19/2019		11/19/19 1430
RELINQUISHED BY (Signature)	DATE/TIME	RECEIVED BY (Signature)	DATE/TIME

SAMPLE RECEIPT	
TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS INTACT	
RECEIVED IN GOOD CONDITION	Y
TEMPERATURE	2.0°C
PAGE 1 OF 1	

LABORATORY NOTES:

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Section 203 of “Hawaii Standard Specifications for Road, Bridge and Public Works Construction, 2005" is hereby incorporated into and made part of these specifications by reference unless otherwise modified hereinafter with the exception of sections “Measurement” and “Payment”. All grading work shall conform to the recommendations in the Geotechnical Letter Report, “Proposed Wash Rack and Photovoltaic System, Hawaii Army National Guard, Army Aviation Support Facility Building 30”, dated March 2020, prepared by Yogi Kwong Engineers, LLC, herein referred to as the “Geotechnical Report” and attached at the end of this Section.

1.02 WORK DESCRIPTION

A. Furnish all labor, materials, tools, and equipment necessary to complete the site excavation, filling, backfilling, rough and finish grading, overhauling, stockpiling, trench excavation and backfilling, and related items necessary to complete the site grading for the project.

1.03 ORDINANCES AND PERMITS

A. The Contractor shall comply with all applicable ordinances and regulations and obtain the required permits.

B. The Contractor shall comply with the provisions of Chapter 11-55 Water Pollution Control and Chapter 11-54 Water Quality Standards of the Hawaii Administrative Rules, Department of Health, State of Hawaii. The Contractor shall also be responsible for acquisition and payment for permits under the National Pollutant Discharge Elimination System (NPDES).

1.04 UNFORSEEN CONDITIONS BELOW GRADE

A. Data on the subsurface conditions are not intended as representations or warranties of accuracy or continuity between borings and/or test pits.

B. The existence of active underground utility lines within the construction area are 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 Project Manager of such discovery. The Project Manager shall then investigate and issue instructions for the preservation or disposition of the unknown line. The Project Manager shall issue authorization for extra work only as he deems necessary.

C. Topographic survey is the best information available; however, the survey may not reflect some of the recent construction activities.

D. Unforeseen Subsurface Conditions

1. If any conditions not described in the Contract Documents (such as perched water, seepage, and/or lenticular or confined strata of a potentially adverse nature) are encountered during grading, these conditions shall be

immediately brought to the attention of the Project Manager so that supplemental recommendations may be made to treat these problems.

2. Should excavations encounter loose or unsuitable conditions, lava tubes, or voids, the Contractor shall notify the Project Manager immediately so that supplemental recommendations may be given.

1.05 LAYOUT OF PROJECT

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

1.06 QUALITY ASSURANCE

A. Source Quality Control: Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory and paid for by the Contractor.

B. Shoring and Sheeting Plan: Describe materials or shoring system to be used. Indicate whether or not any components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a licensed professional structural or geotechnical engineer licensed in Hawaii. Indicate sequence and method for installation and removal.

C. Dewatering System**:** Describe methods to be employed in removing water from exposed surfaces and diverting surface water from other areas or structures. Describe the basic components of the dewatering system proposed and its planned method of operation. Provide dewatering plan, sketches, or details along with calculations by a licensed professional civil engineer specializing in geotechnical engineering and licensed in Hawaii. Dewatering plan, as a minimum, shall address those requirements outlined in paragraph entitled "Drainage and Dewatering".

D. Test for Moisture-Density Relations**:** Submit test results for each material at least 7 days prior to compacting of each material.

E. Field Dry density and Moisture Content Tests: Submit field test data not listed above sufficiently in advance of construction so as not to delay work. Furnish a drawing showing test locations, test numbers, and elevations. Submit test results within 3 days of test date.

F. Contractor Responsibility
   1. Job and site safety shall be the sole responsibility of the Contractor.

2. The Contractor under the monitoring of a Geotechnical Engineer shall conduct all clearing, site preparation, and grading work performed on the project.

3. It is the Contractor's responsibilities to prepare the ground surface to receive the fills and to place, spread, mix, moisture-condition and compact the fill in accordance with the specifications herein. The Contractor also shall remove all unsuitable material and deleterious materials present within the limits of grading.

4. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill and sub grade material being placed and prepared. If necessary, excavation equipment shall be shut down to allow completion of compaction. The Contractor with due consideration for the fill material, rate of placement, and the time of year also shall provide sufficient watering apparatus.

5. If the Contractor encounters subsurface conditions at the site that: (a) are materially different from those indicated in the Drawings or Specifications, or (b) could not have been reasonably anticipated as inherent in the Work of the character provided in the Contract, the Contractor shall immediately notify the Project Manager orally and in writing within 24 hours. This notification shall be a condition precedent before any negotiations for "changed or differing site conditions" may proceed. If the Project Manager determines that conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the work under the Contract, then negotiations shall commence between the Project Manager and the Contractor to provide an equitable adjustment to the HIARNG or the Contractor resulting therefrom.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials excavated shall be considered to be unclassified and shall be paid for as such, whether earth, boulders, solid rock, concrete, steel, rubbish, wood, or other materials.

B. General Fill and Backfill Material
   1. General fill and backfill material shall conform to Section 4.4 of the Geotechnical Report.

PART 3 - EXECUTION

3.01 GENERAL

A. No excavation or filling shall be undertaken until the area has been cleared and grubbed or soil treated for vegetation control.

B. Install temporary erosion, dust and siltation control measures as shown on the Drawings or ordered by the Project Manager. Remove temporary measures after permanent measures have been established.

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

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

E. The Contractor shall at all times control the grading around building areas so that the ground is adequately sloped to prevent any water from flowing into building areas and open trench excavations. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove water to the extent required in carrying on the work. The Contractor shall obtain the NOI (Notice of Intent) permit from the State Department of Health for any dewatering activities.

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

Construction equipment, which requires water in their operation, shall not be used in the vicinity or within the building area without the approval of the Project Manager.

F. The Contractor shall use the best management practices to reduce the amount of soil erosion resulting from the grading work.

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

G. The areas not covered by concrete or A.C. pavements up to the project limit shall be graded to conform to finish contours with allowance for topsoil as indicated on Drawings.

H. Laying Out

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

2. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Project Manager before proceeding any further with the work, otherwise he will be held responsible for any costs involved in correction of construction placed due to such discrepancies. The Contractor shall be responsible for re-establishing property corners or survey control points that are destroyed by his operations.

3.02 EXCAVATION

A. General Requirements

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

2. Usable Materials as approved by the Geotechnical Engineer shall be stockpiled (for later use as fill material) in a location approved by the HIARNG. Crushing basalt fragments may be necessary prior to reuse in compacted fills. This material may also be excavated directly to fill at the Contractor's option, provided that the materials conform to the requirements of the intended use as specified hereinbefore and sub grade preparation requirements have been met in the fill areas.

3. Non-usable Material such as mud, soft material, and expansive soils and excess materials shall become the property of the Contractor and shall be legally disposed of off-site.

4. Unsuitable sub grade soil, as determined by the Geotechnical Engineer, shall be excavated and removed by the Contractor.

B. Structural Excavation

1. As specified by Section 206 of the "Hawaii Standard Specifications for Road, Bridge and Public Works Construction, 2005" except as modified herein.

C. Trench Excavation

1. As specified in SECTION 02315 - UTILITY TRENCH EXCAVATION AND BACKFILL.

3.03 FILL AND BACKFILL

A. General Requirements

1. Filling operations shall be performed so as to bring the fill area to the finished grades shown on the Drawings, allowing for topsoil and concrete slab paving and base course.

2. In areas with gravelly material, the exposed gravelly material should be scarified to a depth of 6 inches and recompacted to a minimum of 95 percent compaction, as determined by ASTM D 1557, prior to placement of the fill.

B. Placing, Spreading, and Compacting Fill Material

1. When moisture content of the fill material is below optimum, water shall be added until the moisture content is optimum to ensure that the proper compaction can be obtained. When the moisture content of the fill material is above optimum, the fill material shall be aerated until the optimum moisture content is obtained.

2. Backfill at Storm Drain Manhole Slab
   a. Backfill over new construction at abandoned storm drain manhole should be placed in lifts of no more than 6 inches in loose thickness, moisture-conditioned to within 3 percent of is approximate optimum moisture content, and uniformly compacted to at least 85 percent relative compaction as determined by Laboratory Compaction Test ASTM D1557. Compaction of the backfill should be accomplished by a light static compactor to reduce the potential for vibrations into the subsurface. The use of a vibratory compactor is NOT allowed.

3. Testing: Shall conform to Section 4.5 of the Geotechnical Report.

4. Recompaction: Where test results or observations of the Geotechnical Engineer indicate that the moisture content of the fill is not suitable, or that insufficient compaction has been obtained, the fill shall be reconditioned and recompacted prior to placing additional fill material.

   The Contractor shall be responsible for placing and compacting approved fill material in accordance with these Specifications. If the Contractor fails to meet the compaction requirements, he shall stop hauling or reduce his rate of haul, furnish additional spreading, watering and/or compaction equipment as may be required, or make any other adjustments necessary to produce a satisfactory compacted fill.

5. During construction, all fill surfaces shall be sloped to provide positive surface drainage and to prevent ponding of water. If it appears that rain is imminent, the Contractor shall roll the surface with smooth rollers or rubber-tired equipment to seal the surface against excessive infiltration of water. Temporary surface drains and ditches shall be provided by the Contractor as necessary to expedite runoff and to prevent erosion.

C. Slopes and Final Grading

1. The Contractor will be required to obtain a minimum relative compaction of 90 percent of maximum dry density out to the finish fill slope face. Fill slopes shall be constructed by over-building and cutting-back to the finished grades to expose a well-compacted surface.

2. Excavation and embankment shall be finished with all slopes cut true and straight, in accordance with the lines and grades shown in the Drawings. All slopes, whether old or new, shall be maintained with true and smooth surfaces. Over breaks shall be trimmed smoothly and neatly. The tops and ends of all slopes shall be flared and rounded.

3. All cut and fill slopes shall have a minimum of 6 inches of topsoil and shall be grassed by hydro mulching or protected from erosion by other approved methods immediately upon their completion.

4. Cut Slopes
   a. If any conditions not anticipated, such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Geotechnical Engineer and recommendations shall be made to treat these problems. The Contractor shall halt the grading work in such areas until the recommendations are made.

3.04 PROTECTION

A. Protect benchmarks, property monuments, retaining walls, fences, and roads.

B. Protect above and below grade utilities that are to remain.

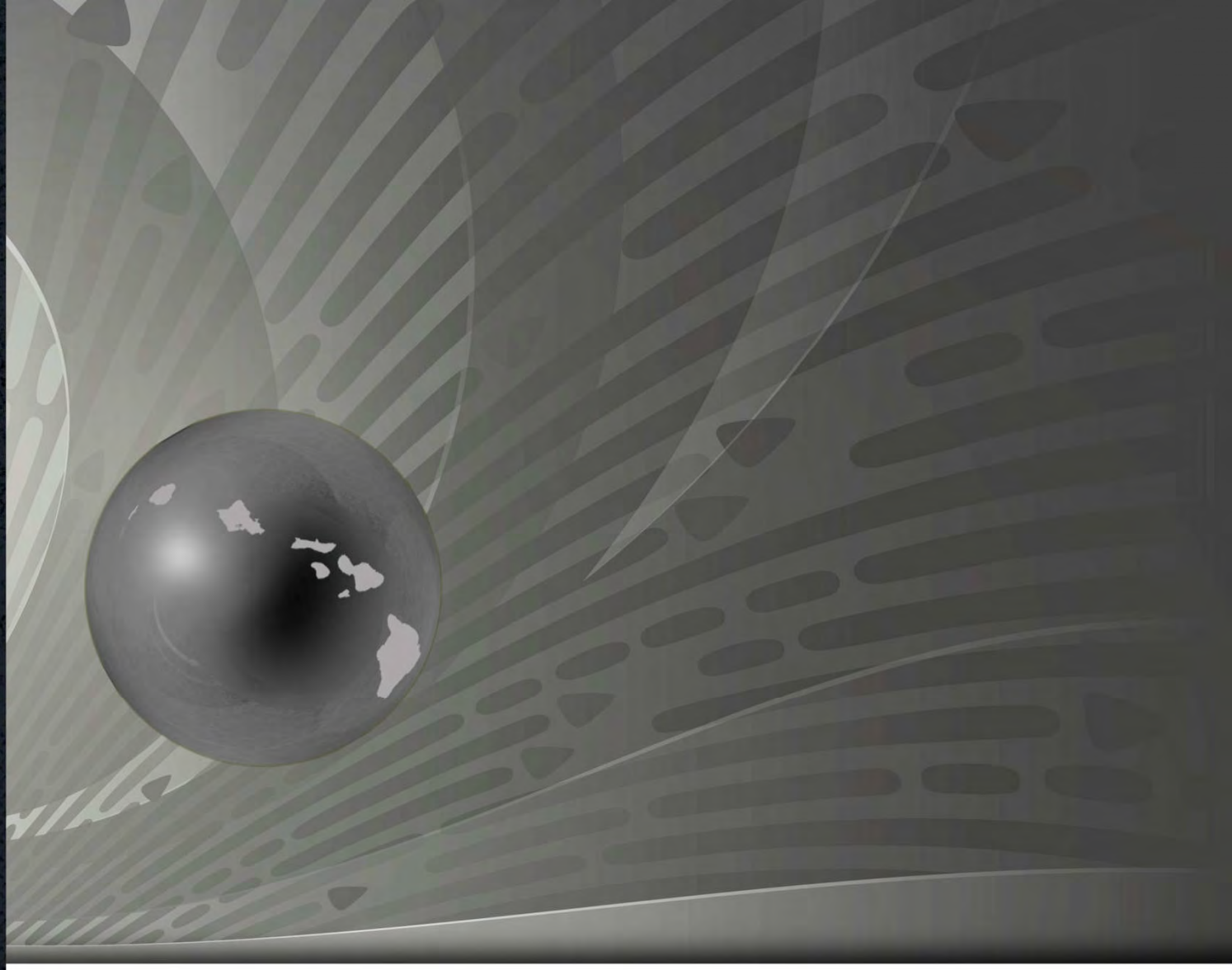
C. Protect newly graded surfaces from traffic and erosion; keep areas free of trash and debris. Repair and re-establish grades in settled, rutted, and eroded areas.

D. Repair all damages caused by and resulting from construction activities in accordance with the requirements of the Standard Specifications and as directed by the Project Manager.

3.05 CLEAN UP

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

END OF SECTION



FINAL SUBMITTAL

Geotechnical Letter Report

Proposed Wash Rack and Phototvoltaic System
Hawaii Army National Guard
Army Aviation Support Facility Building 30

Kalaeloa, Oahu, Hawaii

Prepared for:

Okahara & Associates, Inc.
677 Ala Moana Blvd., Suite 703
Honolulu, HI 96813

Prepared by

Yogi Kwong Engineers, LLC
677 Ala Moana Blvd., Suite 710
Honolulu, Hawaii 96813

March 2020

YKE Project No. 19018

March 17, 2020

Mr. Charles Jury, P.E.
Okahara & Associates, Inc.
677 Ala Moana Boulevard, Suite 703
Honolulu, HI 96813

Subject: **Final Submittal**
Geotechnical Letter Report
Proposed Wash Rack and Photovoltaic System
Hawaii Army National Guard
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii

Dear Mr. Jury,

Yogi Kwong Engineers, LLC (YKE) is pleased to submit this Final Submittal of our Geotechnical Letter Report (henceforth referred to as the Geotechnical Report) in support of the proposed wash rack and photovoltaic (PV) system with battery storage for the Hawaii Army National Guard – Army Aviation Support Facility Building 30 project, in Kalaeloa on the Island of Oahu, Hawaii, for your use.

YKE previously submitted a Draft Geotechnical Report on January 13, 2020 for review and comment. At the time of preparing the Draft Geotechnical Report, it was our assumption that the PV system's trellis would be supported by columns bearing on shallow spread footing foundations. On February 9, 2020, YKE received the 90% pre-final drawings from Okahara & Associates, Inc. (OAI) which indicated that the PV trellis would be supported by columns bearing on 30-inch diameter drilled shaft foundations.

On February 19, 2020, YKE submitted an Interim Geotechnical Memorandum to provide preliminary geotechnical recommendations for using drilled shaft foundations to support the proposed PV trellis as shown in the 90% pre-final drawings. This Geotechnical Report includes the geotechnical recommendations for drilled shaft foundations as an alternate foundation support for the proposed PV trellis for your use.

1.0 INTRODUCTION

This Geotechnical Report summarizes the findings of our geotechnical exploration and presents our geotechnical engineering recommendations for the foundation support, pavement thicknesses, and subgrade preparation of the proposed wash rack and PV system's trellis. The approximate

Yogi Kwong Engineers, LLC
677 Ala Moana Blvd., Suite 710
Honolulu, Hawaii 96813
Tel: (808) 942-0001
Fax: (808) 942-0004

location of the proposed wash rack and PV trellis is shown on the Project Location Map, Figure 1, and the Aerial Photograph of Project Location, Figure 2.

1.1 PROJECT UNDERSTANDING

It is our understanding that the Hawaii Army National Guard (HIARNG) project will include the construction of various improvements (grouped under eight separate tasks) at the Army Aviation Support Facility (AASF) as listed in our revised fee proposal dated March 25, 2019 to Okahara & Associates, Inc. (OAI). The future Building 30 expansion in the vicinity is not part of the current scope for this project.

Of the 8 tasks currently proposed by HIARNG in the Scope of Work (SOW) documents provided by OAI on March 11, 2019, only Task 1 (Wash Rack) and Task 3 (PV System with Battery Storage) now require YKE's geotechnical support as indicated in the Notice To Proceed email dated August 20, 2019 from HIARNG via OAI.

Based on correspondence with the Project Team, it is our understanding that Task 1 will consist of an asphalt concrete (AC) aircraft taxiway and ground vehicle driveway leading to and from the new wash rack area approximately 120 feet x 134.5 feet in footprint, which will be covered by Portland cement concrete (PCC) slabs or pads approximately 2.5 to 3 feet thick. A new control (or equipment) building to house a booster pump, water tank, controls, and various support equipment will be built next to the new wash rack intended for ground vehicles and small aviation vehicles.

Based on the 90% pre-final plan drawings provided to YKE on February 9, 2020, within the proposed wash rack footprint are four new wash stations (two wash stations designated for ground vehicles and two wash stations designated for aircrafts) each made of a sloped concrete pad and equipped with a water cannon, a single light pole, an optional foamer system hose reel, and a pressure washer at the ground vehicle wash stations. During a project team teleconference call on November 14, 2019, YKE was informed that the originally proposed underground water tank would now be located above ground within the new control building to be built between the aircraft wash station and the west-most ground vehicle wash station.

The proposed PV system with battery storage will be built further northwest of the wash rack location along the border zone of an existing parking lot, and will consist of a 20 feet x 295 feet new cantilevered canopy over existing parking stalls with support columns spaced every three stalls within an existing adjacent concrete sidewalk. The PV panels will be located on top of the canopy and sloped back toward the concrete sidewalk at a 12H:2V slope. The canopy is proposed to be tall enough to allow continual parking of passenger vehicles on the existing AC and PCC pavements beneath.

1.2 SCOPE OF SERVICES

The following work was performed by YKE in general accordance with the geotechnical scope of services for Task 1 and Task 3 in our revised fee proposal dated March 25, 2019 to OAI in support of the design and construction of the wash rack and PV system with battery storage for the HIARNG project:

- Reviewed available geotechnical and geologic information pertinent to the geotechnical exploration for Tasks 1 and 3;
- Conducted an initial site visit, selected the exploratory boring locations, and contacted Hawaii One Call Center to tone for underground utilities and clear the boring locations prior to drilling;
- Coordinated with OAI to obtain FAA clearances to perform the geotechnical exploration;
- Supervised and logged the drilling and sampling of three exploratory borings to approximate depths 16.5 to 21.5 feet below the existing ground surface (bgs). Two probe holes were also drilled to approximate depths of 29 to 32 inches bgs to perform in-hole Dynamic Cone Penetrometer tests for field California Bearing Ratio (CBR) correlations;
- Performed geotechnical laboratory testing on selected soil samples and rock cores to evaluate pertinent geotechnical engineering properties of materials encountered;
- Performed geotechnical engineering evaluations pertaining to the following:
    - Allowable bearing capacity, estimated potential settlements, and lateral resistance for footing support of the wash rack control building and PV trellis;
    - Probe and grout considerations for the proposed concrete pads of the wash stations and footing foundations of the wash rack control building and PV trellis;
    - Drilled shafts with different diameters and embedment lengths as an alternate foundation system for the PV trellis;
    - Subgrade preparation, backfill, and compaction requirements; and,
    - Pavement thicknesses for the aircraft taxiway, ground vehicle driveway, and the wash rack stations.
- Summarized the results of our geotechnical field exploration and laboratory test program, and presented our geotechnical recommendations in this Geotechnical Report;
- Performed a quality assurance review of this Geotechnical Report by a Principal Engineer of our firm;

1.3 EXCLUSIONS

The following are specifically excluded from the scope of services for YKE on this project:

- Geotechnical scope of services for Tasks 2, 4, 5, 6, 7, and 8 listed in the SOW documents provided by OAI on March 11, 2019;
- Geotechnical evaluation and recommendations for trench drain excavations and light pole foundations under Task 1;
- Geotechnical scope of services for the future Building 30 expansion;
- General civil engineering, topographic surveying, hydraulic engineering, structural engineering, corrosion engineering, traffic engineering, environmental engineering, and hazardous waste assessments or evaluations; noise variance and construction permit applications; traffic management and control evaluation; archeological services; and construction cost estimating services;
- Environmental evaluation and contaminated soils and groundwater investigations;
- Field and laboratory permeability, percolation, and infiltration testing;
- Seismic site class evaluation;
- Preparation of boring log plan sheets; and,
- Attendance of construction pre-bid conference, public hearings, neighborhood board meetings, and/or community association meetings.

2.0 GEOTECHNICAL EXPLORATION

2.1 FIELD EXPLORATION

The field exploration for this project included three exploratory borings drilled on November 12, 2019 and November 26, 2019 to approximate depths ranging from 16.5 to 21.5 feet bgs, and two probes drilled on November 26, 2019 to approximate depths ranging from 4 to 12 inches bgs. Field DCP tests were performed within the probe holes. Borings B-1 and B-2, and Probe P-1, were performed within the proposed PV trellis footprint provided by OAI on November 7, 2019. Boring B-3 and Probe P-2 were performed within the proposed wash rack footprint provided by OAI. The approximate locations of the exploratory borings and probes are shown on the Approximate Boring Location Plan (Figure 4).

The borings and probes were drilled by YK Drilling, LLC using a Mobile Drill B-54 truck-mounted drill rig with 4-inch and 6-inch diameter solid stem augers and a PQ wireline coring system and using hand augers, under the supervision of a YKE engineer. The drilling methods employed are noted on the Logs of Borings and Logs of Probes, which are presented on Figures A-4 through A-8 of Appendix A. After drilling, the boreholes and probe holes were backfilled with drill cuttings and Quikrete concrete. AC cold patch was used to restore the surface of Boring B-1 and Probe P-1. Geotechnical soil sampling and rock coring were conducted under the supervision of a YKE engineer, who logged the materials encountered in the borings and probes, and obtained samples for further examination and laboratory testing.

Soil samples were obtained using a Modified California Drive sampler (outside diameter (OD) of 3 inches and inside diameter (ID) of 2.5 inches) and a Standard Penetration Test (SPT) sampler (OD of 2 inches and ID of 1.5 inches). The samplers were driven into the ground by successive blows of a 140-pound hammer falling 30 inches. The sampler was driven for a total distance of 18 inches or until refusal, and blow counts for each 6 inches of penetration were recorded. Where the SPT sampler was used, the procedure followed the ASTM D1586 standard for determining the standard penetration resistance of soil. Where the Modified California Drive sampler was used, the procedure followed the ASTM D3550 standard practice for thick wall, ring-lined, split barrel, drive sampling of soils. Blow counts for the last 12 inches of penetration are noted at the appropriate sample depths on the Logs of Borings. A manually grab sample was also taken from Probe P-1 as indicated at the appropriate sample depth on the Log of Probe P-1.

Soil samples recovered from the field were initially classified according to the ASTM D2488 standard and the Unified Soil Classification System shown in Figure A-1 of Appendix A. These classifications were later refined, as necessary, according to ASTM D2487 based on the results of laboratory tests performed on selected samples. Results of these tests are presented on the Logs of Borings and Log of Probe P-1 at the appropriate sample depths, and in Appendix B.

Rock core samples were obtained by using a PQ wireline coring system (approximately 3.25 diameter cores) in maximum 5-foot runs or intervals. Percentages of recovery (REC) and Rock Quality Designation (RQD) were recorded for each core run. The RQD was determined by measuring the percentage of rock pieces greater than 4 inches in length over the entire length of the core run, in general accordance with the ASTM D6032 standard test method. Cores were classified according to Figure A-2, Description of Rock Materials, and as presented on the Log of Boring B-1 at the appropriate sample depths in Appendix A.

Dynamic Cone Penetrometer (DCP) tests were performed at Probes P-1 and P-2 in accordance with ASTM D6951 by YKE's engineering personnel to the approximate depths of 29 and 32 inches bgs, respectively. The DCP probes consisted of continuously driving a 60 degree steel conical tip (20 mm in diameter) into the ground by successive blows of a 17.6 pound hammer falling 22.6 inches. For each DCP test, the number of blows and depth of cone tip penetration were recorded and the values were later converted to DCP indices. The DCP indices were used to correlate CBR values indirectly by application of various equations dependent on soil type, which are provided in ASTM D6951. Results of the DCP tests performed and the correlated CBR values are presented in Figures A-9 and A-10.

2.2 LABORATORY TESTING

Geotechnical laboratory tests were performed on selected soil samples and rock cores recovered from the field exploration to verify our visual field classifications, and to determine pertinent geotechnical engineering properties of the soils and rock encountered in the exploratory boring.

The geotechnical laboratory tests that were performed at YKE's laboratory in Honolulu, Hawaii, included moisture content and density tests (ASTM D2216 and ASTM D7263), gradation analyses by sieve analysis (ASTM D422), a direct shear test (ASTM D3080), and Moh's hardness (on selected core samples). Unconfined compressive strength (UCS) tests (ASTM D7012) on selected core samples were performed by Construction Engineering Labs, Inc. in Pearl City, Hawaii.

The laboratory test results are presented on the Logs of Borings and Log of Probe P-1 at the appropriate sample depths and in Appendix B.

2.3 PREVIOUS GEOTECHNICAL EXPLORATIONS BY OTHERS

This subsection lists previous geotechnical explorations performed by others in the vicinity of the project area for reference only. The referenced information listed below includes geotechnical engineering report figures, borings, and selected laboratory data provided by OAI on March 11, 2019.

- (2015) National Guard Bureau Project No. 150023. Army Aviation Support Facility, Hawaii Army National Guard, Kalaeloa, Oahu, Hawaii. Drawings C-001, C-601, C-602, C-603, and CS-100.

3.0 SURFACE AND SUBSURFACE CONDITIONS

3.1 GENERAL SITE SURFACE CONDITIONS

Based on both the 30% conceptual and 90% pre-final drawings provided to YKE, the proposed wash rack and PV system will be located in the west vicinity of existing Building 30 within the HIARNG AASF property, which is generally bordered by Langley Street, Enterprise Street, Saratoga Avenue, Independence Avenue, Coral Sea Road, and Kalaeloa Airport, within the district of Kapolei, on the island of Oahu, Hawaii.

The AASF property is presently covered by AC pavement and three strips of PCC pavement running from northwest to southeast. A chain link fence stretches across the middle of the site, from the southwest to the northeast, dividing the site into a secured "flight line" area to the south containing support buildings and structures, and an area with an administration building, large parking areas, and a hanger to the north.

The proposed wash rack is located just south of the central chain link fence, within the "flight line" area. The existing ground within the proposed wash rack footprint is covered by relatively level AC and PCC pavements, with elevations ranging from approximately 40 to 42.5 feet MSL. The concrete pavement was observed with occasional visible surface cracks locally. A row of existing light poles is located within the footprint of the proposed wash rack.

The proposed PV trellis is located along the border of an existing parking lot approximately 100 feet northwest of the proposed wash rack. The existing ground within the proposed PV trellis footprint is also paved by relatively level AC and PCC pavements, with elevations ranging from approximately 42 to 44 feet MSL. A raised concrete sidewalk borders the parking lot area behind the proposed PV trellis location. A row of existing light poles is located further behind and parallel to the raised concrete sidewalk, with one light pole located at each end within the parking lot.

Selected photographs of the general site surface conditions taken during YKE's field exploration are included in Appendix D.

3.2 REGIONAL GEOLOGY

The Island of Oahu was formed by the coalescing of two separate volcanic islands formed by the Waianae Volcano in northwest Oahu and the Koolau Volcano in southeast Oahu. The Waianae Volcano moved away from a crustal "hot spot" and ceased eruptions first, over 2.9 million years ago (Sherrod et al, 2007). The Koolau Volcano basalts filled the sea between the two volcanic islands and lapped over the older Waianae Volcano basalts, forming the present Schofield Plateau in the center of Oahu, until the ceasing of eruptions over 1.78 million years ago (Sherrod et al, 2007).

After the Waianae and Koolau eruptions ceased, no further volcanic activity occurred on Oahu for about one million years while the sea level rose and fell during glacial and interglacial periods. During these periods, a large portion of each of the Waianae and Koolau volcanoes were removed by fluvial and marine erosion during the Pleistocene, that created deep valleys and removed the silts and clays derived from the older, weathered basalt. At the base of these valleys, extensive coastal plains unique to Oahu were formed by the accumulation of the alluvial and calcareous marine deposits. After these erosion cycles, the island was submerged more than 1,200 feet, and the valleys were drowned and alluviated.

The project site is located within the Ewa coastal plain. The geologic history of the study area is complicated by sea level changes during the Pleistocene and Holocene epochs. Glacial and interglacial periods resulted in a series of sea level transgressions and regressions.

During glacial periods the sea level was low, and erosion was the dominant geomorphic process due to lowered stream base. Makakilo gulch was probably a major stream channel in the Ewa plain. Large amounts of alluvial sediments were deposited from erosion of the Waianae Volcano, and these deposits are classified as Older Alluvium. Stream sediments were deposited further seaward and below present-day sea level due to the lowered stream base. During the Waipio Low Stand, the sea level may have dropped as much as 350 feet below present-day sea level (Stearns, 1978). As a result, extremely deep alluvial channels cut into the coastal plain and cut through the coral ledges that formed during higher sea level stands.

During interglacial periods the sea level was relatively high, so calcareous reef rock and marine sediments (Qcrs) were formed above the present-day sea level and within the project study area. The sea level was probably as high as 95 feet above present-day sea level during the Kaena High Stand (Stearns and Vaksviks, 1935). The marine-coral reef depositional environment was highly complex, with intercalating coral reef limestone ledges and coralline detritus layers. As a result, the vertical and lateral variations of these calcareous formation and deposits are usually highly variable in all directions.

It is believed that surface and groundwater from the valleys have continued to flow through the complex sequence of alluvial and coralline deposits and coral limestone formation on the coastal plains. Since freshwater contains organic and carbonic acids, caves and sinkholes were formed within the coral formations due to altered and dissolved the calcium carbonate. Coral formations that exhibit these cavities are called karst formations. Current research has found fossils of birds that have been extinct for hundreds of years in Ewa Karst. It is believed that the Ewa Karst subterranean system is approximately 50 square kilometers (Halliday, 1998).

Based on the available geologic information shown on the Regional Geology Map (Figure 3), the project site consists primarily of Calcareous Reef Rock and Marine Sediment (Qcrs), with deposits of Older Alluvium (QTao) mapped approximately 1,750 feet to the northwest of the project site.

3.3 ANTICIPATED SUBSURFACE CONDITIONS

The anticipated subsurface conditions presented in this Geotechnical Report are based on our interpretation of the subsurface data obtained from the geotechnical field exploration and laboratory testing, available geologic maps, and YKE's general experience in this area. More detailed descriptions of the subsurface conditions encountered in the YKE borings are presented on the Logs of Borings in Appendix A.

Based on the exploratory boring and the laboratory test data, the anticipated subsoils at the project site can be generalized into four local geologic units: Fill, Coralline Deposits, Coral Reef Limestone, and Intercalated Older Alluvium with Coralline Deposits.

In general, the project site is primarily underlain by the thin fill unit overlying loose to very dense coralline deposits. In the southwestern portion of the proposed PV trellis location, localized layers of coralline limestone and intercalated older alluvium varying in thickness were encountered within the coralline deposits.

3.3.1 FILL

Fill materials were encountered in all borings drilled for this project from approximately 10 to 12 inches below the existing ground surface to approximate depths of 1.8 to 3 feet bgs. The fill materials primarily consisted of medium dense to dense, grayish tan to tan to brown silty coralline sand or gravel. The Fill layer was overlain by 4 inches of AC pavement and 6 inches of aggregate fill at Boring B-1, and 11 inches of concrete pavement at Borings B-2 and B-3.

Modified California (MC) sample blow counts ranged from 23 to 55 blows per foot with an average of 35 blows per foot. Moisture content ranged approximately from 13% to 29% with an average of 21%. Dry density ranged approximately from 89 to 110 pcf with an average of 100 pcf.

3.3.2 CORALLINE DEPOSITS

Coralline Deposits were encountered in all borings drilled for this project below the Fill layer to an approximate depth of 6.3 feet bgs in Boring B-1, and the approximate explored depths in Boring B-2 (21.5 feet bgs) and Boring B-3 (16.5 feet bgs). In general, the Coralline Deposits primarily consisted of off-white to tan, loose to very dense silty coralline sand and gravel. Cobbles were observed at an approximate depth of 4.8 to 6.2 feet bgs in Boring B-1. Pockets of brown elastic silt were observed in Borings B-2 and B-3 at the approximate depths of 4 to 5 feet bgs.

MC sampler blow counts ranged from 9 to 16 blows per foot with an average of 13 blows per foot. One of the five MC samples resulted in refusal with 75 blows after 4 inches of penetration. SPT sample blow counts ranged from 5 to 64 blows per foot with an average of 27 blows per foot. One of the six SPT samples resulted in refusal with 50 blows per 6 inches. Moisture content ranged approximately from 9% to 16% with an average of 13%. Dry density ranged approximately from 77 to 99 pcf with an average of 87 pcf.

3.3.3 CORAL REEF LIMESTONE

Coral Reef Limestone was encountered below the Coralline Deposits in Boring B-1 at approximate depths from 6.3 to 10 feet bgs, and from 15.8 to the explored depth of 21 feet bgs. The Coral Reef Limestone was generally off-white with tan, medium hard, and highly fractured. From approximately 15.8 feet to the explored depth of 21 feet bgs, the coral reef limestone was interbedded with off-white mottled with tan, very dense, silty coralline sand with gravel.

3.3.4 *INTERCALATED OLDER ALLUVIUM WITH CORALLINE DEPOSITS*

Intercalated Older Alluvium with Coralline Deposits was encountered between the two layers of Coral Reef Limestone in Boring B-1 and was approximately 5.8 feet thick. The intercalated layer consisted of tan to brown, very dense, clayey coralline sand with gravel and cobbles.

All three MC samples resulted in refusal with 25 blows or 60 blows for 3 inches of penetration. SPT sample blow counts were 69 blows per foot. One of the two SPT samples resulted in refusal with no penetration for 10 blows. Moisture content ranged approximately from 13% to 36% with an average of 25%. Liquid limits were approximately 49% and 85%, and plasticity indices were approximately 22% and 51%.

3.4 GROUNDWATER CONDITIONS

Groundwater was not encountered within the explored depths of the borings during the field exploration. The groundwater level is expected to fluctuate with rainfall and tides as the project site is in close proximity to the ocean.

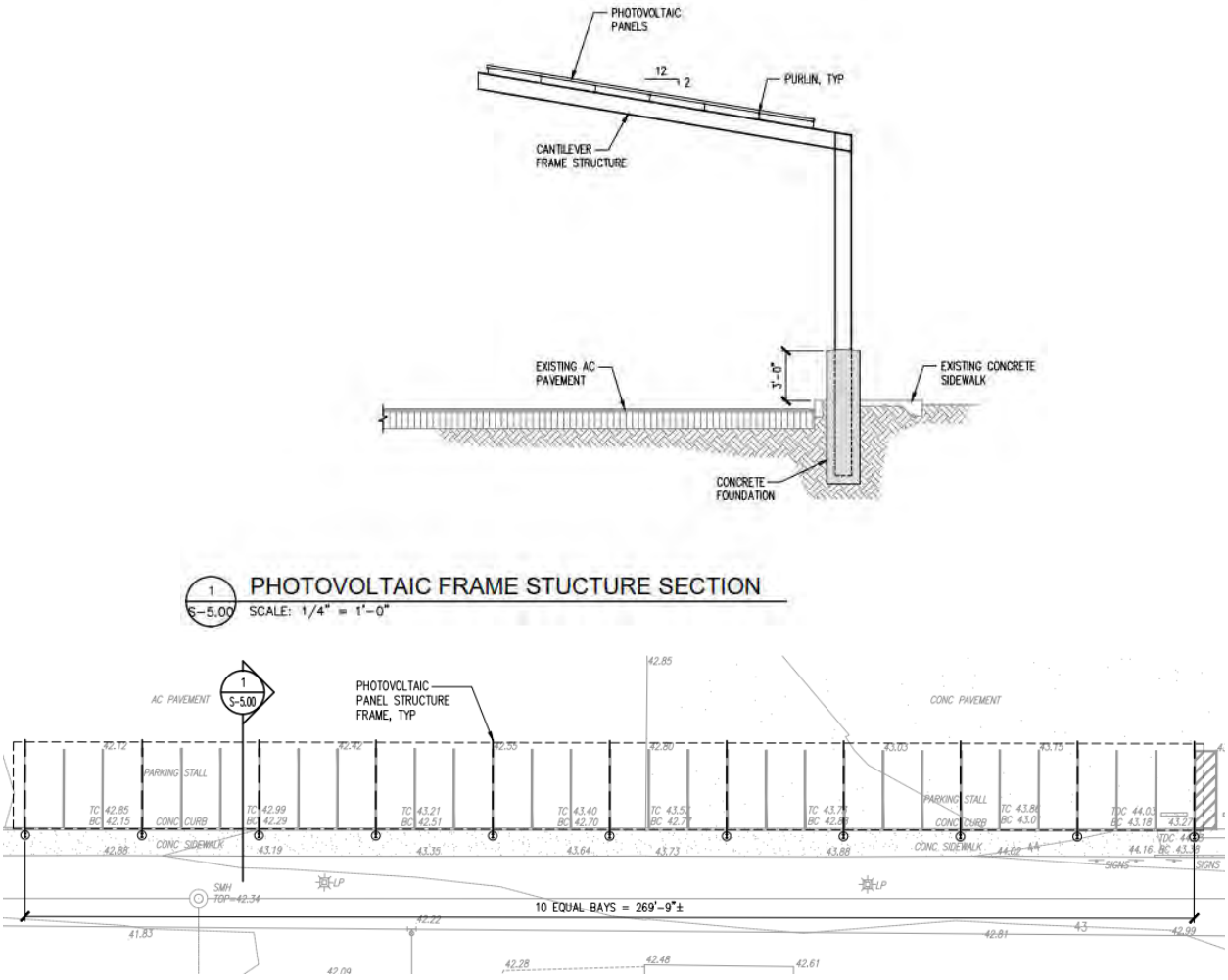
4.0 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

This section presents our pertinent geotechnical considerations and recommendations with minimum requirements for the foundation design and construction of the proposed wash rack control building and PV trellis using spread footing foundations or drilled shafts as alternate foundation support. Also presented are our pertinent geotechnical considerations and recommendations for the aircraft taxiway and ground vehicle driveway AC and wash rack PCC pavement thicknesses, and the required subgrade preparation and backfill compaction requirements.

4.1 SPREAD FOOTING FOUNDATIONS

Based on the 30% conceptual plans provided by OAI, and discussions with the project team, the PV trellis will be supported by columns bearing on shallow spread footing foundations at a 25-foot center to center spacing (every three parking spaces) along the canopy length within the existing raised sidewalk. The PV trellis foundation details, as presented in the 30% conceptual drawings, are shown in Insert 4-1 below.

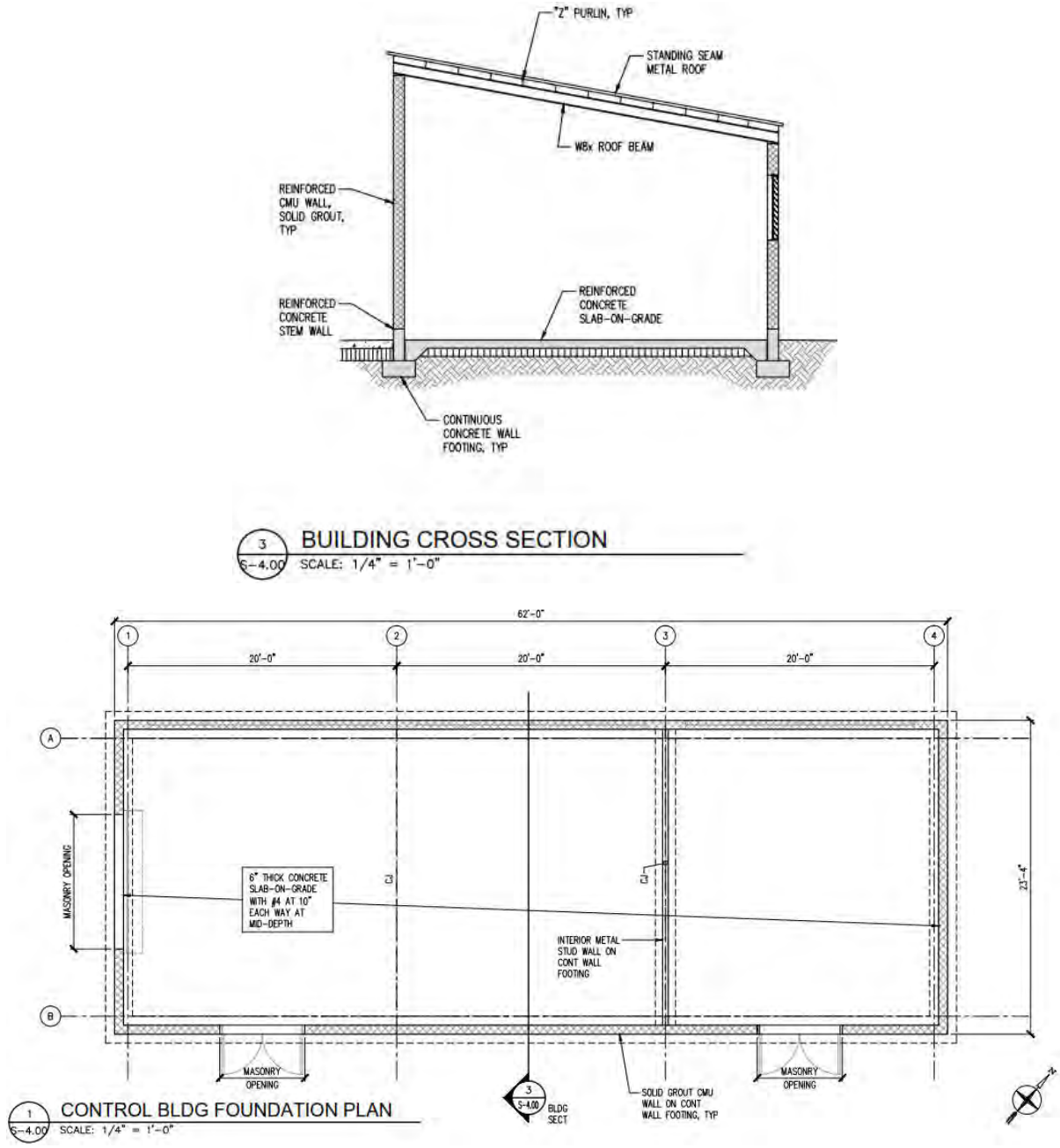
Based on an email response by Kai Hawaii (KAI) on December 6, 2019, the preliminary design loads for a single column supporting the PV trellis are 19.0 kips for axial load, 1.6 kips for lateral shear load, and 192 kip-feet for bending moment.



Insert 4-1: PV Trellis Details (OAI, January 6, 2020)

According to the 30% conceptual plans, the roof structure of the proposed single-story wash rack control building will be supported by perimeter and interior CMU walls bearing on continuous wall footings and a reinforced concrete slabs-on-grade will be provided inside the building. The wash rack control building foundation details, as presented in the 30% conceptual drawings, are shown in Insert 4-2 below.

Based on an email response by Kai Hawaii (KAI) on December 6, 2019, the preliminary design wall load for the wash rack control building is 3.5 kips per foot.



Insert 4-2: Wash Rack Control Building Details (OAI, 2019)

4.1.1 ALLOWABLE BEARING PRESSURES AND POTENTIAL SETTLEMENTS

Based on our foundation support evaluation, it is our opinion that an allowable vertical bearing pressure of 3,000 psf for total dead load plus live loads can be used to design the spread footings and continuous wall footings bearing on properly probed and grouted foundation subgrade with a minimum footing embedment of 2 feet below the lowest adjacent finished grade. A one-third (1/3) increase in the allowable vertical bearing pressure can be used for design when considering all

loads including wind loads and seismic forces. Based on the allowable vertical bearing pressure and the recommended probed and grouted subgrade conditions, the estimated settlements of the continuous wall footings are anticipated to be less than ½ inch total and ½ inch differential.

It is noted that the preliminary design loading, including axial and lateral loads and a large bending moment per column as provided by Kai Hawaii on December 6, 2019 for the PV trellis, may require a large footing size to accommodate the eccentricity of the combined loading on the spread footings. If it is determined that it is not feasible or economical to construct a large enough spread footing to resist the design loading with a large bending moment of 192 kip-feet per column, a continuous mat foundation along the PV trellis footprint or deep foundations such as drilled shafts could be considered. Please refer to Section 4.1.2 of this report for geotechnical recommendations pertaining to drilled shaft foundations.

4.1.2 SLIDING RESISTANCE

An allowable friction coefficient of 0.3 between the footing bottom and the properly re-compacted footing subgrade, and an allowable passive pressure of 200 psf per foot of depth against the footing foundation face can be used to determine the sliding resistance of the footing foundations embedded below the AC parking pavement and concrete sidewalk for design purposes.

The passive pressures are expressed in equivalent fluid pressures. The allowable friction coefficient should be applied to vertical dead loads only and may be used to compute frictional resistance for cast-in-place concrete placed against properly re-compacted subgrade. It should be noted that larger strains are required to mobilize the passive soil resistance as compared to frictional resistance. Based on the tolerable displacements, appropriate factors of safety should be applied if passive subsoil resistance and frictional resistances are considered to act together.

Footings that are designed to resist sliding by means of passive subsoil resistance need to be protected from nearby future excavation, loss or removal of overburden soils, and/or reduction of embedment depth, if anticipated. The top 2 feet of subsoils below the lowest adjacent grade in front of the footings should be excluded when calculating passive resistance of footings as necessary.

4.1.3 PROBE AND GROUT CONSIDERATIONS

Based on the regional geology, YKE Boring B-1 and previous borings by other, karst formations with coral reef limestone were encountered at relatively shallow depths at the AASF site. The previous boring logs by other are included in Appendix E for information. Special design and construction should be given to mitigate potential subsurface cavities and very soft/loose zones

within the underlying coral formations in locations where shallow footing foundations are considered.

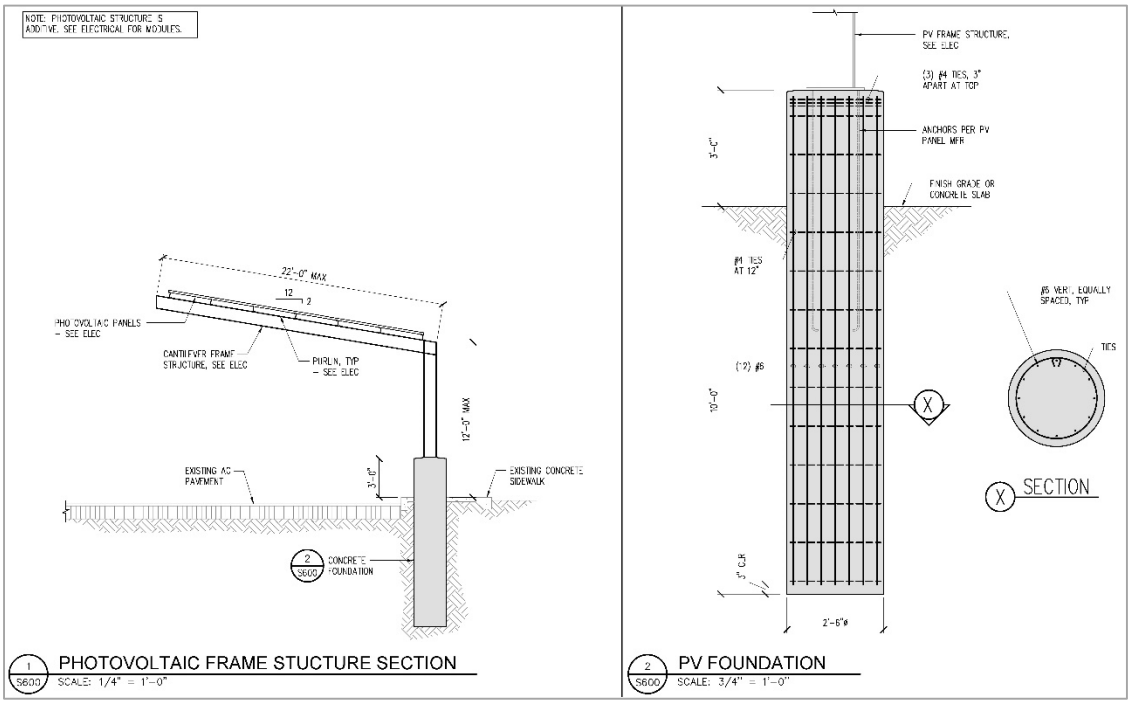
A thorough probe and grout program should be developed and implemented for the PV trellis and wash rack control building shallow foundations. In theory, the bearing stress influence zone could extend to two times the widths of the foundations or deeper, with the highest bearing stress in the upper influence zone. The design assumption is that significant voids, if present within the bearing stress influence zone (especially the upper portion) beneath the foundations, would be properly probed and grouted to reduce the potential of undetected cavities causing local excessive settlements upon loading.

Therefore, prior to the footing foundation construction, we recommend drilling and grouting probe holes a minimum of 3 inches in diameter at a maximum 5-foot spacing along the continuous wall footings, and in each horizontal direction within the footprints of the spread footing foundations, to a depth of at least two times the foundation widths. Any cavities and/or loose zones encountered within the primary bearing stress zones below the footing foundation locations should be filled or densified with cement grout to provide sufficient bearing support for the foundations. Refer to the project specifications for the probe and grout program's minimum requirements.

The foundation probing and grouting could be performed under the supervision of the Contractor-retained Geotechnical Engineer and/or QC Inspector during construction. The probing and grouting records should at least include the drilling rates at maximum 1 foot per minute, the Geotechnical Engineer and/or QC Inspector's observation of drilling progress and drill cuttings, and the amount and rate of cement grout intake.

4.2 DRILLED SHAFT FOUNDATIONS

This section presents our geotechnical recommendations for drilled shaft foundation support to the PV trellis, as an alternative to shallow spread footing foundations. According to the 90% pre-final plans, the PV trellis is proposed to be supported on columns bearing on 30-inch diameter drilled shaft foundations extending to 10 feet below the finished grade (Insert 4-3)



Insert 4-3: Proposed PV trellis foundations (Drawing S600 of the 90% pre-final plans).

As discussed in Subsection 4.11, the preliminary design loads, including dead loads, wind loads, and seismic loads, for a single column supporting the PV trellis are:

- 19 kips for axial load.
- 1.6 kips for lateral shear load.
- 192 kip-feet for bending moment.

The design loads are assumed to be applied atop of the drilled shaft at 3 feet above the adjacent finish grade.

The software programs SHAFT and LPILE by Ensoft Inc. were used to evaluate the proposed 30-inch diameter drilled shaft and a larger 36-inch diameter drilled shaft, based on the available subsoil information. The calculated lateral deflections, bending moments and axial capacities for the evaluated drilled shafts with different diameters and embedment lengths are provided in Tables 4-1 and 4-2 below for design consideration.

Table 4-1: Estimated Lateral Deflections of Drilled Shafts under Design Loads[1]

Shaft Diameter (in)	Depth below Finish Grade (ft)	Deflection at Top of Shaft[2] (in)	Maximum Bending Moment (kip-in)	Depth of Maximum Bending Moment[3] (ft)
30	10	3.50	2,409	1.42
30	13	0.92	2,390	1.48
30	18	0.73	2,390	1.62
36	10	2.17	2,395	1.29
36	12	0.61	2,386	1.50

1. Assume free-head conditions.
2. Top of drilled shaft extends to 3 feet above finish grade.
3. Depth below finish grade.

Table 4-2: Allowable Axial Capacities and Estimated Settlements of Drilled Shafts

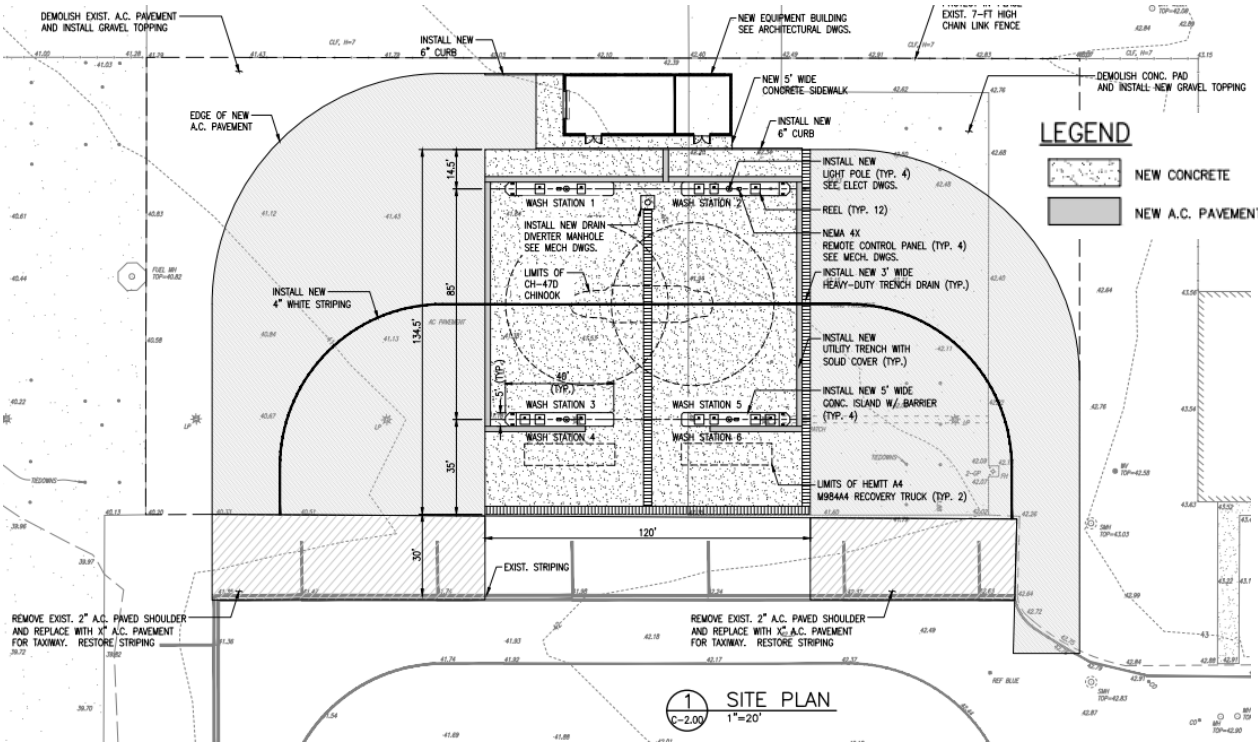
Shaft Diameter (in)	Depth below Finish Grade (ft)	Allowable Axial Capacity[1] (kips)	Estimated Settlement (in)
30	10	138	0.011
30	13	191	0.014
30	18	152	0.012
36	10	168	0.012
36	12	209	0.013

1. For total dead load plus long-term live loads.

4.3 PAVEMENT THICKNESS RECOMMENDATIONS

The proposed AC and PCC pavement areas, as presented in the 30% conceptual plans, are shown in Insert 4-4 below. Based on the updated site layout, we understand that the proposed wash rack will consist of PCC paved wash station areas, with AC paved taxiways and driveways leading to and from the wash rack.

The design traffic based on the vehicle types and weights and their wash frequencies was provided by OAI on November 15, 2019 and is summarized in Table 4-3 below. It was assumed that all areas of the AC and PCC pavements would be subject to the same design traffic load as presented in Table 4-3.



Insert 4-4: Wash Rack Pavement Details (OAI, 2019)

Table 4-3: Design Traffic Loads and Frequencies (OAI, 2019)

Vehicle	Gross Weight (lb)	Vehicle Washing Frequency
Chinook CH-47F Block II	54,000	2 per week
M998 Humvee	67,775	4 per month
HEMTT	25,000	2 per month
FMTV	40,000	4 per month

To support thickness design of the new pavements, both flexible and rigid pavement thicknesses were evaluated based on the UFC Pavement Design for Roads and Parking Areas Manual (UFC 3-250-01, 2016 edition), the UFC Civil Engineering (UFC 3-201-01 with Change 2), and the use of the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) software (Adolf, 2010).

Based on our field CBR tests on the subgrade materials, the observed existing pavement conditions, and the estimated design traffic with negligible projected growth over a design life of 25 years, it appears that both the new AC and PCC pavements should match in thickness with the existing pavement structures that will need to be demolished prior to reconstruction, with consideration of our local experience in maintenance and long term performance of roadway pavements in Hawaii, as presented below:

Flexible Pavements:

5-inch Asphalt Concrete
6-inch Base Course (95% relative compaction per ASTM D1557)
11-inch Minimum Total Thickness on properly compacted subgrade

Rigid Pavements:

11-inch Portland Cement Concrete (flexural strength = 650 psi)
6-inch Subbase (95% relative compaction per ASTM D1557)
17-inch Minimum Total Thickness on properly compacted subgrade

Base course for flexible pavements should consist of locally available aggregate base course meeting the material requirements of Section 703.06, "Aggregate for Untreated Base", of the 2005 edition of the State of Hawaii Department of Transportation (HDOT) Standard Specifications for Roads and Bridges. Subbase for rigid pavements should consist of select borrow meeting the material requirements described in Subsection 4.4 below.

The recommended pavement sections consider that good surface and/or subsurface drainage should be provided to divert surface and underground seepage water away from the pavement areas. The proposed pavement sections should be modified if additional or different traffic mix and loading data become available or a different design life is required.

According to the 90% pre-final plan sheet C100, the wash rack is proposed to be separated into ground vehicle wash stations (Wash Stations 1 and 2) and aircraft wash stations (Wash Stations 3 and 4), with the same wash frequencies shown in Table 4-3. It is our recommendation that the pavement thicknesses presented above based on the 30% conceptual submittal also apply to the currently proposed wash station configuration in the 90% pre-final plans.

4.4 SUBGRADE PREPARATION

Based on the 30% conceptual drawings, the proposed PV trellis will be constructed over the northwestern parking lot where the existing AC and PCC pavements will be demolished and removed at the new foundation footprints. The existing AC and PCC paved areas within the proposed footprints of the wash rack and adjacent control building will also be demolished and removed for the construction of the wash rack PCC slabs and the control building footing foundations.

The excavated subgrades for the spread and continuous wall footing foundations for the proposed PV trellis and wash rack control building should be scarified to a minimum depth of 6 inches below the cleared or foundation subgrade surface, moisture conditioned to within 2% above optimum moisture content, and properly re-compacted to a minimum of 95% relative compaction. Relative

compaction in this report is defined as the dry density of the compacted material expressed as a percentage of the maximum dry density of the same material based on the latest version of ASTM D1557 test procedures. Any rain-impacted subgrade must be adequately dried and properly recompacted prior to footing concrete pour.

Any unsuitable materials and/or boulders encountered at or immediately below the cleared or recompacted subgrade surface should be removed to a minimum depth of 24 inches, replaced with imported select borrow backfill as described in Subsection 4.4 below, and compacted to a minimum of 95% relative compaction.

Soft and/or pumping subgrades, if encountered, should be over-excavated to a minimum depth of 24 inches and replaced to the proposed grade with clean, granular basalt gravel such as ASTM C33/33M Size Number 67 aggregate, wrapped in a suitable geotextile fabric such as Mirafi 140N or equivalent.

4.5 FILL AND BACKFILL MATERIALS

Based on the available boring data, the geotechnical laboratory test results, and YKE's general experience with similar soil conditions, it is our opinion that the open excavations that may be required for construction of the new footing foundations are not anticipated to generate a sizeable amount of granular materials or soils that can be reused as select borrow that meets the requirements specified herein.

Where available, the excavated onsite granular soils may be reused for general fills and backfills outside of any foundation footprint, and no less than 2 feet below the final pavement structure subgrade elevation at new or restored pavement locations. The onsite granular materials should be free of any organics, debris, concrete, old pavements, and any particles larger than 3 inches in maximum dimension. If re-used as general fill and backfill, the onside granular material should be moisture conditioned to within 2% above the optimum moisture content, placed in maximum 8-inch thick loose lifts, and compacted to a minimum of 95% relative compaction.

The fill or backfill below new footing foundations, and the upper 2 feet of fill or backfill below new or restored pavement structures, should consist of imported select borrow consisting of granular materials classified as silty gravel (GM) or well-graded gravel (GW) per ASTM D2487. The select borrow should be free of organics, debris, concrete, old pavement, other deleterious materials, and particles larger than 2-1/2 inches in maximum dimension, with less than 15% fines passing the No. 200 sieve. Quarry products meeting the material requirements of Section 703.17, "Aggregate for Subbase", of the 2005 HDOT Standard Specifications for Roads and Bridges will be acceptable. Select borrow should be placed in maximum 8-inch thick loose lifts and compacted to a minimum of 95% relative density.

The compacted fills and backfills should be maintained in the properly compacted and moisture conditioned state at all times while exposed to weather and construction activities. The Contractor should be required to perform proper quality control field compaction density testing during subgrade and fill compaction and backfill re-compaction in accordance with the project specification requirements, and the recommendations outlined herein. A qualified geotechnical Quality Control (QC) engineer retained by the Contractor should be present onsite to observe and document that the fill and backfill materials are properly moisture conditioned prior to and during compaction, and to test and document that the fill/backfill and subgrade are compacted to meet the project specification's density requirements.

4.6 FILLS AND SUBGRADE TESTING FREQUENCY

We recommend that at least one laboratory compaction density test should be performed for each type of on-site subgrade material to be re-used during construction, and each type of imported fill and/or backfill material to be used. Additional laboratory compaction density tests should be performed for each material source change for QC purposes. Laboratory compaction density tests should be performed in accordance with ASTM D1557.

In-place field compaction tests as part of the project QC program should follow the minimum testing frequency listed below. Field compaction tests should be performed in accordance with ASTM D1556 or ASTM D6938.

- Subgrade for PV trellis footings: Two tests per column.
- Subgrade for wash rack control building wall footings: One test per 50 linear feet, or fraction thereof.
- Fill and backfill for PV trellis footings: Two tests per column per lift.
- Fill and backfill for wash rack control building wall footings: One test per 50 linear feet, or fraction thereof, per lift.

5.0 LIMITATIONS

This Geotechnical Report was prepared solely for the use by OAI, and their designated design consultants on this project only, in general accordance with the scope of services outlined in our March 25, 2019 fee proposal to OAI, and generally accepted geotechnical engineering principles and practices. The geotechnical recommendations and opinions presented in this Geotechnical Report are based on the assumption that the scope of the designed and constructed project as described does not change appreciably, and that significant variations in soil properties from those encountered during the geotechnical exploration for this project do not occur.

This Geotechnical Report presents our opinion of the anticipated subsurface conditions and the geotechnical properties of the subsurface materials anticipated to be encountered during construction of the subject project. While the properties of the materials encountered in the field are expected to be within the ranges discussed, the actual lateral and vertical distribution of materials encountered will likely vary from those discussed in this Geotechnical Report. The descriptions and discussions of anticipated subsurface conditions presented in this Geotechnical Report are intended to assist the project team in design considerations and preparation of construction bid documents. If any conditions notably different from those described here are encountered during construction, we should be immediately notified.

The geotechnical opinions and recommendations given in this Geotechnical Report are based on our evaluation of the data collected for this project. Additive conclusions or recommendations made from this data by others for other uses are their responsibility. No warranty is included, either expressed or implied, that the actual conditions encountered will conform exactly to the conditions described herein. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances in Hawaii. No other representation is intended or implied.

Environmental evaluation and contaminated soils and groundwater investigations, handling and disposal are beyond the scope of this Geotechnical Report. This Geotechnical Report was not intended to investigate potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to make a geoenvironmental exploration differ substantially from those applied in geotechnical engineering.

Note that the scope of service associated with this Geotechnical Report was designed solely to achieve the objectives, schedule, budget, and risk-management preferences that the OAI design team has established for this project. Except for the OAI design team, no one should use or rely on this Geotechnical Report. No one, not even the OAI design team, should use or rely on this Geotechnical Report for any extension of this project, for any other project, or for any other purpose. Unless YKE verifies in writing that it has reviewed the Geotechnical Report and that the proposed use, reuse, or reliance is acceptable, any such use, reuse, or reliance is prohibited and shall be at the user's, reuser's, or relier's sole risks.

6.0 REFERENCES

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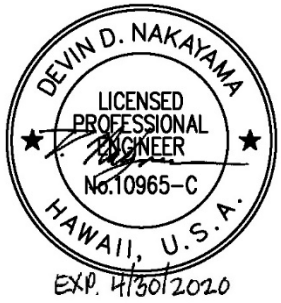
We appreciate the opportunity to provide these services to OAI. This Geotechnical Report has been reviewed for quality assurance purposes by Mr. Michael U. K. Ung, P.E., Principal Engineer. If you have any questions regarding this Geotechnical Letter Report, please do not hesitate to contact us.

Yours truly,
Yogi Kwong Engineers, LLC



Devin Nakayama, P.E.
Associate

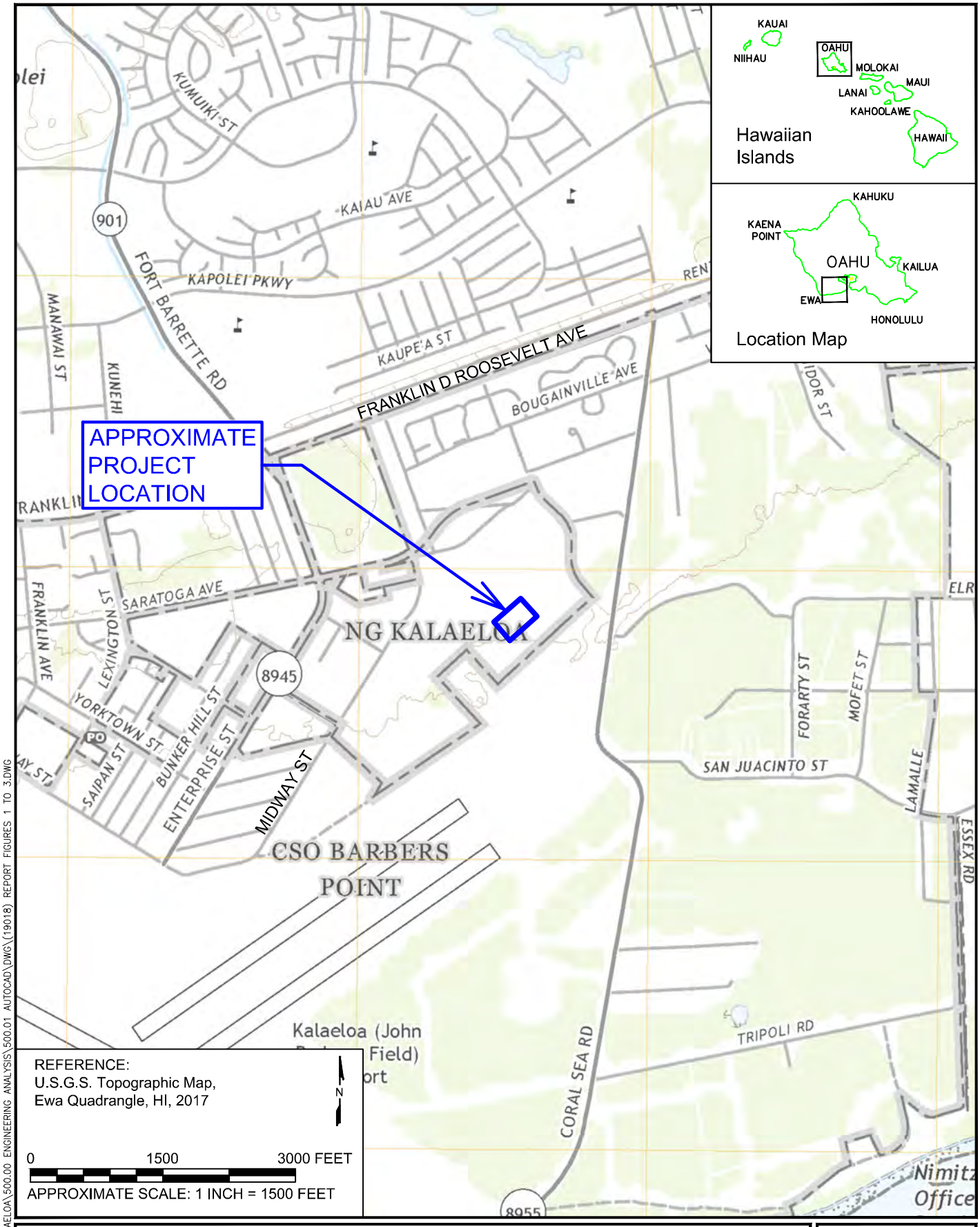
Melia Iwamoto, Ph.D.
Geotechnical Engineer

Attachments:

Figure 1:	Project Location Map
Figure 2:	Aerial Photograph of Project Location
Figure 3:	Regional Geology Map
Figure 4:	Approximate Boring Location Plan

Appendix A:	Field Exploration
Appendix B:	Laboratory Testing
Appendix C:	Photographs of Selected Soil Samples and Cores
Appendix D:	Selected Photographs of Site Conditions Taken During Field Exploration
Appendix E:	Previous Geotechnical Exploration by Other

FIGURES



P:\19018 HIARNG KALAELOA\500.00 ENGINEERING ANALYSIS\500.01 AUTOCAD\DWG\(19018) REPORT FIGURES 1 TO 3.DWG

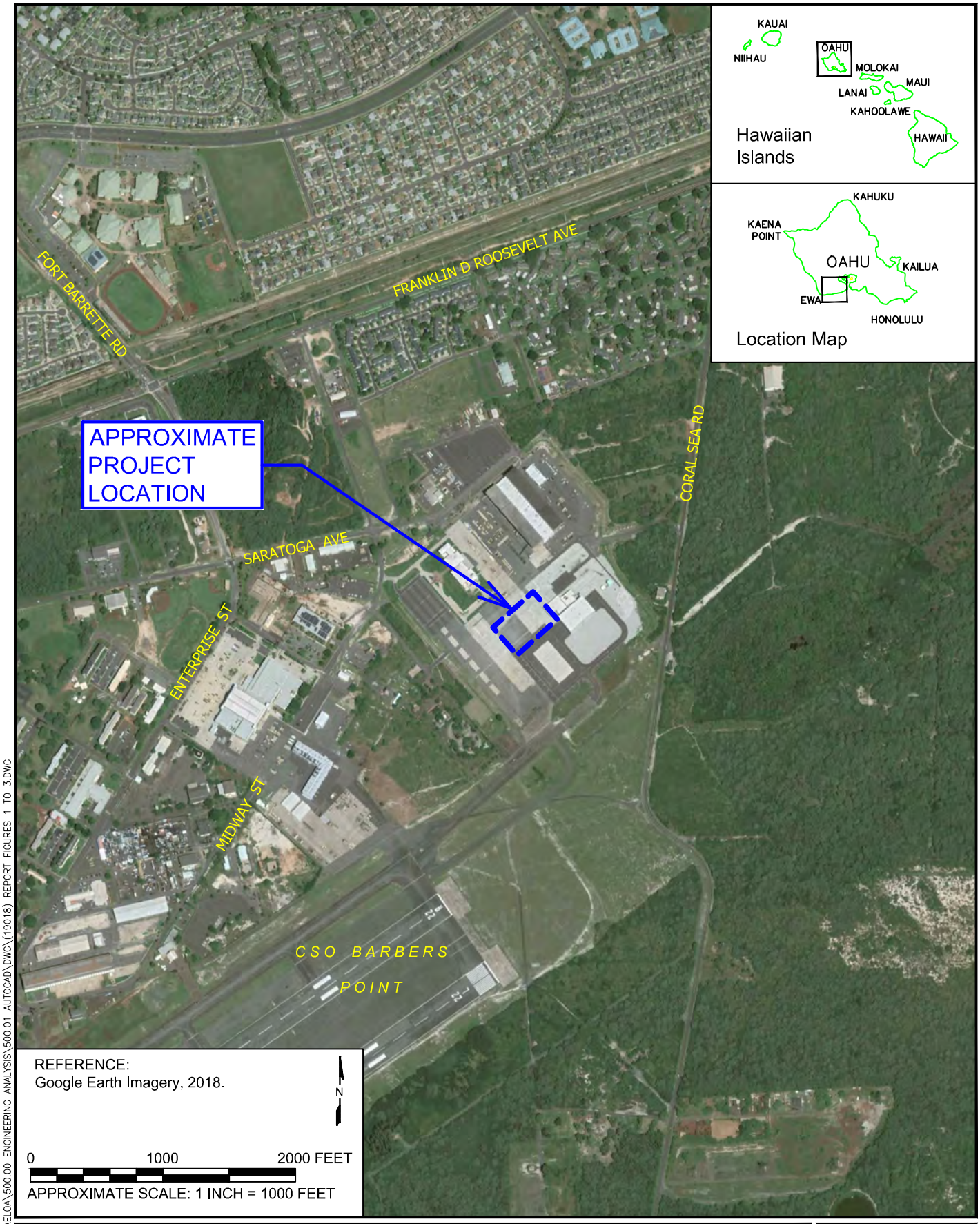
PROJECT LOCATION MAP

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii

Project No. 19018

YOGI KWONG ENGINEERS, LLC

FIGURE 1



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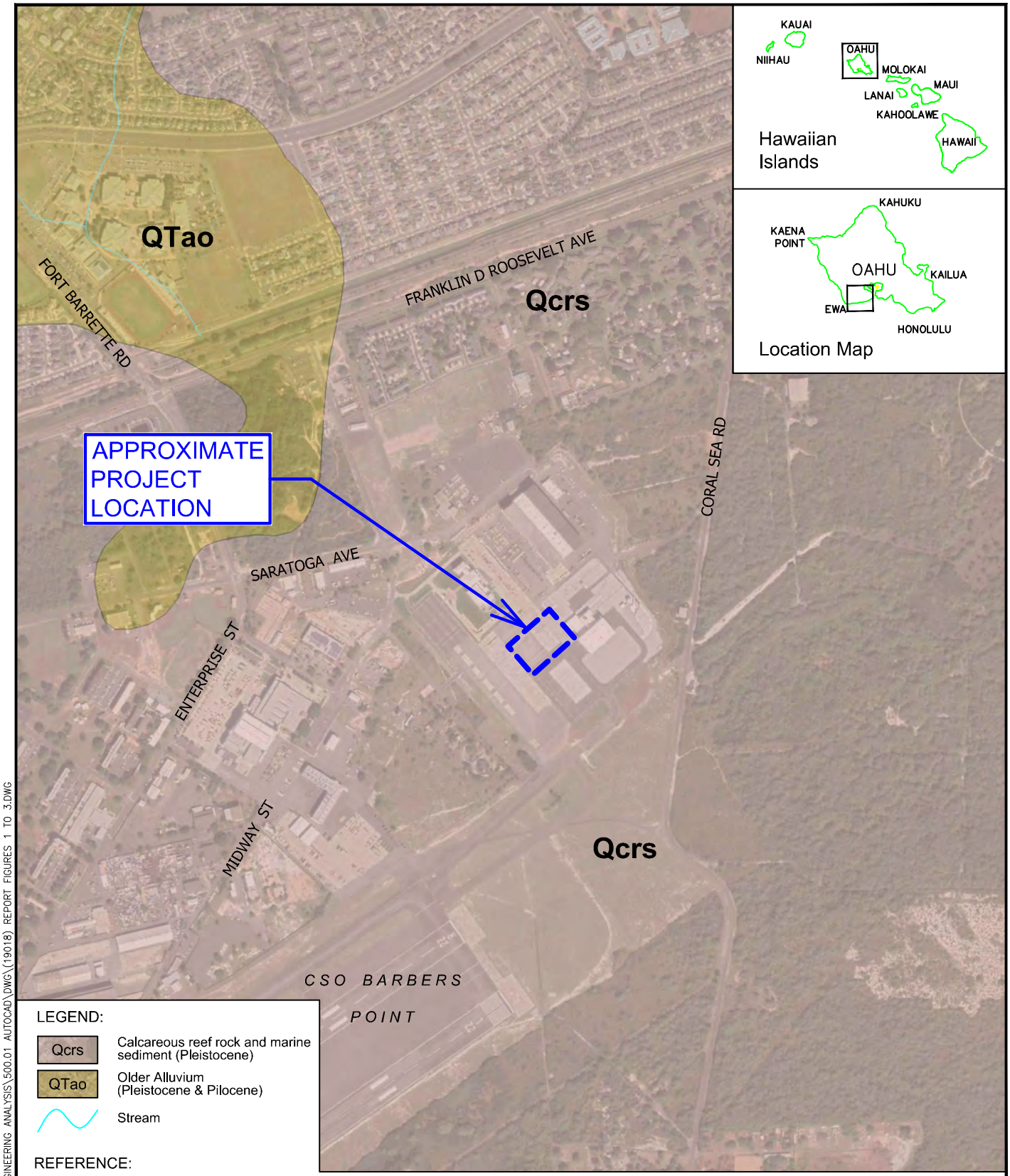
AERIAL PHOTOGRAPH OF PROJECT LOCATION

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii

Project No. 19018

YOGI KWONG ENGINEERS, LLC

FIGURE 2



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REGIONAL GEOLOGY MAP

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii

Project No. 19018

YOGI KWONG ENGINEERS, LLC

FIGURE 3

B-1
P-1
B-2
B-3
P-2
X

LEGEND:

APPROXIMATE BORING LOCATION

APPROXIMATE PROBE LOCATION

APPROXIMATE BORING LOCATION PLAN

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii

Project No. 19018

REFERENCE:

1. Topographic Survey Plans provided by OAI on November 7, 2019.
2. Conceptual Site Plan provided by OAI on January 6, 2020.

0 50 100 FEET

APPROXIMATE SCALE: 1 INCH = 50 FEET

YOGI KWONG ENGINEERS, LLC

FIGURE 4

P:\19018 HARNG KALAELOA\500.00 ENGINEERING ANALYSIS\500.01 AUTOCAD\DWG\(19018) REPORT FIGURE 4 – BORING LOCATION PLAN.DWG

APPENDIX A

Field Exploration

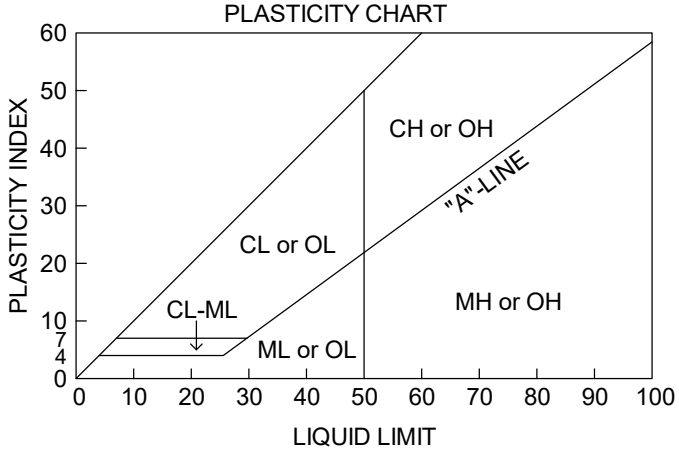
Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOL	TYPICAL NAMES	OTHER CRITERIA
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	GRAVELS (more than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVELS (<5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Cu≥4 and 1≤Cc≤3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting Cu and Cc criteria for GW
		GRAVELS W/ FINES (>12% fines)	GM	Silty gravels, gravel-sand-silt mixtures	Fines classify as ML or MH
			GC	Clayey gravels, gravel-sand-clay mixtures	Fines classify as CL or CH
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (<5% fines)	SW	Well-graded sands, gravelly sands, little or no fines	Cu≥6 and 1≤Cc≤3
			SP	Poorly graded sands, gravelly sand, little or no fines	Not meeting Cu and Cc criteria for SW
		SANDS W/ FINES (>12% fines)	SM	Silty sands, sand-silt mixtures	Fines classify as ML or MH
			SC	Clayey sands, sand-clay mixtures	Fines classify as CL or CH
FINE GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	PI<4 or plots below "A"-line
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays	PI>7 and plots on or above "A"-line
			OL	Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS (Liquid Limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silt	PI plots below "A"-line
			CH	Inorganic clays of high plasticity, fat clays	PI plots on or above "A"-line
			OH	Organic clays of high plasticity, organic silts	
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils	

Notes:
1. Reference: ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
2. Cu = D60 / D10, Cc = (D30^2) / (D60 x D10) where D60, D30, and D10 are diameters associated with 60%, 30% and 10% finer in gradation curves.
3. Dual symbols are used to indicate soils containing 5 to 12% fines, when the plot of the liquid limit and plasticity index values falls into the cross-hatched area of the plasticity chart, or for borderline classifications.

PLASTICITY CHART



GRADATION CHART

Soil Fraction		Size Range			
		Lower Limit		Upper Limit	
		Millimeters	Sieve	Millimeters	Sieve
Boulders		304.8	12*	914.4	36*
Cobbles		76.2	3*	304.8	12*
Gravel		4.76	4**	76.2	3*
Sand	Coarse	2	10**	4.76	4**
	Medium	0.42	40**	2	10**
	Fine	0.074	200**	0.42	40**
Fines				0.074	200**

* U.S. standard sieve opening in inches
** U.S. standard sieve number

FIGURE A-1

DEGREE OF WEATHERING

The following terms were used to describe the chemical weathering of rock:

Residual soil: All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported. The material can be easily broken.

Completely weathered (Saprolite): All rock material is decomposed and/or altered. The original mass structure is still largely intact. The material can be easily broken.

Highly weathered: More than half of the rock material is decomposed and/or altered. Fresh or discolored rock is present as either as a continuous framework or as corestones. A 2-inch diameter core can be readily broken by hand across the rock fabric.

Moderately weathered: Less than half of the rock material is decomposed and/or altered. Fresh or discolored rock is present as either as a continuous framework or as corestones. A 2-inch diameter core cannot usually be broken by hand across the rock fabric.

Slightly weathered: Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh conditions.

Fresh: No visible sign of rock material weathering, perhaps some slight discoloration on major discontinuity surfaces.

HARDNESS

The following terms were used to describe the hardness of rock and soil:

Very soft (friable): Can be peeled by a knife. Crumbles under firm blows with the point of a geologic hammer.

Soft: Can be peeled by a knife with difficulty. Shallow indentations made by firm blows with the point of a geological hammer.

Medium hard: Cannot be scraped or peeled with a knife, but can be scratched with a knife point. Can be fractured with a single firm blow of a geological hammer.

Hard: Difficult to scratch with a knife point. Requires more than one blow of geological hammer to fracture it.

Very hard: Cannot be scratched with a knife. Requires many blows of geological hammer to fracture it.

ROCK FRACTURE CHARACTERISTICS

The general fracture spacing is described in the boring log according to the following criteria:

Crushed: Less than 5 microns (mechanical clay) to 1/2 inch

Intensely fractured: 1/2 to 1 inch (contain no clay)

Highly fractured: 1 to 6 inches

Moderately fractured: 6 inches to 1 foot

Occasionally fractured: 1 to 3 feet

Slightly fractured: Over 3 feet

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF BORING/PROBE KEY

LOCATION:
DATE(S) DRILLED:
CONTRACTOR:
DRILL EQUIPMENT:
GROUND ELEVATION:

LOGGED BY:
HAMMER TYPE:
DRILLING METHOD:
BOREHOLE BACKFILL:

PROJECT NO.: 19018
CHECKED BY:
HAMMER WT./DROP:

DEPTH, FT	SAMPLE TYPE & NO.	● SPT ● 10 20 30 40 / O MOD. CAL. O 18 36 54 72 / RQD % / REC % 20 40 60 80	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				STRATA SYMBOLS					
				Asphalt concrete pavement					
				Concrete					
				Silty gravel (GM)					
5				Silty sand (SM)					
				Clayey sand (SC)					
				Coral reef limestone					
10				Cobbles					
15									
20									
25									

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

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FIGURE A-3

YKE

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF BORING/PROBE KEY

LOCATION:
DATE(S) DRILLED:
CONTRACTOR:
DRILL EQUIPMENT:
GROUND ELEVATION:

LOGGED BY:
HAMMER TYPE:
DRILLING METHOD:
BOREHOLE BACKFILL:

PROJECT NO.: 19018
CHECKED BY:
HAMMER WT./DROP:

DEPTH, FT	SAMPLE TYPE & NO.	● SPT ● 10 20 30 40 / O MOD. CAL. O 18 36 54 72 / RQD % / REC % 20 40 60 80	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
25		30●		SAMPLE AND OTHER SYMBOLS Standard Penetration Test (SPT) sampler, and number of blows to advance sampler the last 12 inches, or distance indicated Modified California sampler, and number of blows to advance sampler the last 12 inches, or distance indicated Core sample Grab sample Percent recovery: Length of sample or core recovered divided by distance the sampler was driven or core run length Rock Quality Designation (RQD): Sum of lengths of all pieces of sound rock over 4 inches in length divided by core run length					
30		O30							
35		80 30							
40				ABBREVIATIONS FOR TESTS Gravel = % of sample passing through 76.2 mm sieve and retained on #4 sieve Sand = % of sample passing through #4 sieve and retained on #200 sieve Fines = % of sample passing through #200 sieve PI = Plasticity Index (% moisture) LL = Liquid Limit (% moisture) UCS = Unconfined Compressive Strength Mohs = Moh's Hardness Test PID = Volatile Organic Compound (ppm)					
45									
50									
55									

FIGURE A-3

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF BORING B-1

SHEET 1 OF 1

LOCATION: Photovoltaic Trellis, Kalaeloa, Oahu, Hawaii
PROJECT NO.: 19018
DATE(S) DRILLED: 11/26/2019
LOGGED BY: P. Lischick
CHECKED BY: E. Ng
CONTRACTOR: YK Drilling, LLC
HAMMER TYPE: Automatic
HAMMER WT./DROP: 140 lb / 30 in
DRILL EQUIPMENT: Mobile Drill B-54+
DRILLING METHOD: 4" Solid Stem Auger, Wash Boring with P-size casing
GROUND ELEVATION: ~41.9 ft MSL
BOREHOLE BACKFILL: Quikrete, Cold Patch

DEPTH, FT	SAMPLE TYPE & NO.	SPT / MOD. CAL. / RQD % / REC %	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				**4" ASPHALT CONCRETE PAVEMENT**					
	1	23		**6" AGGREGATE FILL** Brown silty gravel (GM), moist	29	89			
				FILL Brown silty coralline sand with gravel (SM), medium dense, moist					
	2	64>>			12				Gravel=7% Sand=59% Fines=34%
5				**CORALLINE DEPOSITS** Tan silty coralline sand (SM), medium dense, moist					
	3	75/4">>		becomes very dense	9	92			Light auger grinding
	4 PQ-1	50/6">>		contains probable cobbles	13				Samplers not advancing Install casing at 6.3'
	PQ-2	0 / 22 / 69 / 100		**CORAL REEF LIMESTONE** Off-white with tan coral reef limestone, medium hard, highly fractured					Off-white water return Mohs=3
10	5	25/3">>							Tan water return UCS=239 psi
	6 PQ-3	10/0">>		**INTERCALATED OLDER ALLUVIUM AND CORALLINE DEPOSITS** Brown clayey coralline sand with gravel and coralline cobbles (SC), very dense, moist	36				Samplers not advancing LL=85 PI=51 LL=49 PI=22
		7 / 70							Brown water return Mohs=3
15	7	60/3">>		becomes tan with light brown					Sampler not advancing
	8	69>>		becomes off-white mottled with tan	13				Gravel=19% Sand=51% Fines=30%
	PQ-4	0 / 100		**CORAL REEF LIMESTONE** Off-white with tan coral reef limestone, medium hard, highly fractured					Mohs=3 Brown water return
20	9	46/6">>			15				Sampler not advancing
				Boring completed at 21.0 feet below existing ground surface on 11/26/2019.					
25									

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

Groundwater not encountered during drilling to depth of boring

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FIGURE A-4

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF BORING B-2

SHEET 1 OF 1

LOCATION: Photovoltaic Trellis, Kalaeloa, Oahu, Hawaii
PROJECT NO.: 19018
DATE(S) DRILLED: 11/12/2019
LOGGED BY: P. Lischick
CHECKED BY: E. Ng
CONTRACTOR: YK Drilling, LLC
HAMMER TYPE: Automatic
HAMMER WT./DROP: 140 lb / 30 in
DRILL EQUIPMENT: Mobile Drill B-54+
DRILLING METHOD: 4" Solid Stem Augers, CARDI Core Drill
GROUND ELEVATION: ~43.1 ft MSL
BOREHOLE BACKFILL: Quikrete, Quikset

DEPTH, FT	SAMPLE TYPE & NO.	SPT (10 20 30 40) / MOD. CAL. (18 36 54 72) / RQD % / REC % (20 40 60 80)	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				**11" CONCRETE PAVEMENT**					
	1	○28		**FILL** Tan with light brown and orange silty coralline gravel with sand (GM), medium dense, moist	13	110			
	2	●9		**CORALLINE DEPOSITS** Tan silty coralline sand with gravel (SM), loose, moist	11				
5	3	○34		contains pockets of brown elastic silt, medium dense	14 12	99 77			Gravel=34% Sand=49% Fines=17%
10	4	51>>●		contains less gravel with pockets of brown elastic silt, very dense	16				Gravel=11% Sand=57% Fines=32%
15	5	○27		becomes off-white and contains more coralline gravel, medium dense	10	89			
20	6	●19		becomes off-white and tan	12				
25				Boring completed at 21.5 feet below existing ground surface on 11/12/2019.					

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

Groundwater not encountered during drilling to depth of boring

FIGURE A-5

YKE

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF BORING B-3

SHEET 1 OF 1

LOCATION: Wash Rack, Kalaeloa, Oahu, Hawaii
PROJECT NO.: 19018
DATE(S) DRILLED: 11/12/2019
LOGGED BY: P. Lischick
CHECKED BY: E. Ng
CONTRACTOR: YK Drilling, LLC
HAMMER TYPE: Automatic
HAMMER WT./DROP: 140 lb / 30 in
DRILL EQUIPMENT: Mobile Drill B-54+
DRILLING METHOD: 4" and 6" Solid Stem Augers, CARDI Core Drill
GROUND ELEVATION: ~42.2 ft MSL
BOREHOLE BACKFILL: Quikrete, Quikset

DEPTH, FT	SAMPLE TYPE & NO.	SPT / MOD. CAL. / RQD % / REC %	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				**11" CONCRETE PAVEMENT**					
	1	55		**FILL** Grayish tan silty coralline gravel with sand (GM), medium dense to dense, moist					Bulk sample from 1'-2.5' bgs / PID = 49.6ppm PID = 17.8 ppm
	2	16		**CORALLINE DEPOSITS** Tan silty coralline sand (SM), medium dense to dense, moist	16				Gravel=9% Sand=58% Fines=33%
5				contains pockets of brown elastic silt, medium dense					
	3	18		becomes loose to medium dense	14	88			Direct Shear
10	4	5		becomes off-white, loose	14				
15	5	20		becomes medium dense	11	77			
				Boring completed at 16.5 feet below existing ground surface on 11/12/2019.					
20									
25									

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

Groundwater not encountered during drilling to depth of boring

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FIGURE A-6

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF PROBE P-1

SHEET 1 OF 1

LOCATION: Photovoltaic Trellis, Kalaeloa, Oahu, Hawaii
PROJECT NO.: 19018
DATE(S) DRILLED: 11/26/2019
LOGGED BY: P. Lischick
CHECKED BY: E. Ng
CONTRACTOR: YK Drilling, LLC
HAMMER TYPE: Automatic
HAMMER WT./DROP: 140 lb / 30 in
DRILL EQUIPMENT: Mobile Drill B-54+
DRILLING METHOD: 4" Solid Stem Auger
GROUND ELEVATION: ~42.2 ft MSL
BOREHOLE BACKFILL: Quikrete, Cold Patch

DEPTH, FT	SAMPLE TYPE & NO.	SPT 10 20 30 40 / MOD. CAL. 18 36 54 72 / RQD % / REC % 20 40 60 80	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				**4" ASPHALT CONCRETE PAVEMENT**					
				AGGREGATE FILL Brown silty sand with gravel (SM), moist					
	1			**CORALLINE DEPOSITS** Tan with off-white silty coralline sand (SM), moist	13				Gravel=6% Sand=55% Fines=39%
5				Probe completed at 4.0 feet below existing ground surface on 11/26/2019.					
10									
15									
20									
25									

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

Groundwater not encountered during drilling to depth of probe

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FIGURE A-7

Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30

LOG OF PROBE P-2

SHEET 1 OF 1

LOCATION: Wash Rack, Kalaeloa, Oahu, Hawaii
PROJECT NO.: 19018
DATE(S) DRILLED: 11/26/2019
LOGGED BY: P. Lischick
CHECKED BY: E. Ng
CONTRACTOR: YK Drilling, LLC
HAMMER TYPE: Automatic
HAMMER WT./DROP: 140 lb / 30 in
DRILL EQUIPMENT: Mobile Drill B-54+
DRILLING METHOD: 4" Solid Stem Auger, CARDI Core Drill
GROUND ELEVATION: ~42.2 ft MSL
BOREHOLE BACKFILL: Quikrete, Quikset, Cuttings

DEPTH, FT	SAMPLE TYPE & NO.	SPT 10 20 30 40 / MOD. CAL. 18 36 54 72 / RQD % / REC % 20 40 60 80	GRAPHIC LOG	DESCRIPTION	WATER CONTENT, %	DRY UNIT WEIGHT, PCF	POCKET PEN., TSF	TORVANE, TSF	OTHER TESTS & REMARKS
0				**11" CONCRETE PAVEMENT**					
				FILL Brown silty sand (SM), moist					
				CORALLINE DEPOSITS Tan with off-white silty coralline sand (SM), moist					PID = 1.3 ppm
5				Probe completed at 4.0 feet below existing ground surface on 11/26/2019.					
10									
15									
20									
25									

SUMMARY OF MEASURED WATER LEVELS

DATE	TIME	DEPTH, FT	DATE	TIME	DEPTH, FT

Groundwater not encountered during drilling to depth of probe

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FIGURE A-8

DCP TEST REPORT

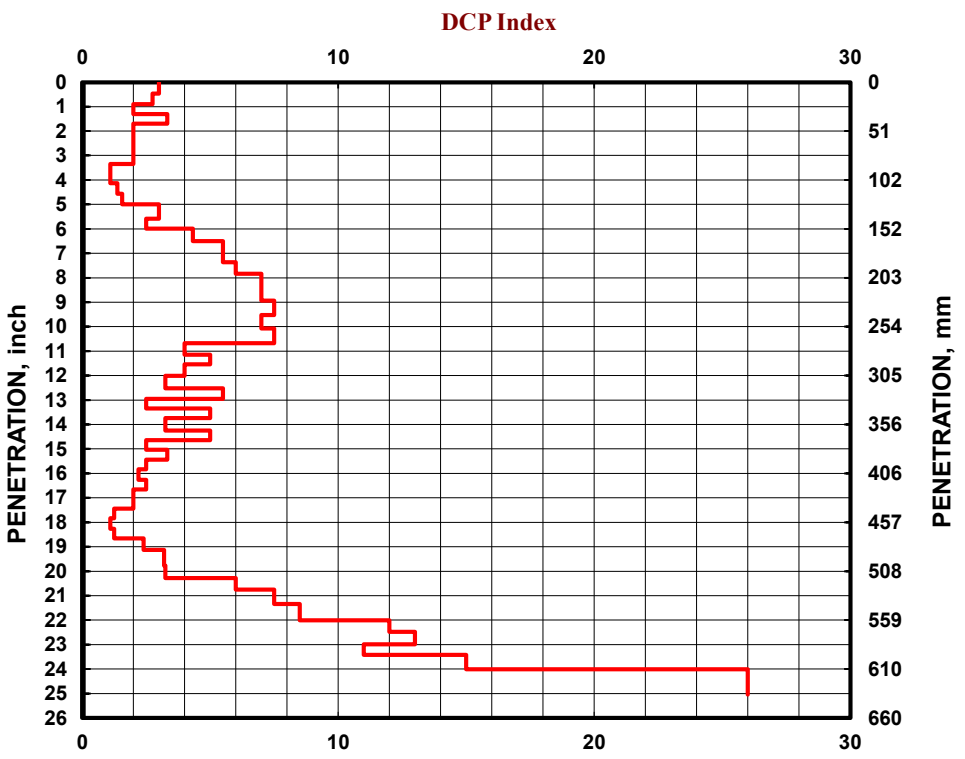
Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Date: 11/26/2019
Project No. 19018
Start Depth: 4"
Location: P-1
Soil Type(s): SM

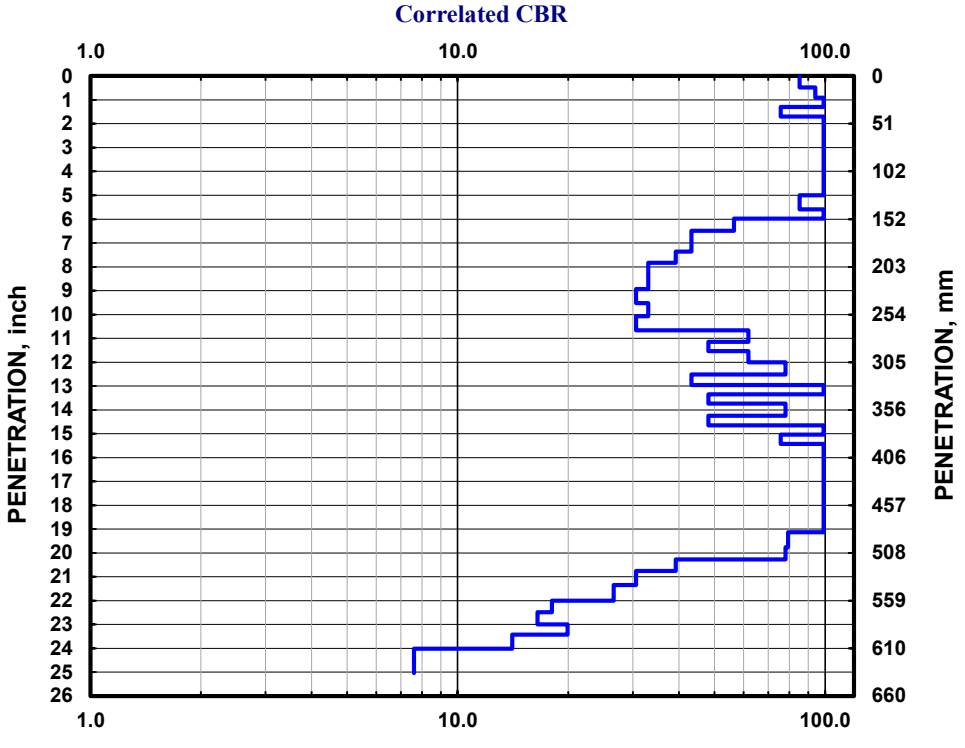
Hammer
- ○ 10.1 lbs. (2)
- ◉ 17.6 lbs. (1)
- ○ Other

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

Test Method: ASTM D6951

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
4	12	1
4	23	1
5	33	1
3	43	1
5	53	1
5	63	1
5	73	1
6	85	1
9	95	1
9	105	1
8	116	1
7	127	1
5	142	1
4	152	1
3	165	1
2	176	1
2	187	1
2	199	1
2	213	1
2	227	1
2	242	1
2	256	1
2	271	1
3	283	1
2	293	1
3	305	1
4	318	1
2	329	1
4	339	1
2	349	1
4	362	1
2	372	1
4	382	1
3	392	1
4	402	1
5	413	1
4	423	1
5	433	1
5	443	1
8	453	1
10	464	1
8	474	1
5	486	1
5	502	1
4	515	1
2	527	1
2	542	1
2	559	1
1	571	1
1	584	1
1	595	1
1	610	1
1	636	1





DCP TEST REPORT

Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Date: 11/26/2019
Project No. 19018
Start Depth: 12"
Location: P-2
Soil Type(s): SM

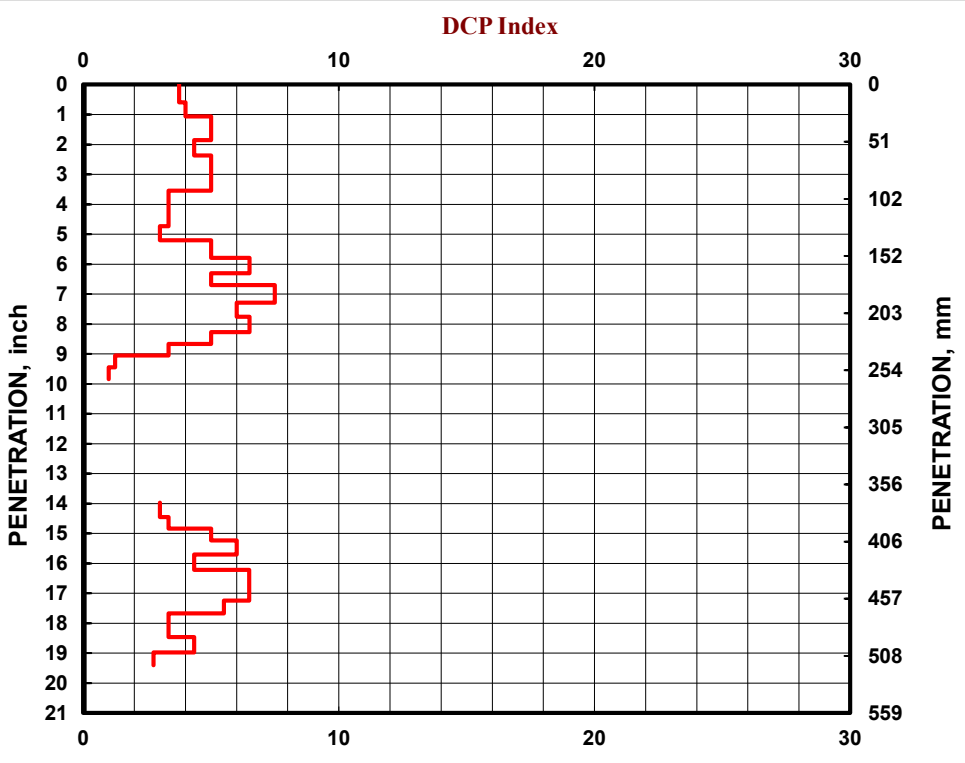
Hammer
- ○ 10.1 lbs. (2)
- ◉ 17.6 lbs. (1)
- ○ Other

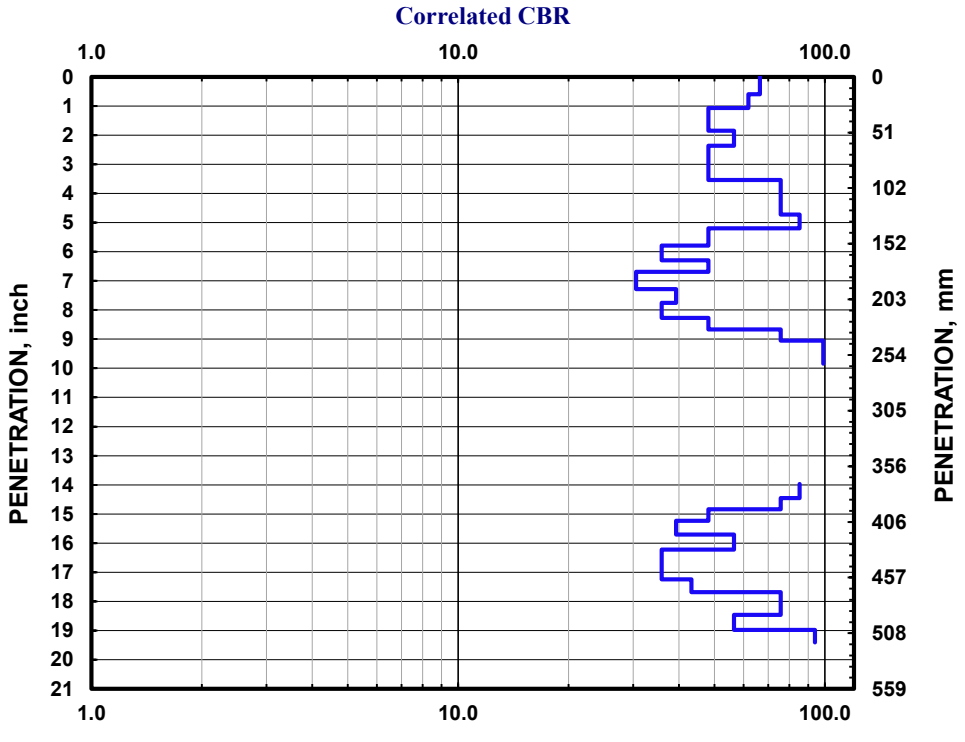
Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

Test Method: ASTM D6951

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
4	15	1
3	27	1
2	37	1
2	47	1
3	60	1
2	70	1
2	80	1
2	90	1
3	100	1
3	110	1
3	120	1
4	132	1
3	147	1
2	160	1
2	170	1
2	185	1
2	197	1
2	210	1
2	220	1
3	230	1
8	240	1
10	250	1
0	355	1
4	367	1
3	377	1
2	387	1
2	399	1
3	412	1
2	425	1
2	438	1
2	449	1
3	459	1
3	469	1
3	482	1
4	493	1

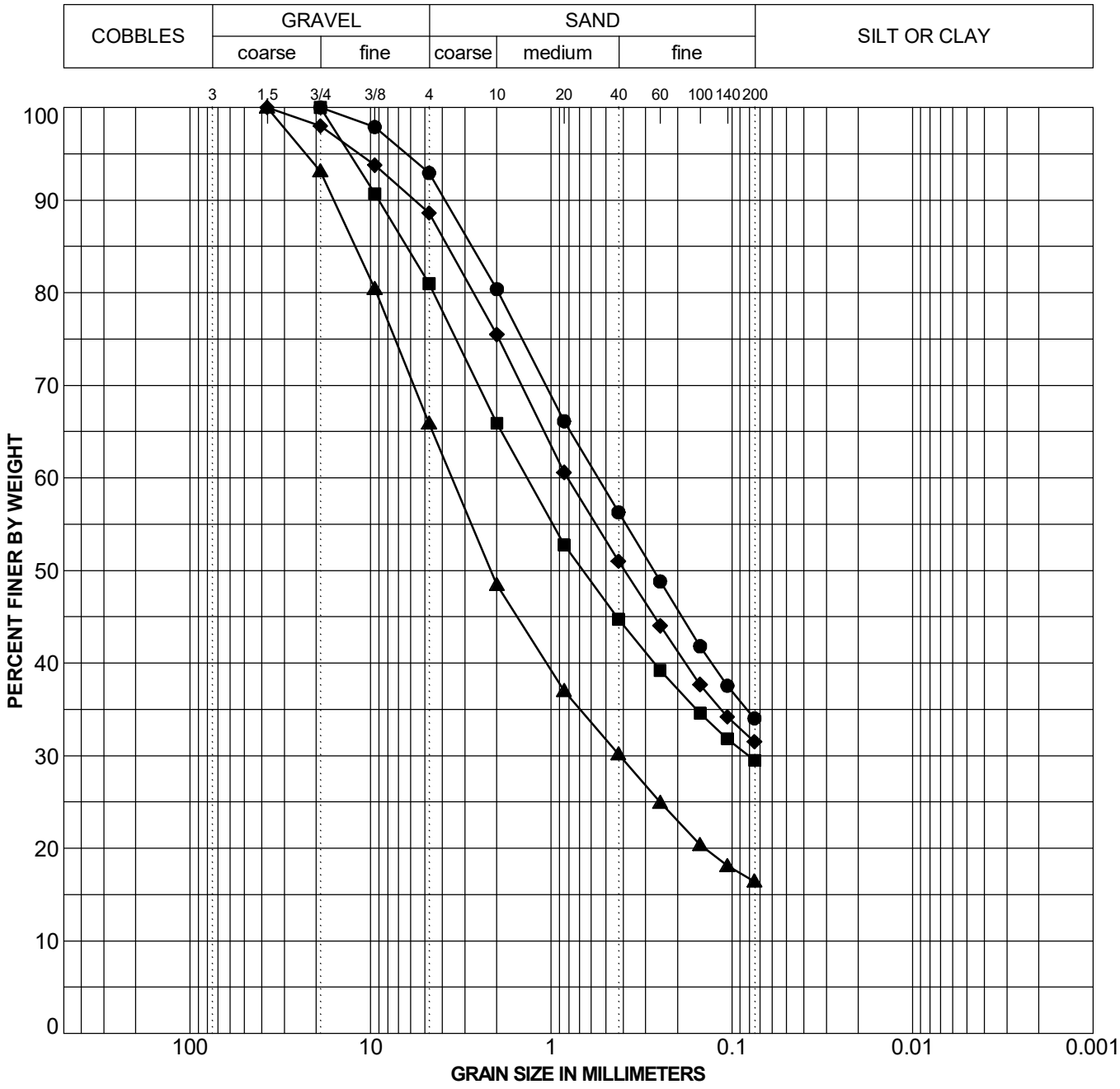
Note: Break in graph due to obstruction encountered at approximately 21.8 inches below ground surface. A 4" diameter solid stem auger was used to drill through the obstruction approximately 4 inches. The DCP test was continued from the resulting depth, approximately 25.9 inches below ground surface.





APPENDIX B

Laboratory Testing

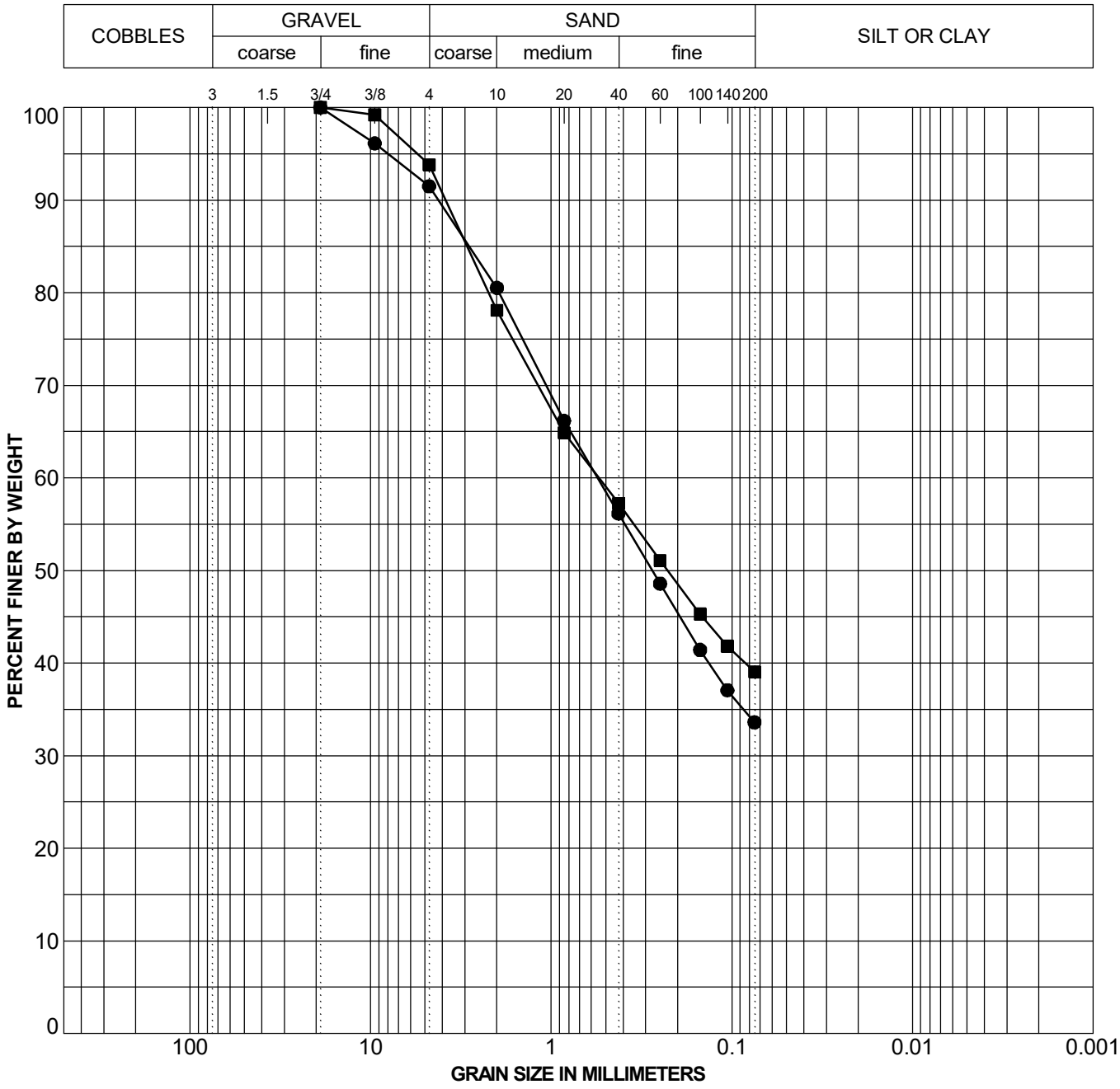


Boring		Depth (ft)	Description	Gravel %	Sand %	Fines %	Cc	Cu
●	B-1	3.0	Silty sand (SM)	7	59	34		
■	B-1	15.8	Silty sand with gravel (SM)	19	51	30		
▲	B-2	5.5	Silty sand with gravel (SM)	34	49	17		
◆	B-2	10.0	Silty sand (SM)	11	57	32		

Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii
Project Number: 19018

GRAIN SIZE DISTRIBUTION CURVES

FIGURE B-1.1

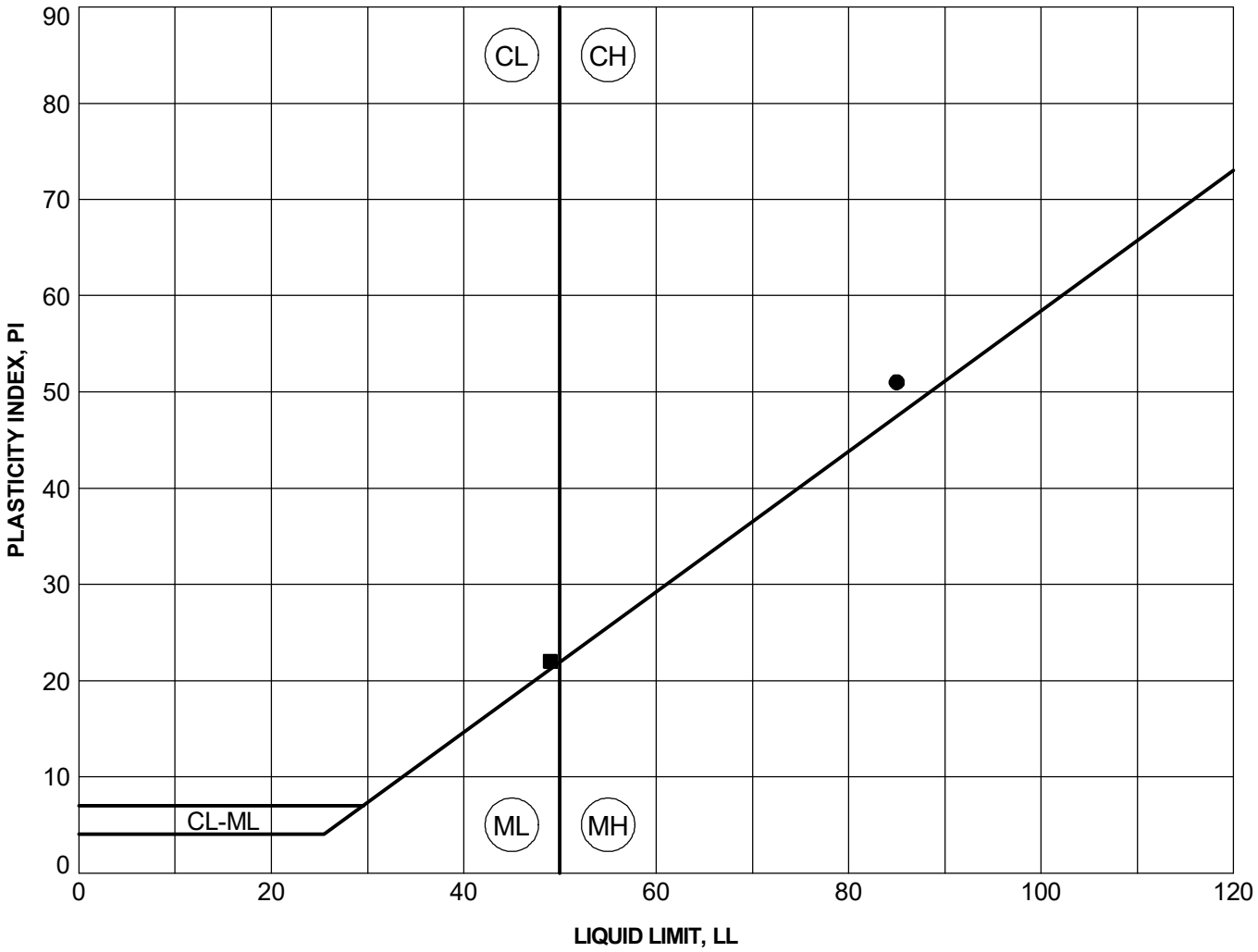


Boring		Depth (ft)	Description	Gravel %	Sand %	Fines %	Cc	Cu
●	B-3	3.0	Silty sand (SM)	9	58	33		
■	P-1	2.0	Silty sand (SM)	6	55	39		

Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii
Project Number: 19018

GRAIN SIZE DISTRIBUTION CURVES

FIGURE B-1.2

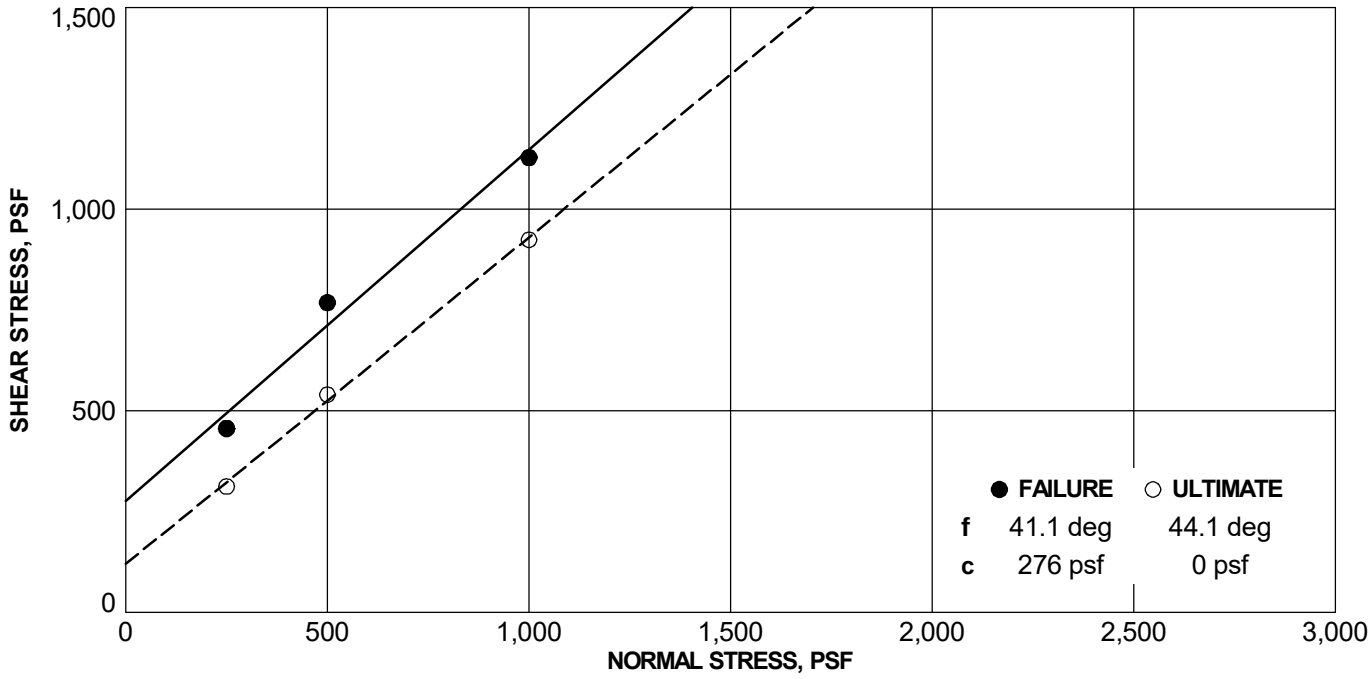


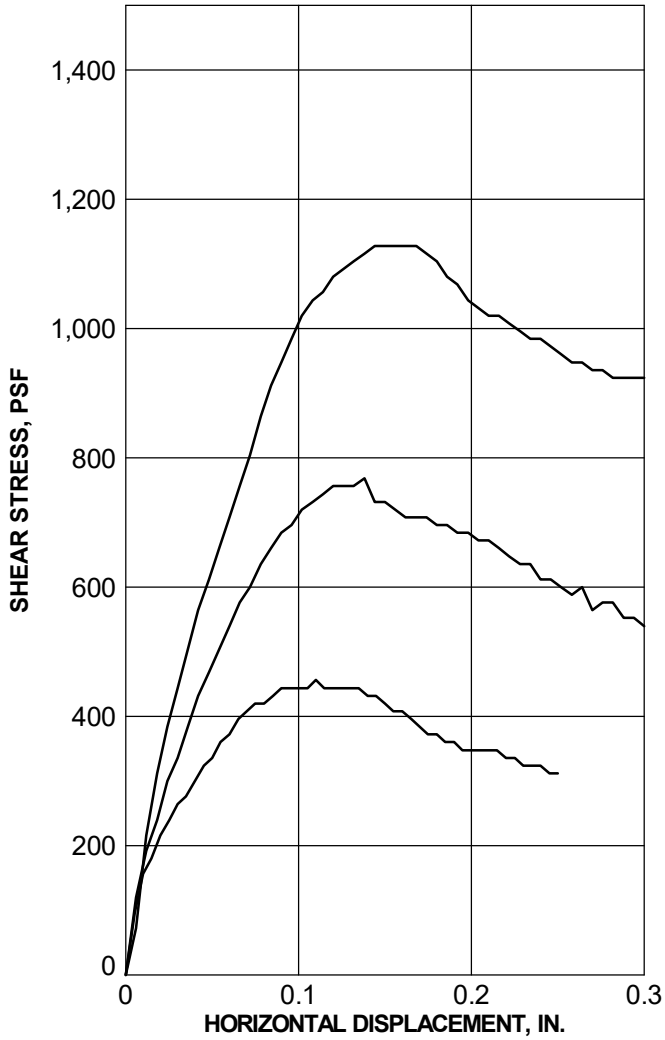
Boring		Depth (ft)	LL	PL	PI	Description
●	B-1	9.8	85	34	51	Fat Clay (CH) (Fines Portion of Clayey Sand)
■	B-1	11.5	49	27	22	Lean Clay (CL) (Fines Portion of Clayey Sand)

Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii
Project Number: 19018

PLASTICITY CHART

FIGURE B-2





Boring	B-3	Depth, ft	5
Description	Tan silty sand with gravel (SM)		

Sample No.		1	2	3
Initial	Water Content, %	25	22	28
	Dry Density, pcf	86	91	80
	Height, in.	1.000	1.000	1.000
Final	Water Content, %	34	30	40
	Dry Density, pcf	86	92	81
	Height, in.	0.998	0.989	0.982
Diameter, in.		2.416	2.416	2.416
Strain Rate, in./min.		0.002	0.002	0.002
Normal Stress, psf		250	500	1,000
Failure Stress, psf		456	768	1,128
Displacement, in.		0.110	0.115	0.120
Ultimate Stress, psf		312	540	924
Displacement, in.		0.250	0.250	0.250

Project: Proposed Wash Rack and Photovoltaic System
Army Aviation Support Facility Building 30
Kalaeloa, Oahu, Hawaii
Project Number: 19018

DIRECT SHEAR TEST

FIGURE B-3

Yogi Kwong Engineers, LLC
677 Ala Moana Blvd., Suite 710
Honolulu, Hawaii 96813

Date: 12/14/2019
Report: 835.001

TEST REPORT

Project: HIARNG(19018)	W.O. No. 835
Client: YKE	Received: 12/03/2019
Description of material: Rock Cores	Tech: RP/KG
Source: See Below	Sample #: 835

Core Identification	Test Method ASTM	Wet Unit Weight (pcf)	Length	Diameter	Moisture Content (%)	Strength (psi)
B-1 PQ-2 8.0-9.0	D 7012	118.6	10.02	3.31	6.5	239

Respectfully,
CONSTRUCTION ENGINEERING LABS, INC.

By: Ronald A. Pickering II
Its: President

APPENDIX C

Photographs of Selected Soil Samples and Cores

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample 1, Depth 1.0' - 2.5'

Boring B-1, Sample 1, Depth 1.0' - 2.5'

Boring B-1, Sample 1, Depth 1.0' - 2.5'


Boring B-1, Sample 1, Depth 1.0' - 2.5'

Boring B-1, Sample 2, Depth 3.0' - 4.5'

Boring B-1, Sample 2, Depth 3.0' - 4.5'

FIGURE C-1

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample 2, Depth 3.0' - 4.5'

Boring B-1, Sample 2, Depth 3.0' - 4.5'

Boring B-1, Sample 3, Depth 5.0' - 5.8'

Boring B-1, Sample 3, Depth 5.0' - 5.8'

Boring B-1, Sample 3, Depth 5.0' - 5.8'

Boring B-1, Sample 3, Depth 5.0' - 5.8'

FIGURE C-2

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample 4, Depth 5.8' - 6.3'


Boring B-1, Sample 4, Depth 5.8' - 6.3'

Boring B-1, Sample 4, Depth 5.8' - 6.3'

Boring B-1, Sample PQ-1, Depth 6.3' - 7.0'

Boring B-1, Sample PQ-1, Depth 6.3' - 7.0'

Boring B-1, Sample PQ-2, Depth 7.0' - 10.0'

FIGURE C-3

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

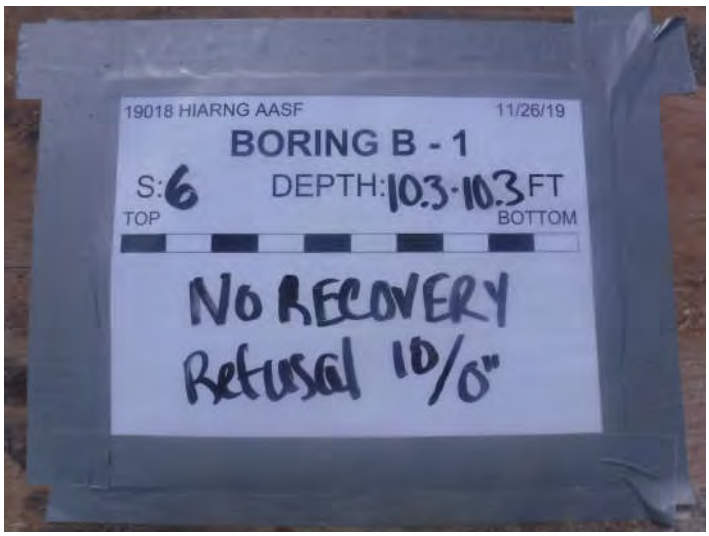
Boring B-1, Sample PQ-2, Depth 7.0' - 10.0'

Boring B-1, Sample PQ-2, Depth 7.0' - 10.0'

Boring B-1, Sample PQ-2, Depth 7.0' - 10.0'

Boring B-1, Sample 5, Depth 10.0' - 10.3'

Boring B-1, Sample 5, Depth 10.0' - 10.3'



Boring B-1, Sample 6, Depth 10.3' - 10.3'

FIGURE C-4

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample PQ-3, Depth 10.3' - 15.0'

Boring B-1, Sample PQ-3, Depth 10.3' - 15.0'


Boring B-1, Sample PQ-3, Depth 10.3' - 15.0'

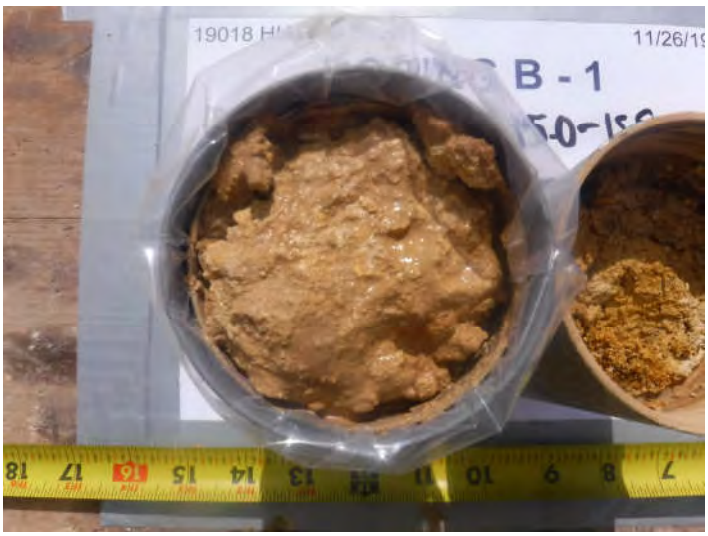

Boring B-1, Sample PQ-3, Depth 10.3' - 15.0'


Boring B-1, Sample PQ-3, Depth 10.3' - 15.0'

Boring B-1, Sample 7, Depth 15.0' - 15.8'

FIGURE C-5

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30



Boring B-1, Sample 7, Depth 15.0' - 15.8'


Boring B-1, Sample 7, Depth 15.0' - 15.8'

Boring B-1, Sample 8, Depth 15.8' - 17.3'

Boring B-1, Sample 8, Depth 15.8' - 17.3'

Boring B-1, Sample 8, Depth 15.8' - 17.3'

Boring B-1, Sample PQ-4, Depth 17.3' - 20.0'

FIGURE C-6

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample PQ-4, Depth 17.3' - 20.0'


Boring B-1, Sample PQ-4, Depth 17.3' - 20.0'


Boring B-1, Sample PQ-4, Depth 17.3' - 20.0'

Boring B-1, Sample PQ-4, Depth 17.3' - 20.0'

Boring B-1, Sample 9, Depth 20.0' - 21.0'

Boring B-1, Sample 9, Depth 20.0' - 21.0'

FIGURE C-7

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-1, Sample 9, Depth 20.0' - 21.0'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-2, Sample Core, Depth 0.0' - 1.0'


Boring B-2, Sample Core, Depth 0.0' - 1.0'

Boring B-2, Sample 1, Depth 1.0' - 2.5'

Boring B-2, Sample 1, Depth 1.0' - 2.5'

Boring B-2, Sample 1, Depth 1.0' - 2.5'

Boring B-2, Sample 1, Depth 1.0' - 2.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-2, Sample 1, Depth 1.0' - 2.5'

Boring B-2, Sample 2, Depth 3.0' - 4.5'

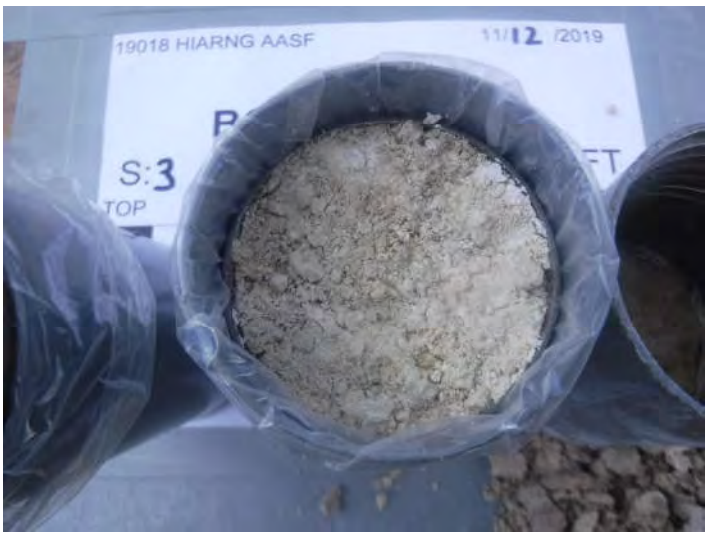
Boring B-2, Sample 2, Depth 3.0' - 4.5'

Boring B-2, Sample 2, Depth 3.0' - 4.5'

Boring B-2, Sample 3, Depth 5.0' - 6.5'

Boring B-2, Sample 3, Depth 5.0' - 6.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30



Boring B-2, Sample 3, Depth 5.0' - 6.5'


Boring B-2, Sample 3, Depth 5.0' - 6.5'


Boring B-2, Sample 3, Depth 5.0' - 6.5'

Boring B-2, Sample 4, Depth 10.0' - 11.5'


Boring B-2, Sample 4, Depth 10.0' - 11.5'


Boring B-2, Sample 4, Depth 10.0' - 11.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-2, Sample 4, Depth 10.0' - 11.5'

Boring B-2, Sample 5, Depth 15.0' - 16.5'


Boring B-2, Sample 5, Depth 15.0' - 16.5'


Boring B-2, Sample 5, Depth 15.0' - 16.5'


Boring B-2, Sample 5, Depth 15.0' - 16.5'


Boring B-2, Sample 5, Depth 15.0' - 16.5'

FIGURE C-12

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-2, Sample 6, Depth 20.0' - 21.5'


Boring B-2, Sample 6, Depth 20.0' - 21.5'

Boring B-2, Sample 6, Depth 20.0' - 21.5'

Boring B-2, Sample 6, Depth 20.0' - 21.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-3, Sample Core, Depth 0.0' - 1.0'


Boring B-3, Sample Core, Depth 0.0' - 1.0'

Boring B-3, Sample 1, Depth 1.0' - 2.5'


Boring B-3, Sample 1, Depth 1.0' - 2.5'

Boring B-3, Sample 1, Depth 1.0' - 2.5'


Boring B-3, Sample 1, Depth 1.0' - 2.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-3, Sample 2, Depth 3.0' - 4.5'

Boring B-3, Sample 2, Depth 3.0' - 4.5'

Boring B-3, Sample 2, Depth 3.0' - 4.5'

Boring B-3, Sample 2, Depth 3.0' - 4.5'

Boring B-3, Sample 3, Depth 5.0' - 6.5'

Boring B-3, Sample 3, Depth 5.0' - 6.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-3, Sample 3, Depth 5.0' - 6.5'


Boring B-3, Sample 3, Depth 5.0' - 6.5'


Boring B-3, Sample 3, Depth 5.0' - 6.5'

Boring B-3, Sample 4, Depth 10.0' - 11.5'

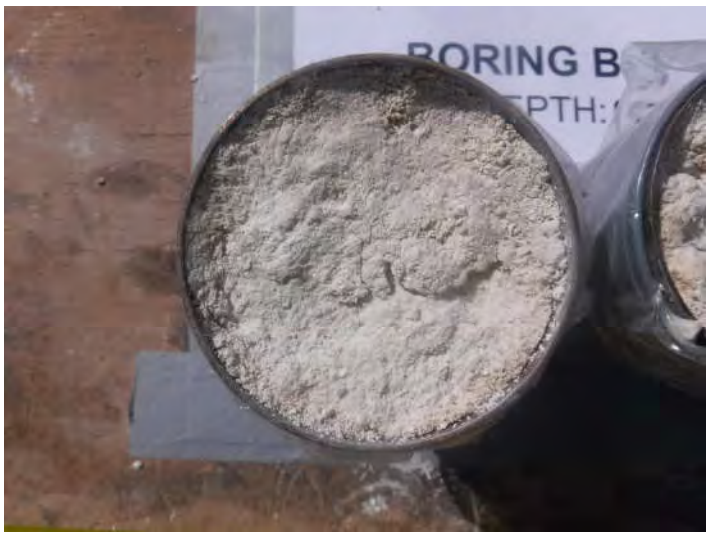

Boring B-3, Sample 4, Depth 10.0' - 11.5'

Boring B-3, Sample 4, Depth 10.0' - 11.5'

FIGURE C-16

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Boring B-3, Sample 5, Depth 15.0' - 16.5'



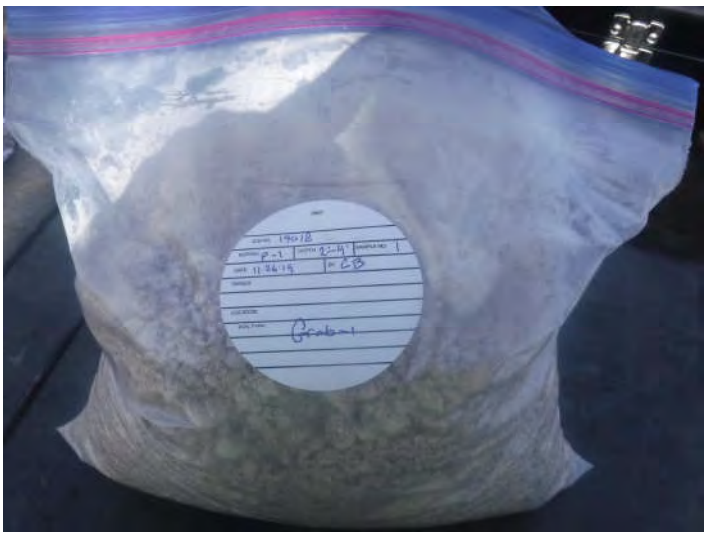
Boring B-3, Sample 5, Depth 15.0' - 16.5'

Boring B-3, Sample 5, Depth 15.0' - 16.5'

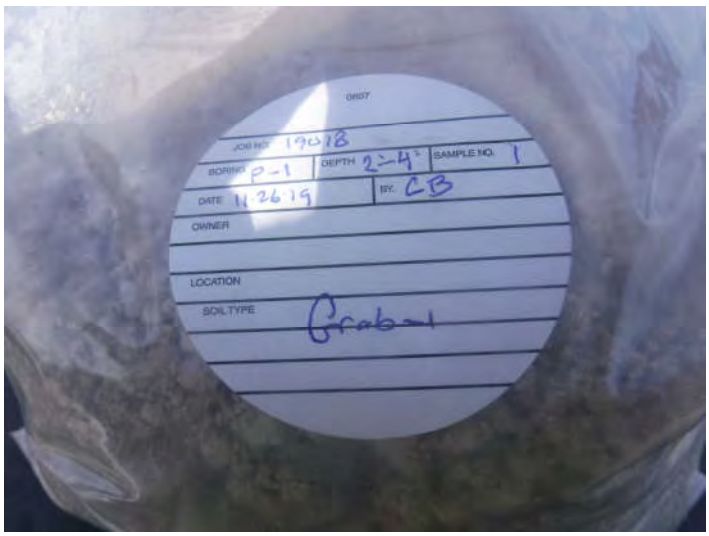
Boring B-3, Sample 5, Depth 15.0' - 16.5'


Boring B-3, Sample 5, Depth 15.0' - 16.5'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30



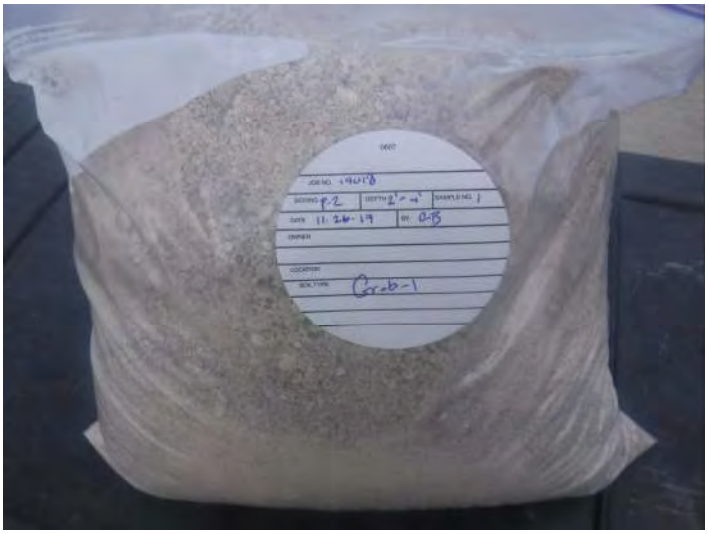
Probe P-1, Sample 1, Depth 2.0' - 4.0'

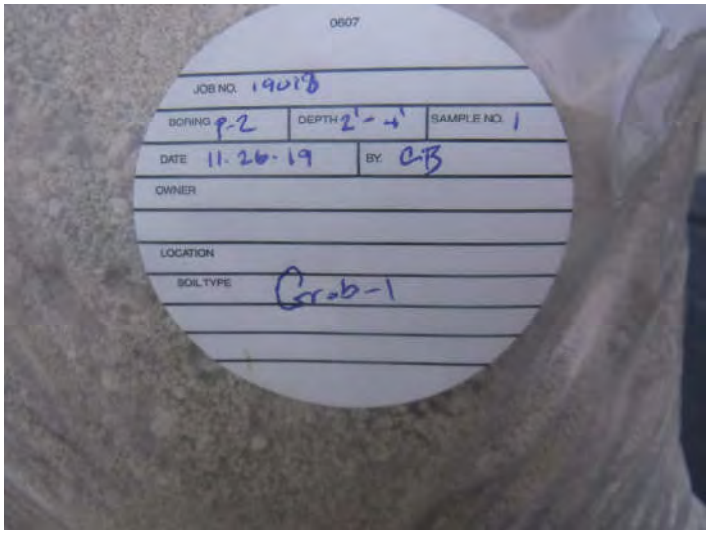


Probe P-1, Sample 1, Depth 2.0' - 4.0'

Probe P-1, Sample 1, Depth 2.0' - 4.0'

APPENDIX C
PHOTOGRAPHS OF SELECTED SOIL SAMPLES AND CORES
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30


Probe P-2, Sample 1, Depth 2.0' - 4.0'



Probe P-2, Sample 1, Depth 2.0' - 4.0'


Probe P-2, Sample 1, Depth 2.0' - 4.0'

APPENDIX D

Selected Photographs of Site Conditions Taken During Field Exploration

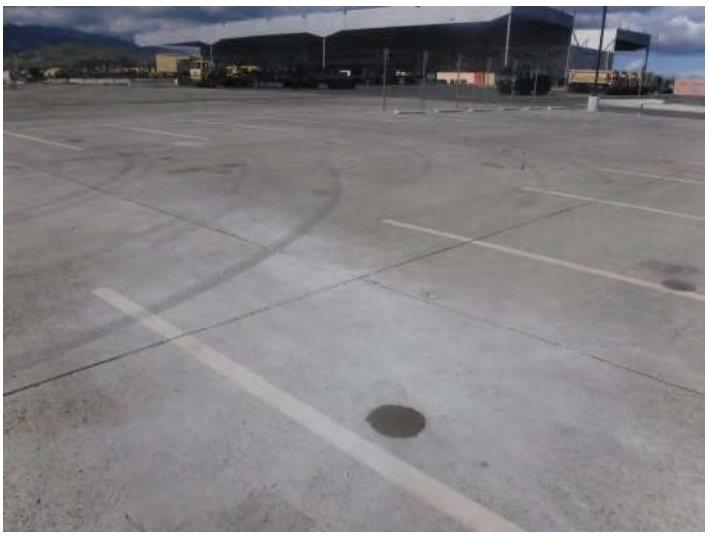
APPENDIX D
SELECTED PHOTOGRAPHS OF SITE CONDITIONS TAKEN DURING FIELD EXPLORATION
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30

Vicinity of Boring B-1 and Probe P-1.

Vicinity of Boring B-1 and Probe P-1.

Vicinity of Boring B-1 and Probe P-1.


Vicinity of Boring B-1 and Probe P-1.


Vicinity of Boring B-2.

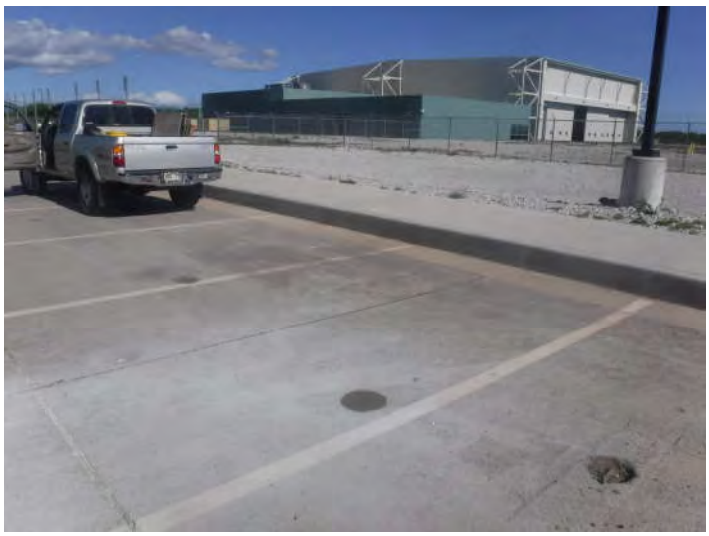

Vicinity of Boring B-2.

FIGURE D-1

APPENDIX D
SELECTED PHOTOGRAPHS OF SITE CONDITIONS TAKEN DURING FIELD EXPLORATION
PROPOSED WASH RACK AND PHOTOVOLTAIC SYSTEM
ARMY AVIATION SUPPORT FACILITY BUILDING 30


Vicinity of Boring B-2.


Vicinity of Boring B-2.


Vicinity of Boring B-3.


Vicinity of Boring B-3.

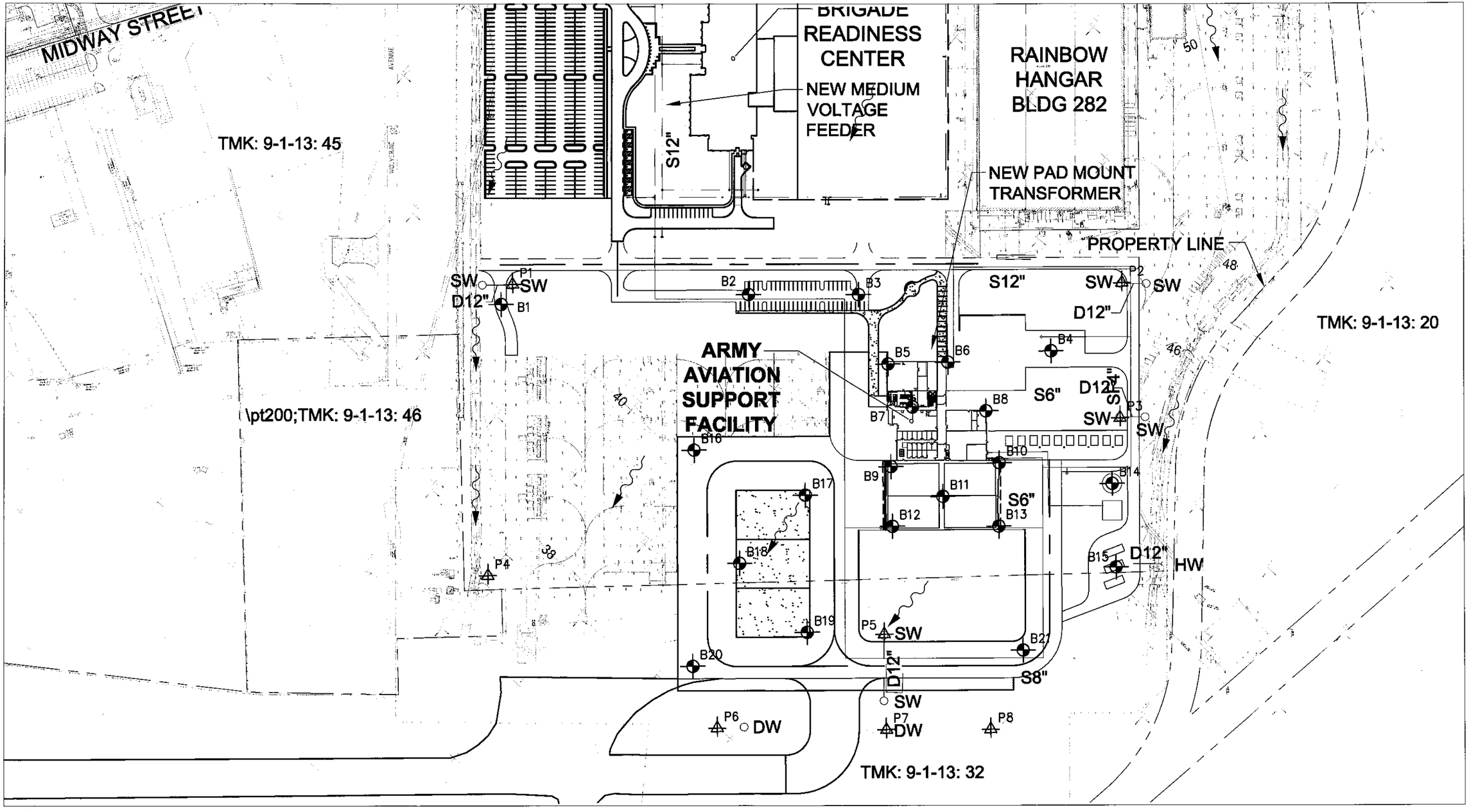

Vicinity of Boring B-3.


Vicinity of Boring B-3.

FIGURE D-2

APPENDIX E

Previous Geotechnical Exploration by Other



LEGEND:

- Approximate location of borings
- Approximate location of percolation test holes

Reference: Conceptuol Grading and Drainage Plan provided by Belt Collins Hawaii Ltd. in February 2011.

GRAPHIC SCALE:
0 100 200 400FT.
1" = 200'

W.O. 11-5059	HIARNG Army Aviation Support Facility, Phase 1
Hirata & Associates, Inc.	BORING LOCATION PLAN Plate A2.2

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B2 DRIVING WT. 140 lb. START DATE 04/18/11

SURFACE ELEV. 42.5± DROP 30 in. END DATE 04/18/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			7/6" 16/6"	61	27	Silty Coralline SAND (SM) – Light brown, slightly moist, medium dense, with coral gravel. Covered by 3 inches of asphalt concrete over 3 inches of base course material. Brown clayey silt at 2.5 feet.
5			50/1" 10/No Penetration			CORAL – Tan, slightly moist, dense to medium hard.
			50/1"		9	
10						End boring at 8 feet. Neither groundwater nor seepage water encountered.
15						
20						
25						
30						

Plate A4.2

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B3 DRIVING WT. 140 lb. START DATE 04/18/11
SURFACE ELEV. 44± DROP 30 in. END DATE 04/18/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			88	82	20	Silty Coralline GRAVEL (GM) – Mottled ton, slightly moist, dense, with sand. (Fill) Covered by 3 inches of asphalt concrete over 3 inches of base course material. Asphalt concrete fragments at 2 feet.
5			15/6" 58/6" 36	88	27 18	CORAL – Tan, slightly moist, dense.
10						End boring at 6.5 feet. Neither groundwater nor seepage water encountered.
15						
20						
25						
30						

Plate A4.3

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B10 DRIVING WT. 140 lb. START DATE 04/13/11

SURFACE ELEV. 42.5± DROP 30 in. END DATE 04/13/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			36/6" 37/6"	105	11	Silty Coralline SAND (SM) – Tan, slightly moist, medium dense, with coral gravel. Covered by 12 inches of Portland Cement concrete.
			50/2"			
			10/No Penetration			CORAL – Tan, slightly moist, medium hard.
5			50/2"		11	
			50/3"		10	
10						
						Medium dense at 13 feet.
			10/No Penetration			
15						Brown clayey silt at 16 to 18 feet.
			50/2"			
20						
			10/No Penetration			
25						End boring at 24 feet.
						Neither groundwater nor seepage water encountered.
30						

Plate A4.10

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B17 DRIVING WT. 140 lb. START DATE 04/15/11

SURFACE ELEV. 41± DROP 30 in. END DATE 04/15/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Silty Coralline SAND (SM) – Tan, slightly moist, dense, with coral gravel. Covered by 12 inches of Portland Cement concrete.
			8	73	42	Clayey SILT (ML) – Brown, moist, medium stiff, with coral gravel.
5			50/2"			CORAL – Tan, slightly moist, dense to medium hard.
			10/No Penetration			
10						End boring at 8 feet. Neither groundwater nor seepage water encountered.
15						
20						
25						
30						

Plate A4.17

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B18 DRIVING WT. 140 lb. START DATE 04/15/11
SURFACE ELEV. 39± DROP 30 in. END DATE 04/15/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0						Silty Coralline GRAVEL (GM) – Tan, slightly moist, dense, with sand. Covered by 3 inches of asphalt concrete over 4 inches of base course material.
			52	105	9	
5			34	91	11	
			76	92	13	CORAL – Tan, slightly moist, dense to medium hard.
10						End boring at 9.5 feet. Neither groundwater nor seepage water encountered.
15						
20						
25						
30						

Plate A4.18

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B19 DRIVING WT. 140 lb. START DATE 04/15/11
SURFACE ELEV. 39± DROP 30 in. END DATE 04/15/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			14/6" 30/6" 50/3"	78	13	Silty Coralline SAND (SM) – Tan, slightly moist, dense, with coral gravel. Covered by 3.5 inches of asphalt concrete over 4 inches of base course material.
5			56		12	CORAL – Tan, slightly moist, dense to medium hard.
			52	102	13	
10						End boring at 9.5 feet. Neither groundwater nor seepage water encountered.
15						
20						
25						
30						

Plate A4.19

HIRATA & ASSOCIATES, INC.

BORING LOG

W.O. 11-5059

BORING NO. B20 DRIVING WT. 140 lb. START DATE 04/14/11
SURFACE ELEV. 39± DROP 30 in. END DATE 04/14/11

DEPTH	GRAPH	SAMPLE	BLOWS PER FOOT	DRY DENSITY (PCF)	MOIST. CONT. (%)	DESCRIPTION
0			40/6" 50/3"	104	7	Silty Coralline SAND (SM) – Tan, slightly moist, dense, with coral gravel. Covered by 3.5 inches of asphalt concrete over 3 inches of base course material.
			19/6" 50/2"		13	CORAL – Tan, slightly moist, dense to medium hard.
5			10/No Penetrotion			
			50/3"		6	
10						End boring at 9.5 feet. Neither groundwater nor seepoge water encountered.
15						
20						
25						
30						

Plate A4.20

SECTION 02315 – UTILITY TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY

A. This work consists of excavating and backfilling for drain lines to the lines and grades indicated. The work includes sheeting and bracing, dewatering, hauling and stockpiling of surplus excavated materials declared as suitable, and hauling and disposing of excavated materials declared as unsuitable.

1.02 RELATED DOCUMENTS

A. The Work under this Section is specified in the following sections:
   1. Section 11 – Trench Excavation and Backfill of the City and County of Honolulu Department of Public Works (DPW) Standard Specifications, 1986. All references to measurement and payment do not apply.

B. Related Work not Included in this Section:
   1. Earthwork and fill materials are specified in SECTION 02300 – EARTHWORK.

   2. Requirements of the drainage system improvements are specified in SECTION 02630 – STORM DRAINAGE.

   3. Requirements of the water system improvements are specified in SECTION 02713 – WATER SYSTEM.

   4. Requirements of the sewer system improvements are specified in SECTION 02731 – SEWER SYSTEM.

1.03 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

2.01 MATERIALS

A. Bedding and backfill materials for drain lines shall be in accordance with Section 11 of the DPW Standard Specifications.

B. 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 Contracting Officer, is unsuitable. All material to be used as select material shall be approved by the Contracting Officer.P

C. 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 shall not contain stone,

rock or other material larger than six inches in its longest dimensions. No wood, vegetable matter or other material that, in the opinion of the Contracting Officer, is unsuitable, shall be included in the backfill. No “adobe” or other materials determined to be deleterious by the Contracting Officer shall be included in the backfill.

D. The Contractor shall obtain the written approval of the Contracting Officer of all backfill material.

2.02 BURIED WARNING AND IDENTIFICATION TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid and alkali resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape in rolls, 3-inch minimum width, color coding as stated below for the intended utility with warning and identification imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification to read, “CAUTION, BURIED (intended service) LINE BELOW” or similar wording. Color and printing is to be permanent, unaffected by moisture or soil.
   1. Drainage System: Green

B. Warning Tape for Metallic Piping. Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1,500 pounds per square inch (psi) lengthwise, and 1,250 psi crosswise, with a maximum 350 percent elongation.

C. Detectable Warning Tape for Non-Metallic Piping. Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1,500 psi lengthwise and 1,250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

D. Detection Wire for Non-Metallic Piping: Detection wire shall be insulated single strand, solid copper with a minimum diameter of 12 AWG.

2.03 OTHER MATERIALS

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

PART 3 - EXECUTION

3.01 GENERAL

A. Perform excavation, and placement and compaction of bedding and backfill materials for drain lines and structures as indicated and specified in Section 11 of the DPW Standard Specifications.

B. Buried Warning and Identification Tape: Install tape in accordance with manufacturer's recommendations except as modified herein. Unless otherwise indicated, bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of sub grade.

C. Buried Detection Wire: Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal.

3.02 FINISH ELEVATION 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 Contracting Officer and shall be carried on in an orderly manner. No jumps or spaces will be permitted unless approved by the Contracting Officer. Before proceeding with any excavation under 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 Contracting Officer, but no additional compensation will be allowed for such extra width.

C. Trench Depths

1. In general, trench depths for all pipes and appurtenances shall be as shown on the Drawings.

2. Where necessary, the Contracting Officer 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 HIARNG.

3.03 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 HIARNG.

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 record information on field-posted "as-built" plans.

4. If service is interrupted as a result of work under this Section, immediately restore service by repairing damaged utility at no additional cost to the HIARNG.

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 Contracting Officer and secure his instructions.

6. Do not proceed with permanent relocation of utilities until written instructions are received from the Contracting Officer.

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.

5. 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. 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.

D. 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.

E. 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 Contracting Officer, 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.

F. Surplus Material
1. Unless otherwise specified in the Plans or Specification, or ordered by the Contracting Officer, 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 HIARNG.

3.04 TRENCHING

A. 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 Contracting Officer, 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 Contracting Officer may permit portions of sheeting to be cut off and remain in the trench.

B. Excavation
1. Short sections of a trench may be tunneled if, in the opinion of the Contracting Officer, 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 HIARNG, as directed by the Contracting Officer.

3. When the void is below the sub grade for the utility bedding, use select materials and compact to the relative density directed by the Contracting Officer, 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 to compacted or consolidated as approved by the Contracting Officer, but in no case to a relative density less than 80%.

5. Excavating for Appurtenances
a. Excavate for cleanouts and similar structures to a distance sufficient to leave at least 12 inches 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 Contracting Officer, and at no additional cost to the HIARNG.

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

D. 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.

3.05 BEDDING

A. Provide bedding as indicated on the Drawings.

3.06 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 Contracting Officer shall approve the method of compaction and all compaction shall be done to the satisfaction of the Contracting Officer.

   2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no cost to the HIARNG, furnish material as specified in this section in the amount required to complete the backfill.

   3. When trucks deliver backfill material, 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 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 Contracting Officer.

END OF SECTION

SECTION 02370 – SEDIMENT AND EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all labor, materials and equipment necessary for the installation and maintenance of the construction sediment and erosion control measures.

1.02 GENERAL REQUIREMENTS

A. All erosion and sediment control measures shall comply with the State Department of Health regulations and the Rules Relating to Water Quality of the Administrative Rules, Title 20, Department of Planning and Permitting, Chapter 3.

B. The CONTRACTOR shall ensure that erosion and sediment control measures are implemented and maintained as necessary and in accordance to the Erosion and Sediment Control Plan (ESCP).

1.03 SUBMITTALS

A. Product Data: Submit product data for silt barrier, and other erosion control materials used for this Project.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Silt Fences. Silt fences shall be synthetic filter fabric mounted on posts and embedded in compacted ground in accordance with contract documents, and shall be in compliance with ASTM D6462, Standard Practice for Silt Fence Installation.

B. Silt Barrier:

Silt Barrier: EnviroTech BioSolutions – BioSock, or approved equal.

1. Composite Filter Media: Sanitized, mature compost with no identifiable feedstock constituents or offensive odors meeting all Local, State, and Federal quality requirements. Biosolids compost shall meet the Standards for Class A Biosolids outlined in 40 Code of Federal Regulations (CFR) Part 503.

Compost used for filtration shall meet the following parameters:

Parameter	Unit	Value
pH:		6 - 8
Moisture Content:	%, wet weight	30 - 60
Organic Matter:	%, dry weight	25 - 65
Particle Size:	% passing mesh size, dry weight	2 in. = 100% 0.375 in. = 10 – 30%

Stability (CO_2 Rate):	Mg CO_2-C per gram of organic matter per day	< 8
Physical Contaminants (Manmade Inerts):	%, dry weight	< 1

2. Roll: Silt barrier shall utilize an outer layer of filtration mesh, and an inner layer of containment netting. All layers shall collectively enclose the compost filtration media. Silt barrier shall be 12” nominal diameters or as indicated on the Drawings.

3. Wood Anchor Stakes: Wood anchor stakes shall have a nominal classification of ¾” by ¾” and a minimum length of 24 inches. CONTRACTOR shall not use rebar or other metal rods

PART 3 – EXECUTION

3.01 CONSTRUCTION

A. Prior to starting any construction, the CONTRACTOR shall install the sediment control measures at the construction limits as indicated on the plans and per manufacturer’s specifications to prevent silt and debris from leaving the Project site.

B. Temporary seeding shall be placed on exposed surfaces that will not be brought to final grading or permanent cover treatment within 30 days of the exposure to reduce erosion and sedimentation by stabilizing exposed soils. Seeded areas shall be checked regularly for bare spots, washouts, and healthy growth to assure that a good stand of grass is being maintained. Reseed areas that fail to establish vegetation cover as soon as such areas are identified.

C. Install, maintain, and inspect sediment control measures in accordance to City and County of Honolulu Administrative Rules Title 20 Chapter Rules Relating to Water Quality

3.02 CONFORMANCE

A. Failure to conform to the above requirements and regulations will be cause for temporary or permanent suspension of operations. If operations are suspended due to the CONTRACTOR’s failure to conform, the CONTRACTOR shall maintain the Project during the period of suspension at no cost to the HIARNG.

END OF SECTION

SECTION 2513 – ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes hot-mix asphalt patching, paving, and pavement marking paint.

1.02 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D8 for definitions of terms.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
   1. Job-Mix Designs: Certification of each job mix proposed for the Work.

   2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings.

C. Qualification Data: For qualified manufacturer and installer

D. Material Certificates: For each

C. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.

   2. Project title and number.

   3. Name, address, and telephone number of testing agency.

   4. Dates and locations of samples and tests or inspections.

   5. Names of individuals making tests and inspections.

   6. Description of the Work and test and inspection method.

   7. Identification of product and Specification Section.

   8. Complete test or inspection data.

   9. Test and inspection results and an interpretation of test results.

   10. Ambient conditions at time of sample taking and testing and inspecting.

   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

   12. Name and signature of laboratory inspector.

   13. Recommendations on retesting and reinspecting.

14. Combined Contractor Production and Contractor Quality Control Report, (one sheet): By 10:00 AM the next working day after each day that work is performed.

D. Permits, Licenses, and Certificates: Submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.05 SCHEDULE FOR SUBMITTING INFORMATION AND REPORTS

A. Deliver the original and two (2) copies each of the following to the Department:
   1. Combined Contractor Production and Contractor Quality Control Report, (one (1) sheet): By 10:00 AM the next working day after each day that work is performed.

   2. Field Test Reports: Within two (2) working days after the test is performed, attached to the Contractor Quality Control Report;

   3. Monthly Summary Report of Tests: Two (2) copies attached to the Contractor Quality Control Report;

   4. Testing Plan and Log: Two (2) copies, at the end of each month;

   5. Rework Items List: Two (2) copies, by the last working day of the month;

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Professional Architect or Engineer Qualifications: A professional architect or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing architect or engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

D. Inspection and Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E-548, and that specializes in types of tests and inspections to be performed.

1.07 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Engage qualified inspection or testing agencies to perform quality-control services, unless services are indicated as the Department's responsibility.

   2. Notify Project Manager and the inspection or testing agencies at least seven (7) calendar days in advance of time when Work that requires testing or inspecting will be performed.

   3. Submit certified written reports of each quality-control service.

   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Retesting and Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with the Department and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify the Project Manager and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

   2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

   3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

   4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.

   5. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.

   2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field-curing of test samples.

5. Preliminary design mix proposed for use for material mixes that require control by testing agency.

6. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.08 QUALITY CONTROL MANAGER

A. Duties: Provide a Quality Control Manager at the work site to implement and manage the QC Program. In addition to implementing and managing the QC Program, the QC Manager may perform the duties of the Project Superintendent. The QC Manager is required to; conduct the QC meetings, perform submittal review, ensure testing is performed and provide QC certifications and documentation required in this Contact. The QC Manager is responsible for managing and coordinating Testing Laboratory personnel and any other inspection and testing personnel required by this Contract.

B. Qualifications: An individual with a minimum of ten (10) years experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual must have experience in the areas of hazard identification and safety compliance. It is desirable that the QC Manager completed the course “Construction Quality Management for Contractors” offered by the Navy or the Army Corps of Engineers or other similar course.

C. Approval: QC Manager shall be subject to the approval of the Project Manager. Unless the Contractor has a QC Manager on staff, the Contractor shall provide the names of at least three (3) individuals, and shall rank the individuals based on the Contractor’s preference to work with or hire. The Project Manager may approve all or any one of the individuals. If any individual is presently working for the Contractor as a QC Manager, the Contractor may choose to submit only one individual, and that individual is subject to approval.
   1. Furnish evidence showing the individual(s) meets the qualifications, experience, training and other criteria required by this Section.

1.09 RECORD (As-Builts) DRAWINGS

A. The QC Manager is required to ensure the record drawings and jobsite record sets are kept current on a daily basis in accordance with SECTION 01770 - CLOSEOUT PROCEDURES.

1.10 NOTIFICATION OF NON-COMPLIANCE

A. Contractor will be notified of any detected non-compliance items. Take immediate corrective action after receipt of such notice.

1.11 RELATED DOCUMENTS

A. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, the asphalt pavement in conformity with the dimensions, profiles, sections, and details shown on the plans. Work relating to the flexible pavement shall be governed by the following sections of the State of Hawaii Standard Specifications for Road and Bridge Construction (dated 2005):

Hot Mix Asphalt (HMA) Pavement ..... Section 401

Tack Coat ..... Section 407

Primer for Untreated Permeable Base Course ..... Section 420

Bituminous Material ..... Section 702

Aggregate for Untreated Base ..... Section 703.06

PART 2 – PRODUCTS

2.01 AGGREGATES

A. Base course for flexible pavements shall consist of locally available aggregate base course meeting the material requires of the State of Hawaii Standard Specifications.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320, PG 64-16.

B. Asphalt Cement: Performance-graded asphalt binder shall conform to AASHTO M 320.

C. Prime Coat: Emulsified asphalt (Type CSS-1h or SS-1h).

D. Tack Coat: Emulsified asphalt (Type SS-1, SS-1h, CSS-1 of CSS-1h).

E. Water: Potable.

2.03 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provided in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073 or AASHTO M 29, Grade Nos. 2 or 3.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free,

ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
1. Color: As indicated.

D. Glass Beads: AASHTO M 247, Type 1.

2.04 MIXES

A. Hot-Mix Asphalt: State of Hawaii, Mix IV.

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. General: On completion testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.02 DEPARTMENT'S AUTHORITY

A. Review and removal of Quality Control Personnel:
1. All Quality Control organization personnel are subject to review by Project Manager; and the Project Manager may interview any member of the Quality Control organization at any time in order to verify the submitted qualifications.

2. The Project Manager has the authority to have the QC Manager replaced at any time for cause. Justifications may include, but are not limited to: not being on site when QC Manager's duties are required, or wrongfully approving substandard and noncompliant work.

3. The Contractor is not entitled to any claim or cost increase or time extension due to the Project Manager's disapproval of an agency or individual.

END OF SECTION

SECTION 02630 – STORM DRAINAGE

PART 1 - GENERAL

1.01 WORK DESCRIPTION

A. The work to be performed under this section shall consist of furnishing all labor, materials, equipment, tools and incidentals necessary to install and complete the drainage system as indicated and as specified herein.

1.02 RELATED DOCUMENTS

A. The Work under this Section is specified in the following sections:
   1. Section 25 – Drain Manholes of the City and County of Honolulu Department of Public Works (DPW) Standard Specifications, 1986. All references to measurement and payment do not apply.

B. Related Work not Included in this Section:
   1. Earthwork for the drainage system is specified in SECTION 02300 – EARTHWORK.

   2. Trenching and backfill is specified in SECTION 02315 – UTILITY TRENCH EXCAVATION AND BACKFILL.

   3. Concrete work is specified in SECTION 03300 – CAST-IN-PLACE CONCRETE.

   4. Structural Steel is specified in SECTION 05120 – STRUCTURAL STEEL.

1.03 SUBMITTALS

A. Submit shop drawings or manufacturer literature for inlets, frames, gratings, trench drains and appurtenant structures.

B. Submit manufacturer's certificates of conformance for drain pipe.

C. Submit as-built survey data for the pipe inverts at all structures constructed under the project.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drain Pipe: Drainage system pipes shall be high density polyethylene (HDPE). Pipes shall have a smooth interior and a smooth or corrugated exterior.

B. Drain Inlets, Grates and Frames: Inlets shall be as indicated and accepted in the reviewed shop drawings. Grates and frames for drain inlets shall be as indicated or as accepted in the reviewed shop drawings.

C. Trench Drains: Trench drains shall be as shown on the plans, and as indicated and accepted in the reviewed shop drawings.

D. Storm Drain Manholes: Storm drain manholes shall conform to the applicable DPW Standard Specifications and Details.

E. Drain Cleanouts: Drain cleanouts shall be as shown on the plans.

PART 3 - EXECUTION

3.01 EXCAVATION

A. The Contractor shall do all necessary excavation to the depth required by the plans. The excavation shall be unclassified and shall be performed regardless of the material encountered.

B. When unsuitable material is encountered at the excavation, the Contractor shall be responsible for hauling and disposing of the material. The hauling and disposing shall be considered, as incidental to the excavation work and no direct payment will be made. The Project Manager shall determine if the excavation material is unsuitable.

C. The Contractor shall properly sheet and brace all excavations to render them safe and secure from possible slides. All sheeting and bracing shall be considered, as incidental to the excavation work and no direct payment will be made.

D. All excavations shall be kept free from water during the construction and backfilling of the drainage structure.

E. All open excavations shall be covered or barricaded during non-working hours. Traffic bearing covers shall be provided where applicable.

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

3.02 DRAINAGE STRUCTURES

A. Drainage structures shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans.

B. The subgrade for trench drains shall be compacted to 95% of its maximum density for a minimum depth of six (6) inches.

C. Sub-base Preparation. Unsuitable material below the established structure base shall be removed to a depth sufficient to provide a stable foundation when backfilled with granular material.

D. Prefabricated drainage structures shall be installed per manufacturer's instructions. Install such that pipe inverts match drainage structure inverts and positive flow through the system is achieved.

E. After the drainage structure has been constructed, it shall be cleaned of all debris, form work, and loose concrete and mortar.

F. Trench drains shall meet the requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG).

3.03 BACKFILLING DRAINAGE STRUCTURES

A. After a structure has been completed, the area around it shall be filled with approved material, in horizontal layers not to exceed 8 inches in loose depth, and compacted to 90 percent of the material's maximum density. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans.

B. Backfilling shall not be placed against any structure until accepted and the Project Manager gives permission.

3.04 PLACEMENT AND TREATMENT OF FRAMES AND FITTINGS

A. All frames, and fittings shall be placed in the positions indicated on the plans or as directed by the Project Manager, and shall be set true to line and to correct elevation. If frame of fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete is set.

B. After frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for seven (7) days, then the grates or covers shall be installed. Gratings and covers shall lay flat in their respective frames and shall not rock under any condition. Gratings that are warped shall be replaced.

3.05 PIPE

A. Excavation and trench preparation shall be in accordance with SECTION 02315 – UTILITY TRENCH EXCAVATION AND BACKFILL.

B. Lay, join and finish pipe as indicated and in accordance with the pipe manufacturer's recommendations.

C Backfilling operations shall conform to the requirements of SECTION 02315 – UTILITY TRENCH EXCAVATION AND BACKFILL.

3.06 FINISHING

A. Prior to final approval of the drainage system, the Geotechnical Engineer and the Project Manager, accompanied by the Contractor's representatives, shall make a thorough review of the entire installation. Any indication of defects in material or workmanship, or obstruction to flow in the drainage structures, or settlement, shall be corrected. The Contractor without additional compensation shall correct defects due to the Contractor's negligence.

END OF SECTION

SECTION 02713 – WATER SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED

A. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, the potable water system in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.03 RELATED DOCUMENTS

A. Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Honolulu Board of Water Supply (BWS and all subsequent amendments, hereinafter referred to as the BWS Standards, and the Uniform Plumbing Code.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials shall conform to the approved Material List and Standard Details for Water System Construction, BWS, 2002. Water lines shall be copper piping and fittings in accordance to BWS Standards.

B. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

C. Backflow Preventer: Bronze body, reduced pressure principle type, AWWA C511, double check valves, air gap between, test cocks and OS&Y isolation valves in accordance with Board of Water Supply Standards.

PART 3 – EXECUTION

3.01 **INSTALLATION**

A. The installation, testing, disinfection and acceptance of water lines shall be governed by the BWS Standards and the Uniform Plumbing Code.

B. The Contractor shall be responsible for precisely laying out the various utility lines shown on the contract plans as provided elsewhere in these specifications. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

C. In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Project Manager at the Contractor's expense.

D. Connections to or the lowering or relocation of existing mains shall be done by the Contractor in accordance with the BWS Standards. The Contractor shall furnish all necessary pipe, fittings, appurtenances and other incidental materials.

E. Trenching, pipe cushion and backfilling for the water main shall be in accordance with SECTION 02315 – UTILITY TRENCH EXCAVATION AND BACKFILL.

F. The Contractor shall coordinate the connection of the new water line with the Project Manager. The Contractor shall inform the Project Manager a minimum of one week prior to the date of the actual connection. The inverts shown on the plans are approximate only, and the Contractor shall adjust the slope of the new water line as necessary to construct a fully functional and acceptable system. The Contractor shall ensure that all piping, fittings, materials, tools, equipment and incidentals are at the site and ready for connection.

G. The installation, testing, disinfection and acceptance of water lines shall be governed by the BWS Standards.

END OF SECTION

SECTION 02731 – SEWER SYSTEM

PART 1 – GENERAL

1.01 SUMMARY

A. The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 RELATED DOCUMENTS

A. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, the sewer system in conformity with the dimensions, profiles, sections, and details shown on the plans. Work relating to the sewer system shall be governed by the following sections of the State of Hawaii Standard Specifications for Road and Bridge Construction (dated 2005):

Sewer System ..... Section 625

Manholes, Inlets and Catch Basins..... Section 604

Concrete, Clay and Plastic (PVC) Pipe ..... Section 706

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sewer Pipe: PVC Sewer Pipe and Appurtenances

B. Sewer Manholes: As specified in Section 604 – Manholes, Inlets and Catch Basins of the "Standard Specifications."

C. Materials for the sewer system shall be in accordance with the sections of the Standard Specifications noted hereinafter.

PART 3 – EXECUTION

3.01 GENERAL

A. Install the sewer system in accordance with the sections of the Standard Specifications noted hereinbefore.

B. The Contractor shall be responsible for precisely laying out the sewer line shown on the contract plans. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

C. In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

D. The installation of sewer pipes and testing and acceptance shall be governed by the DPW Standard Specifications.

END OF SECTION

SECTION 02770 – CONCRETE SIDEWALKS

PART 1 - GENERAL

1.01 WORK DESCRIPTION

A. The work covered by this section consists of furnishing all labor, materials, equipment tools and incidentals necessary to construct cast-in-place concrete sidewalks and curbs with color and finish to the line and grade shown on the Plans and as specified herein.

1.02 RELATED DOCUMENTS

A. Related Work not Included in this Section:

1. Earthwork is specified in SECTION 02300 – EARTHWORK.

2. Cast-in-place concrete is specified in SECTION 03300 – CAST-IN-PLACE CONCRETE.

3. The work in this Section is specified in the following section of the Department of Public Works (DPW) Standard Specifications 1986. All references to measurement and payment do not apply.
   a. Section 29 – Sub grade

   b. Section 31 – Aggregate Base Course

   c. Section 39 – Portland Cement Concrete

   d. Section 42 – Concrete Sidewalk

   e. Section 48 – Reinforcing Steel

1.03 SUBMITTALS

A. Submit the following:

1. Submit three (3) compressive strength 28-day tests for each day's pour as sampled and tested by the approved laboratory. The cost for all sampling, testing, and re-sampling and testing shall be borne by the Contractor

   Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.

2. Transmit Mix Delivery Slips:
   a. Keep records showing time and place of each pour of concrete, together with transmit mix delivery slips certifying contents of the pour. The Contractor shall ensure that all stamps and log data are accurate, clear and legible, including the time stamp upon leaving the yard, the time of arrival at the job site, the time at the start of the unloading, the time unloading is finished, and the time of departure from the job site.

   b. Deliver the records and delivery slips to the Project Manager upon completion of the concrete placement work.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement Concrete, Class “B”, in accordance with Section 39 of the DPW Standard Specifications.

2.02 JOINT MATERIAL

A. Joint sealant shall be multi-component, polysulfide or polyurethane, elastomeric type sealant, conforming to ASTM C920.

B. Sealant shall be self-leveling, traffic bearing, and resistant to UV reversion.

C. Joint sealant color shall match the color of the concrete to the User’s satisfaction.

D. Preformed fillers for joints shall conform to ASTM D994 or D1751.

2.03 FORMS

A. Forms in accordance with Section 42 of the DPW Standard Specifications for concrete sidewalks.

B. Either steel or wood, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Forms shall be free from warps, bends, twists, or other defects, which will impair the appearance of the completed work, extending the full depth of concrete. Use flexible spring steel forms or laminated boards to form radius bends as required.

C. Wood forms shall be surfaced on the upper edges and on the sides against which the concrete is to be placed.

D. Form sections when set in place shall possess adequate strength and rigidity to remain true to the established line and grade.

E. Coat forms with release agent that will not discolor or deface the surface of concrete.

PART 3 - EXECUTION

3.01 ALIGNMENT LAYOUT AND PREPARATION

A. Layout the sidewalk as indicated.

B. Perform earthwork as specified in SECTION 02300 – EARTHWORK.

C. Before erecting forms, the subgrade or subbase shall be graded and compacted. Wherever unsuitable material is encountered, it shall be removed and replaced with select borrow and compacted to the required elevation.

3.02 FORM CONSTRUCTION

A. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the work, and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed form work for grade and alignment to the following tolerances:
   1. Top of form units: Not more than 1/8-inch in 10 feet.

   2. Vertical face: Longitudinal axis, not more than 1/8-inch in 20 feet.

C. All forms, wood or metal, shall be clean and oiled prior to setting in place. The erected forms shall be adequately secure to prevent movement in any direction during placement of the concrete.

3.03 CONCRETE PLACEMENT AND CURING

A. Concrete placement shall be as specified in the DPW Standard Specifications. Reinforcing steel shall be installed as indicated.

B. Prior to pouring concrete, the prepared subgrade or subbase shall be dampened. The concrete shall be poured, spaded, and tamped thoroughly into the forms.

C. Curing and protection shall be as specified in the DPW Standard Specifications.

3.04 JOINTS

A. Joint construction shall be as specified in the DPW Standard Specifications.

B. Expansion Joints.
   1. Construct expansion joints as indicated.

   2. The joints shall be constructed with pre-molded expansion type filler.

C. Crack Control Joints: Construct crack control joints at a spacing not to exceed 5-foot intervals.

D. Construction Joints: Construction joints shall be keyed with a minimum of one #3 tie bar 15 inches long.

E. Joint Sealant: Joint sealant shall be applied in accordance with the manufacturer's recommendations.

3.05 FINISHING

A. Strike-off, consolidation and tamping shall be in accordance with the DPW Standard Specifications.

B. Surface Finish. Broom finish, as shown on the Drawings. Provide non-slip finish.

C. All concrete pavements shall have a uniform color and surface texture, which shall be subject to acceptance by the Project Manager.

3.06 SURFACE TOLERANCES

A. The finished surface of the sidewalks shall be within 0.02 foot above or below the theoretical grade.

3.07 PATCHING

A. Within 3 days after stripping formwork, fill and patch surface defects such as rock pockets, honeycombs, cracks, and holes. The Project Manager will distinguish between concrete that requires replacement or repair and surface defects that requires patching. Permission to patch any area will not be construed as a waiver of the State's right to require complete removal of the defective work if the patching, in his opinion, does not satisfactorily restore the quality and appearance of the surface.

3.08 CLEANING

A. Repair and clean all curb damaged, discolored, or splashed with asphalt or concrete during construction. Damaged section shall be removed entirely and reconstructed. No patching or refinishing shall be permitted.

END OF SECTION

SECTION 02820 - FENCES AND GATES

PART 1 - GENERAL

1.01 WORK DESCRIPTION

A. Furnish materials, labor and equipment necessary to install all chain link fences and gates to the limits shown and as detailed on the plan and as specified herein. All material shall be new, specifically purchased for this project.

B. Section includes:

1. Fence framework, fabric and accessories.

2. Excavation for post bases.

3. Concrete foundation for posts and center drop for gates.

4. Manual gates and related hardware.

5. Gate locking devices.

1.02 SUBMITTALS

A. Submit in accordance with Section 01300 – SUBMITTAL PROCEDURE.

B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, and schedule of components.

C. Product Data: Submit data in the form of manufacturer's technical data, specifications, and installations for fence, posts, gate uprights, post caps, gates, gate hardware and accessories.

D. Manufacturer's Installation Instructions: Submit installation requirements.

1.03 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing product specified in this section with minimum three (3) years of experience.

B. Installer: Company specializing in performing work of this section with minimum three (3) years of experience.

1.04 DELIVERY STORAGE AND HANDLING

A. Deliver, store, protect and handle products with adequate protection against damage.

B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.

C. Identify each package with manufacturer's name.

D. Store fence fabric and accessories in secure and dry place.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials and fittings shall be new, and all ferrous materials shall be hot-dipped galvanized in accordance with the requirements under ASTM A 123. All galvanized materials shall be free from barbs, icicles or other hazardous projections resulting from galvanizing.

A. Chain Link Fence Fabric: Shall be No. 9 gauge conforming to ASTM A392, Class 1. 2-inch mesh unless noted otherwise on the plans. The hot-dipped galvanized fabric shall contain not less than 1.2 ounces per sq. ft of uncoated wire surface as determined by stripping test ASTM A90 and under the PREECE Test (ASTM A239), shall withstand 6 or more one-minute dips before reaching the end point. Top and bottom selvages of chain link fabric shall be knuckled.

B. Tie Wire: Shall be 12-gauge galvanized steel wire as called for on the plans.

C. Tension Bar: Shall be 1/4-inch thick by 3/4-inch wide galvanized mild steel bar for attachment of a fabric to a terminal post.

D. Tension Band and Brace Brand: Shall be formed from galvanized steel bands at least 12 gauge thick by 3/4-inch wide.

E. Tension Rod: Shall be a 3/8-inch dia. galvanized mild steel rod threaded at one end and hooked 180 degrees at the other.

F. Fittings: (Note: Pressed steel fittings shall not be allowed)

1. Post Cap and Eye Top shall be of one-piece hot-dip galvanized cast iron construction and shall attach securely onto their respective posts.

2. Coupling for top rails shall be outside sleeve type, galvanized, at least 6-inches long and crimped at center.

3. Rail Ends shall be snug, one-piece fittings for top and brace rails with holes to receive 5/16-inch bolts for securing to rail end bands.

4. Double Rail End shall be similar to rail and except for an additional 1/2-inch hole to receive the hooked end of a tension rod.

G. Composition and Finish of Metal Parts: All metal parts and fittings, including tracks, gate hardware, bolts and frames, shall be of steel, malleable iron or wrought iron and shall be galvanized by the hot-dip process, after fabrication, in conformance with ASTM A153. The coating on all parts shall be continuous and smooth; that is, free from barbs, icicles or other projections. Bolts may be cadmium-plated in conformance with ASTM A165 instead.

H. Posts, Rails and Braces: Shall be the standard weight, hot-dipped galvanized, welded and seamless steel pipes conforming to ASTM A120.

I. Selvage Wire: Shall be of 8-gauge galvanized coil spring steel wire of good commercial quality.

J. Padlocks are to be of good quality, heavy duty and weather resistant and provided by the Contractor for all gates. All padlocks shall be keyed alike and a minimum of twelve (12) keys shall be provided. The Contractor shall provide a submittal of the padlocks for acceptance by the Project Manager.
   1. Padlock shall be 5-pin cylinder type with brass case and a 5/16-inch diameter hardened steel shackle. Padlocks shall be keyed differently but masterkeyed to the fence system. Two masterkeys shall be provided.

K. Tension Wire shall be of 7-gauge coiled spring galvanized wire.

L. Concrete for post footings shall be Class 2500 as specified in Section 03300 CAST-IN-PLACE CONCRETE.

2.02 OTHER MATERIALS

All other materials not specifically listed herein-in, but required for the successful installation of the work included, are subject to acceptance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of work means installer accepted existing surface and substrate conditions.

3.02 INSTALLATION AND WORKMANSHIP

A. Post and Rail Installationl:
   1. Chain link fencing shall be erected in strict conformance with the plans and these specifications. Posts shall be plumb and in line.

   2. Welding shall be done in accordance with latest AWS standards. However, no splicing of posts, rails or braces shall be accepted.

   3. Where changes in line occur with an angle of deflection of 30 degrees or more, the change point will be considered a corner and a corner post shall be installed thereat.

   4. End, corner, and gate posts for fences with 5-foot and wider fabric shall be braced to the nearest line post with horizontal braces and tension rods. The horizontal braces shall be spaced midway between top rail and ground and securely fastened to posts as shown on plans.

5. Where fencing is placed along a curve with radius of 50 feet, or less, horizontal braces (and tension rods) shall be installed between all posts in like manner. Pull posts, at maximum intervals of 300 feet, shall be braced and trussed in both directions as specified above.

6. Fence Posts, except as otherwise indicated or specified, shall be spaced not more than 10-feet apart. Line posts shall be set so that top of the eye tops shall be at the same height as the fence fabric. Post caps shall be secured in place either by spot welding, S.S. tamper proof set screw, or S.S. setting pin.

7. Allow concrete to cure for minimum seven (7) days before installing fabric and other materials attached to posts.

8. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures, unless indicated otherwise.

9. Set intermediate and terminal posts plumb in concrete footings or concrete walls, as shown on drawings.

10. Line Post Footing Depth Below Finish Grade: Follow ASTM F567, unless indicated otherwise.

11. Corner and Terminal Post Footing Depth Below Finish Grade: Follow ASTM F567, unless indicated otherwise.

12. Top Rails shall pass through and bear firmly on base of eye tops, form a continuous brace from end to end of each stretch of fence, and be securely fastened to terminal posts with rail ends and brace bands. Couplings for the top rails shall be installed at intervals of 24-feet maximum.

13. Install center and bottom brace rail on corner gate leaves.

14. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

B. Chain-Link Fabric Installation

1. Chain Link Fabric shall be fastened on the side of the posts as designated and shall be mounted on the posts so that the bottom of the fabric will be no more above the finished grade than called for on the plans. High points of the ground shall be excavated as necessary. The fabric shall be stretched taut and securely fastened to the posts. The tie shall be installed around the frame member and a single strand of fence fabric. The two ends of the tie shall be twisted together three times forcing the tie to conform to the shape of the frame member to make it difficult to insert an object between the tie and the frame member. The pointed ends of the tie shall lay in the direction of the travel of the fabric and tips shall be severed to reduce the hazard to personnel and make it difficult to untwist the tie. Between posts the top edge of the fabric shall be fastened to the top rail and the lower edge to the tension wire with tie wire of size and at spacing as called for on the plans. Tension wire shall be

stretched tight and shall be installed in a straight line between posts. Tension bars extending the full height of the fence and tension bar bands shall be used for fastening fabric to end, corner, pull and gate posts. Bolted tension bar bands shall be placed at top and bottom of the tension bars and spaced at 12-inch intervals. Fastenings to line posts shall be made with tie wire of size and at spacing as called for on the plans.

2. Do not stretch fabric until grout for sleeves has cured for 14 days.

3. Stretch fabric between terminal post or at intervals of 100 feet maximum, whichever is less.

4. Fasten fabric to top, intermediate and bottom rails, line posts, truss rods, stretcher bars and with tie wire at maximum 15 inches on centers, unless shown otherwise.

5. Attach fabric to end and corner posts with stretcher bars and stretcher bar clips.

C. Gates shall be of size specified in plans. The corners of gate frames shall be fastened together and reinforced with malleable iron fittings or by welding as approved. Welds shall all be ground smooth. Where sizes permit, frames shall be galvanized after fabrication, otherwise all welds shall be finished as specified for touching up abrasions and field welds. All drive gate frames for fences 4-feet and higher and walk gate frames for 6-foot high fences shall be cross-trussed with tension rods welded to frame at hooked end. Fabric specified for the fence shall be attached to the sides of the gate frame with full-height tension bars and tension bar bands at top, bottom and 12-inches o.c. along tension bars with 9-gauge tie wires shall be placed along the top and bottom of the gate at corners and 6-inches o.c. in between. The gates shall be hung by at least two hinges. For the drive gates, latches of the crop rod type shall be provided and shall be of the full gate height, arranged to engage the gate catch. For walk gates, a forked latch may be provided. Catch for the drop rod shall be galvanized pipe and set in concrete. Gate hold-backs shall be positioned to secure and support the free end of the gate in full open position and/or as shall be accessible from both sides of the gates.

3.03 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch

B. Maximum Offset from Indicated Position: 1 inch

C. Maximum Distance from Property Line: 6 inches

3.04 FIELD TOUCHUPS

A. Field welds shall be cleaned of flux and spatter and all damaged galvanizing removed, all hazardous projections ground off, properly prepared, and then heavily coated with self-curing inorganic zinc coating. Manufactured coatings shall be applied in strict accordance with manufacturer's printed specifications. Damage to existing painted surfaces shall be touched up.

B. Adjust gates for smooth and balanced operation.

3.05 FINAL CLEAN-UP

All exposed metal surfaces shall be clean and free of cement. All surplus earth resulting from metal fencing work that is not used in the grading work shall be cleaned up and disposed of off-site. All debris resulting from work of this section shall be removed from the site.

END OF SECTION

DIVISION 3 - CONCRETE

SECTION 03113 - CAST-IN-PLACE CONCRETE FORMING

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools and equipment necessary for completing work of concrete formwork in accordance with County of Hawaii Standard Specifications for Public Works Construction, September 1986, Section 40 and as indicated on the drawings and as specified herein.

1.2 RELATED SECTIONS

A. REINFORCING STEEL — Section 03200

B. CAST-IN-PLACE CONCRETE — Section 03300

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Shop Drawings: Prepared and signed by a qualified professional engineer licensed in Hawaii, detailing fabrication, assembly, and support of formwork for walls. Design and engineering of formwork are Contractor's responsibility.

C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
   1. Form materials

   2. Form-release agent(s)

1.4 QUALITY ASSURANCE

A. Qualifications of formwork installer shall be as follows: An experienced installer who has completed concrete Work similar in material, design, and extent of this Project and whose work has resulted in construction with a record of successful in-service performance. Formwork Contractor to submit work experience performed under company name to Officer-in-Charge prior to beginning work.

B. Qualifications of Professional Engineer hired by Contractor to design formwork for project shall be as follows: A professional engineer who is legally qualified to practice in the State of Hawaii and who is experienced in providing engineering services of the kind required. Engineering services are defined as services performed for formwork and its bracing installations that are similar to those indicated for this Project in material, design, and extent.

C. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 301, "Specification for Structural Concrete."

   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

   3. ACI 347 “Guide to Formwork for Concrete”

PART 2 – PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Furnish only form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Plywood – New untreated Douglas Fir "Plyform", edge branded and sealed, grade marked "EXT-DFPA" or approved substitute.

C. Metal Forms – May be used if they produce surfaces equal in smoothness and trueness to those specified for wood forms.

2.2 ACCESSORIES

A. Form-Release Agent: Furnish only commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulated form-release agent with rust inhibitor for steel form-facing materials.

B. Form Ties: Provide factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete upon removal.
   1. Ties designed to leave a portion of the tie embedded in the concrete section shall not leave corrosive metal closer than 1 inch to the exposed concrete surface. When ties are removed, they shall be designed not to leave holes larger than 1 inch in diameter in concrete surface. Ties shall have integral water-barrier ¾-inch diameter plates or rubber washers where installed into walls indicated to receive waterproofing system. Manufacturer:
      a. Dayton Superior. "Waterseal Washers" for snap ties
      b. Approved substitute

C. Chamfer Strips: Shall be wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, unless noted otherwise on Construction Documents.

PART 3 – EXECUTION

3.1 GENERAL

A. Work shall comply with the methods and sequence presented in ACI 347.

B. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

3.2 FORMWORK

A. Forms shall be designed and constructed in a manner that allows for their removal without prying, hammering against the concrete.

B. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

C. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

D. Provide temporary 18-inch square minimum openings in wall forms for cleanouts, consolidation and inspection that are more than 12 feet in height. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms no more than 3 feet from bulkheads and 8 feet on center horizontally. The lowest row of openings shall not be more than 4 feet above the floor (invert) surface with subsequent rows no more than 6 feet on center.

E. To maintain the concrete construction within the stated tolerances, the formwork shall be cambered to compensate for anticipated deflection in the formwork.

F. Chamfer exterior corners and edges of permanently exposed concrete. Do not chamfer corners or edges of concrete at vertical wall construction joints, unless specifically detailed.

G. Form openings, chases, offsets, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Care shall be taken not to allow agent to puddle or get on items to be embedded in the concrete.

3.3 CONSTRUCTION JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.

C. Form key at joint with preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, where indicated. Embed keys at least 1-1/2 inches into concrete.

3.4 REMOVAL AND REUSE OF FORMS

A. Formwork, for sides of beams, walls, and similar parts of the Work, that does not support weight of concrete shall be as recommended in ACI 347, Section 3.7.2.3.

B. Leave formwork, for beam soffits, slabs, and other structural elements, supporting weight of concrete in place until concrete has achieved <u>all</u> of the following:

1. At least 75 percent of 28-day design compressive strength is achieved from test specimens from same concrete batch as the structural element.

2. The amount of time elapsed since the concrete was placed meets the requirements stated in ACI 347, Section 3.7.2.3.

3. Concrete has attained sufficient strength to safely support its weight and the loads placed thereon.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new coat of form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.5 SCREEDS FOR SLABS

A. Edge forms and intermediate screed strips shall be set accurately to produce the designated elevations and contours of the finished slab surface, and shall be sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the finish specified requires the use of such equipment.

A. The concrete surface shall be aligned to the contours of screed strips by the use of strike-off templates or approved compacting type screeds. Screeds shall be set adjacent to all walls and in parallel rows not to exceed 8 feet on center.

END OF SECTION

SECTION 03200 - REINFORCING STEEL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools and equipment necessary for completing the installation of reinforcing steel as indicated on the drawings and as specified herein.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated, such as mechanical splice devices.

B. Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete and masonry structures.

C. Welding Certificates: Copies of certificates for welding procedures and personnel, if reinforcing bars are to be welded.

D. Material Certificates: Signed by manufacturer certifying that each of the following items complies with requirements:
   1. Steel reinforcement
   2. Reinforcement accessories

1.4 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

B. Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 315, "Details and Detailing of Concrete Reinforcement."
   2. CRSI, "Manual of Standard Practice"

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Store bar bundles off the ground and in a manner that does not leave the bundles exposed to the elements. Position bundles to allow the identification mark tag to be readily accessible.

C. When lifting bars provide sufficient support points to prevent excessive sagging that allow bars to rub against each other causing damage to the epoxy coating. No bare chains or cables shall be used to lift the reinforcing steel.

PART 2 – PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed. The use of re-rolled rail steel or cold twisted bars will not be permitted. Provide epoxy coating in conformance with ASTM A775.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets. See Drawings for gauge of wire and dimensions of mesh required. Provide epoxy coating in conformance with ASTM A884.

D. All reinforcing shall be new, free from dirt, detrimental scale, paint, oil or other foreign substances. No material cleaned by sand blasting will be allowed.

2.2 ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place shall be coated with or manufactured from non-conductive material, such as epoxy or plastic. Manufacture bar supports according to CRSI's "Manual of Standard Practice", Class 1A from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1A plastic-protected bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60, epoxy coating per ASTM A775. Cut bars true to length with ends square and free of burrs prior to coating.

C. Tie Wires: Tie wires shall be PVC coated black annealed iron wire No. 16 B.W.G. for No. 5 bars and lighter, and No. 14 B.W.G. for heavier bars.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

B. Fabricated bars shall be bundled up like-kind and tagged with an identification mark matching the marks in the approved shop drawings.

C. Field bending of reinforcing shall not be permitted, unless approved in writing by the Officer-in-Charge.

D. Cutting of bars is permitted using power shears or a chop saw and cut ends shall be repaired using a two-part epoxy. Bars are prohibited from being flame cut.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Examine coating for any damage, and shall be free of rust, mill scale, soil, and other foreign materials. Repair any areas were coating has been damaged or replace bar.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain the minimum concrete cover specified. Do not tack weld crossing reinforcing bars.
   1. Shop- or field-weld reinforcement according to AWS D1.4, only where indicated.

D. Orient ends of wire ties pointing away from the concrete surface.

E. Install welded wire fabric by rolling out fabric flat and firmly holding in place to the lines and grade as shown on the plans, in the longest practicable lengths, on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets of fabric at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.2 CONSTRUCTION JOINTS

A. Place joints perpendicular to main reinforcement, if not specifically shown on the Contact Drawings.

B. Continue reinforcement across construction joints, unless otherwise indicated.

C. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
   1. Use dowel sleeves or lubricate-coat one-half of dowel length on one side of the joint and wrap coated end to prevent concrete bond to one end of dowel.

3.3 WALL OR SLAB PENETRATIONS

A. Provide additional reinforcing around wall and slab openings as detailed.

B. Locate diagonal bars detailed around openings inside the main reinforcing layers, unless noted otherwise. Position mid-length of diagonal bar at centerline of opening and bend ends of diagonal parallel with slab edge or wall face where specified length of diagonal will not fit in concrete section as a straight bar.

3.4 FIELD INSPECTION

A. Prior to placing concrete, all reinforcing shall be inspected with the inspection documented.

B. The bar spacing and size shall be verified with the shop drawings. Check bars are securely tied to prevent displacement during placing of concrete.

C. Check bar lap lengths meet the minimum required.

D. Check coverage depths are adequate for edge and top bars, and that bars are properly supports to prevent sagging of bars.

E. Check for damage to the epoxy coating and repair as described below. Sufficient time shall be allowed for repair coating to dry prior to placing concrete.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

A. REINFORCING STEEL — Section 03200

B. CAST-IN-PLACE CONCRETE FORMING — Section 03113

1.3 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.
   4. Building walls.

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include statement indicating costs for each product having recycled content.

   2. Design Mixtures for Credit ID 1.1: For each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

F. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

G. Qualification Data: For installer, manufacturer, and testing agency.

H. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   6. Floor and slab treatments.
   7. Bonding agents.
   8. Adhesives.
   9. Vapor retarders.
   10. Semirigid joint filler.
   11. Joint-filler strips.
   12. Repair materials.

I. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.

J. Field quality-control reports.

K. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing

Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site.
   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor.

   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, [steel reinforcement installation, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:
      a. Fly Ash: ASTM C 618, Class F or C.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size**:** ¾-inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Retarding Admixture: ASTM C 494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/, Type II.

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
b. BASF Construction Chemicals - Building Systems; Confilm.
c. ChemMasters; SprayFilm.
d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; Vapor-Aid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. ChemMasters; Safe-Cure Clear.
d. Conspec by Dayton Superior; W.B. Resin Cure.
e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f. Edoco by Dayton Superior; Res X Cure WB.
g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h. Kaufman Products, Inc.; Thinfilm 420.
i. Lambert Corporation; AQUA KURE - CLEAR.
j. L&M Construction Chemicals, Inc.; L&M Cure R.
k. Meadows, W. R., Inc.; 1100-CLEAR.
l. Nox-Crete Products Group; Resin Cure E.
m. Right Pointe; Clear Water Resin.
n. SpecChem, LLC; Spec Rez Clear.
o. Symons by Dayton Superior; Resi-Chem Clear.
p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
   1. Types I and II, non-load bearing for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

   1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
   1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, and concrete with a water-cementitious materials ratio below 0.50.
   4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.45
   3. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 520 lb/cu. yd.
   3. Slump Limit: 4 inches, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
   5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one-part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

   2. After concrete has cured at least 14 days, correct high areas by grinding.

   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. Yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C 31.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION

DIVISION 4 - MASONRY

SECTION 04200 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMU).
   2. Mortar and grout.
   3. Reinforcing steel.
   4. Miscellaneous masonry accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."

C. Qualification Data: For testing agency.

D. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
   2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.2 CONCRETE MASONRY UNITS (CMU)

A. Concrete Masonry Units: ASTM C 90
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
   2. Weight Classification: Normal weight.
   3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207**,** Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

D. Mortar Cement: ASTM C 1329.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Aggregate for Mortar: ASTM C 144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than ¼-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

G. Aggregate for Grout: ASTM C 404.

H. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

2.5 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use Portland cement-lime or mortar cement mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.

D. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown.

B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

C. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

3.5 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.6 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.7 REPAIRING, POINTING, AND CLEANING

A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   2. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

END OF SECTION

DIVISION 5 - METALS

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

1.3 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC 360.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittal:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. Identify members and connections of the seismic-load-resisting system.
   6. Indicate locations and dimensions of protected zones.
   7. Identify demand critical welds.
   8. For structural-steel connections indicated to comply with design loads, include structural design data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

E. Qualification Data: For qualified Installer, fabricator, professional engineer, and testing agency.

F. Welding certificates.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

H. Mill test reports for structural steel, including chemical and physical properties.

I. Product Test Reports: For the following:
1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

J. Source quality-control reports.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and

spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:

   1. W-Shapes: 60 percent.
   2. Channels, Angles: 60 percent.
   3. Cold-Formed Hollow Structural Sections: 25 percent.

B. W-Shapes: ASTM A 992

C. Channels, Angles: ASTM A 36

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

C. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

D. Threaded Rods: ASTM A 36.
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Washers: ASTM A 36 carbon steel.
   3. Finish: Hot-dip zinc coating, ASTM A 153, Class C.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FLUID APPLIED WATERPROOFING

A. Single component cold fluid applied rubberized asphalt elastomeric waterproofing suitable for below grade use on steel.

B. Products:
   1. Henry Company HE787 Elastomulsion Waterproofing
   2. Or Approved Equal

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Roof purlin framing.
   2. Interior wall framing.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated in the Project drawings.
   2. Deflection Limits: Design framing systems to withstand design live loads without deflections greater than the following:
      a. Roof Purlin Framing: Horizontal deflection of 1/360 of the horizontally projected span.
      b. Interior Wall Framing: Horizontal deflection of 1/360 of the wall height.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/8 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, both erection and permanent bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
   1. For cold-formed metal trusses, include structural design calculations signed and sealed by a Hawaii-licensed professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For testing agency.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
   1. Steel sheet.
   2. Mechanical fasteners.
   3. Vertical deflection clips.
   4. Horizontal drift deflection clips
   5. Miscellaneous structural clips and accessories.

F. Research/Evaluation Reports: Report shall be current
   1. Cold- formed metal framing.
   2. Expansion anchors.
   3. Power-actuated anchors.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to the County, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
   1. Dietrich Metal Framing; a Worthington Industries Company.
   2. MarinoWare; a division of Ware Industries.
   3. Approved equal.

2.2 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: ST33H
   2. Coating: G90

2.3 ROOF PURLIN FRAMING

A. Steel Purlins: Manufacturer's standard C- and Z-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0677 inch
   2. Flange Width: 2-1/2 inches, minimum.

B. Built-up Members: Built-up members of manufacturer's standard C-shaped steel section, with stiffened flanges, nested into a U-shaped steel section joist track, with unstiffened flanges; unpunched; of web depths indicated; and as follows:
   1. Minimum Base-Metal Thickness: Matching steel purlins.
   2. Flange Width: 2-1/2 inches, minimum.

2.4 INTERIOR WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0677 inch
   2. Flange Width: 2-1/2 inches, minimum

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 1-1/4 inches

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0677 inch
2. Flange Width: 2-1/2 inches, minimum

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Stud kickers, knee braces, and girts.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, non-leaching.

E. Sealer Gaskets: Closed-cell neoprene foam, ¼-inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies in a way to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate all assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below what is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of truss bottom chord track and the top of wall to ensure a uniform bearing surface on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for chord or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting roof diaphragm structure has been completed and permanent connections are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 FIELD QUALITY CONTROL

A. Testing: County will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Contracting Officer.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07600 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY
A. This section specifies sheet metal flashing, gutters, leader heads, downspouts and trim work related with roofing work.

1.02 COORDINATION WITH OTHER SECTIONS

1.03 SUBMITTALS
A. Shop Drawings: Submit six (6) sets of shop drawings to the Contracting Officer for approval prior to fabrication. Indicate on the shop drawings thickness, dimensions, fastenings, and anchoring methods, expansion joints and other provisions necessary to provide for thermal expansion and contraction.

B. Manufacturer's Specifications: Submit six (6) sets of manufacturer's technical specifications to the Contracting Officer for approval for items which are factory fabricated.

1.04 QUALITY ASSURANCE
A. Workmanship shall conform to the quality, procedures and the methods recommended by the National Association of Sheet Metal Contractors and/or Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.05 GUARANTEE
A. The Contractor shall issue a written guarantee to the Contracting Officer that all work executed under this Section shall be free from defects of materials and workmanship for a period of two (2) years from final acceptance of the building. The following types of failure will be adjudged as defective work:

1. Leaking, failure to stay in place, undue expansion, lifting, deformation, loosening, splitting of seams.

2. The guarantee shall provide the following at no additional cost to the State:
   a. Repair of flashing as necessary to seal leaks which are attributable to faulty materials and/or workmanship.

   b. Repair and replacement of damage to the building and/or its finishes, equipment and/or furniture when occasioned by such leaks, and

   c. Inspection of the flashings together with the Contracting Officer or his designated representative, on or about the 1st and 2nd anniversaries of the Project.

B. The guarantee shall be signed jointly by the Sheet Metal Subcontractor and the General Contractor.

1.06 STORAGE AND HANDLING
A. All materials shall be stored in such a manner as to afford adequate protection. Damaged materials shall not be used and shall be removed from the site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Exposed flashing, and metal edging: 24 gauge aluminum zinc alloy-coated sheet steel, conforming to ASTM A 792, AZ-50.

B. Plastic cement shall conform to F.S. SS-C-153, Type I.

C. Fasteners shall be manufacturer's non-corrosive type, Series 304 or 316 stainless steel, with self sealing neoprene gasketed heads.

D. Copper wire cloth strainers for downspout connector head covers at gutters, formed as shown, and removable.

E. Finish: Shop and field paint all surfaces as specified in painting section 09901.

F. Gutters and Hangers: 24 gauge aluminum zinc alloy-coated sheet steel. Where applicable gutters and hangers shall be of the same material as the metal roofing. Hangers shall be 16 gauge aluminum zinc alloy-coated sheet steel, as indicated on drawings, painted to match gutters.

G. Sheet Metal Section of Downspout: 24 gauge aluminum zinc alloy-coated sheet steel.

H. Downspouts: : 24 gauge aluminum zinc alloy-coated sheet steel. Hangers shall be galvanized steel as indicated on drawings.

I. Flashing Tape: Shall be self-sticking rubberized asphalt with aluminum foil facing for application with vent flashings to seal pipe penetrations and/or where indicated on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION AND WORKMANSHIP

A. Surface to which sheet metal is to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from defects that might affect the application. Report any unsatisfactory surfaces to the Contracting Officer. In the absence of such a report, the Contractor shall be held responsible for the finished product.

B. All accessories or other items essential for the completeness of the sheet metal installation, though not specifically indicated on the drawings or specified, shall be provided. All such items unless otherwise indicated on the drawings or specified, shall be of the same material as the item to be applied. Nails, screws and bolts shall be of the type best suited for the purpose intended and shall be of a composition that is compatible with the metal to which it will contact.

C. Except as otherwise indicated on the drawing or specified, the workmanship of sheet metal work, method of forming joints, anchoring, provisions for expansion, etc,. shall conform to the standard details and recommendations of the Sheet Metal and Air Conditioning Contractors National Association's "Architectural Sheet Metal Manual", and shall be subject to the approval of the Contracting Officer.

D. All sheet metal work shall be watertight and wind-tight in compliance with the purpose intended for the items indicated on the drawings or specified herein.

E. Protection from Contact of Dissimilar Materials: Sheet metal surfaces in contact with dissimilar metal shall be painted with heavy-bodied bituminous paint, or shall be separated by means of moisture-proof building felts. Dissimilar metals shall

be non-compatible materials that when placed in contact with each other will cause a corrosive chemical reaction.

F. All gutters, downspouts, and scupper boxes shall be cleaned of debris, dirt and other material prior to installation, and prior to final inspection.

3.02 PROTECTION

A. Protect all sheet metal work until final acceptance of the project.

3.03 CLEANUP

A. At completion of the work, clean up and remove all rubbish and debris from the premises which resulted from this work to the satisfaction of the Contracting Officer.

B. All gutters and downspouts shall be cleaned prior to installation, and before final inspection after installation.

END OF SECTION

SECTION 07611 – STANDING SEAM METAL ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies standing seam roofing work.

1.02 REFERENCES: The latest publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Iron and Steel Institute (AISI)

AISI SG-673 - Cold-Formed Steel Design Manual

B. ASTM International (ASTM)

ASTM A 36 - Structural Steel

ASTM A 366 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

ASTM A 570 - Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 607 - Steel, Sheet and Strip, High-Strength, Low-Alloy, Columbium or Vanadium, or Both, Hot-Rolled and Cold-Rolled

ASTM A 792 - Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate

ASTM B 117 - Operating Salt Spray (Fog) Testing Apparatus

ASTM C 1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal insulation

ASTM D 4587 - Flourescent UV-Condesation Exposures of Paints and Coatings

ASTM D 522 - Mandrel Bend Test of Attached Organic Coatings

ASTM D 523 - Specular Gloss

ASTM D 714 - Evaluating Degree of Blistering of Paints

ASTM E 84 - Surface Burning Characteristics of Building Materials

ASTM E 1592 - Structural Performance of Sheet Metal Roofing and Siding Systems by Uniform Static Air Pressure Difference

ASTM E 1646 - Water Penetration of Exterior Metal Roof Panel Systems

ASTM E 1680 - Air Leakage Through Exterior Metal Roof Panel Systems

ASTM E 2140 - Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

C. American Society of Civil Engineers (ASCE)
ASCE-7 - Minimum Design Loads for Buildings and Other Structures

D. Testing Application Standards (TAS)

TAS 100 - Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems

TAS 125 - Standard Requirements for Metal Roof Systems

E. INTERNATIONAL BUILDING CODE (IBC)

IBC 2018 - International Building Code

F. National Roofing Contractor Association (NRCA)

NRCA CD - Construction Details

G. Sheet Metal & Air Conditioning Contractors' National Association, Inc. (SMACNA)

SMACNA ASMM - Architectural Sheet Metal Manual

H. Underwriters Laboratory Inc. (UL)

UL 580 - Roofing Materials and System Directory

UL 723 - Test for Surface Burning Characteristics of Building Material

UL 790 - Fire Resistance of Roof Covering Materials

I. National Fire Protection Association (NFPA)

NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials

1.03 DEFINITIONS

A. Factory-Formed Seam: Seams of panels so configured that when adjacent sheets are installed the seam is sealed utilizing mechanical or hand seamers.

B. Roofing System: The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight roof covering.

1.04 SYSTEM DESCRIPTION

A. Design Requirements

1. Hydrostatic standing seam metal roof system with 16” panel and minimum 2” high “T” shaped vertical seam and a separate mechanically seamed cap with continuous factory-applied sealant. Panels shall have factory formed longitudinal stiffening

mesas to minimize the effects of oil canning.

2. Ridge Closures: Factory pre-cut closed-cell foam meeting ASTM D 1056, enclosed in metal channel matching panels.

2. Roof panels shall be attached to the substrate with concealed one-piece anchor clips.

3. Panels shall be continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets shall be in continuous contact from eave to ridge.

4. Panel system shall not have requirement for sequential installation or removal.

5. There shall be no exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners shall be stainless steel screws inserted into predrilled holes.

6. Panels shall support walking loads without permanent distortion or telegraphing of the structural supports.

B. Structural Capacity: Structural capacity of metal roofing system shall be determined in accordance with ASTM E 1592. Extrapolation of data outside independent testing is not allowed.

C. Design Analysis and Uplift Capacity: Roof system manufacturer shall provide a design analysis signed by a Structural Engineer registered in the state of the project, confirming that the structural capacity of the metal roofing system as determined in accordance with ASTM E 1592 is adequate to resist the design loads according to ASCE 7 and local building code. Analysis shall include calculations verifying the design loads, the uplift pressures and how those loads affect the various areas of the roof. Provide attachment method and roof plan with the perimeter areas of discontinuity clearly shown and distinguished from the typical field roof elements.

D. Resistance to Water and Air Infiltration

1. Air infiltration of the roof panel system shall be no more than 0.001 CFM/ft2 at a positive pressure differential of 20 psf when tested in accordance with ASTM E 1680.

2. No water penetration into the building interior when the roof system is tested in accordance with ASTM E 1646 at a positive pressure differential of 20 psf for at least 15 minutes.

3. Roof panel system shall be successfully tested in accordance with FM 4471 for Class 1 approval with 1-90 windstorm and 1-SH hailstorm classification.

4. No wind driven rain penetration or panel movement when exposed to 110 mph wind when tested in accordance with TAS 100.

E. Thermal Movement: Interface between panel and clip shall provide for unlimited thermal movement. The system shall be capable of withstanding thermal movement based on a temperature differential of 150 degrees.

F. Deflection: Panel deflection shall not exceed L/120 under total and L/140 under live load.

G. Structural Performance: The structural performance test methods and requirements shall be in accordance with ASTM E 1592.

1.05 SUBMITTALS

A. Manufacturer's Catalog Data: Submit for all materials to be provided. Submit data and independent test reports sufficient to indicate conformance to specified requirements for the following:

1. Pre-finish standing seam roofing panels

2. Attachment clips

3. Closures

4. Accessories

5. Self adhered roofing underlayment

6. Insulation and Fabric Liner System

B. Shop Drawings:

1. Roofing System: Provide shop drawings from roof system manufacturer’s engineering department. Show typical and special conditions including flashings, accessory installation, materials and thicknesses, all dimensions, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, spacing, provisions for thermal movement, and distinction between factory and field-assembled work.

2. Roof Insulation and Fabric Liner System: Provide shop drawings that indicate the following: Liner fabric layout, Insulation layout and cut list.

C. Load Calculations: Submit roof system manufacturer’s load calculations for the project. Load calculations shall be stamped by a structural engineer registered as a Professional Engineer in the State of Hawaii verifying that the system supplied meets the design loads indicated.

1. Wind load uplift design pressure at roof locations specified in paragraph entitled "Wind Loads."

2. Clip spacing and allowable load per clip calculations.

3. The fastening of clips to structure or intermediate support spacing.

4. Intermediate support spacing and fastening to structure when required.

5. Allowable panel span at anchorage spacing indicated.

6.. Safety factor used in determining loading.

D. Test Reports: Provide certified test reports from an independent laboratory confirming the roof system complies with design requirements of this Section. Results from roof system of different profile, width, gauge, or material are not allowed.

1. ASTM E 1592 test reports clearly indicating the roof system will meet requirements of engineer stamped uplift pressure calculations in all roof zones.

2. ASTM E 1646 and E 1680

3. TAS 100

4. FM 4471: Hail/Impact Resistance

E. Qualification of Installer: Submit documentation proving the installer is factory-trained, has the specified experience and is authorized by the manufacturer to install the products specified.

F. Qualification of Manufacturer: Submit documentation proving the manufacturer has a minimum 20 years experience in successful completion of projects employing similar materials, conditions, and performance requirements. Provide list of five similar completed projects with addresses.

G. Manufacturer's Field Inspection: Submit sample of manufacturer's technical representative's inspection reports as required in 3.04 "Manufacturer's Field Inspection."

H. Manufacturer’s Certification: Provide written statement from the roof system manufacturer stating it has reviewed the Specifications and Drawings and confirms the following:

1. The manufacturer’s proposed system meets or exceeds all performance and aesthetic requirements listed, including, but not limited to thermal movement, seam design, and uplift pressure resistance.

2. Specifications and Drawings are in accordance with the manufacturer’s requirements for a satisfactory installation and nothing therein voids the Warranty.

3. Roof system manufacturer will comply with inspection requirements as listed in 3.04 “Manufacturer’s Field Inspection”.

I. Samples: Provide samples for the following:

1. Roofing Panels: Submit a 12” x 12” section with seam of typical panel in color selected.

2. Accessories: Submit each type of accessory item used in the project including, but not limited to: each type of anchor clip, closures, fasteners, leg clamps, insulation.

1.06 QUALITY ASSURANCE

A. Preroofing Conference: After submittals are received and approved but before roofing

work, including associated work, is preformed, the Contractor shall hold a preroofing conference to review the following:

1. The drawings and specifications

2. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system.

3. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing.

4. Safety requirements: The preroofing conference shall be attended by the Contractor and personnel directly responsible for the roofing installation, and the roofing manufacturer's technical representative. Conflicts among those attending the preroofing conference shall be resolved and confirmed in writing before roofing work, including associated work, is begun. Prepare written minutes of the preroofing conference and submit to the Contracting Officer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

B. Delivery: Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with new material. If materials are wet, remove moisture, restack and protect panels until used.

C. Handling: Handle material carefully to avoid damage to surfaces, edges and ends.

D. Storage: Stack materials stored on the site on platforms or pallets and cover with tarpaulins or other suitable weathertight coverings which prevent water trapping or condensation. Store panels so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

1.08 WARRANTY

A. Furnish manufacturer's non pro-rated No Dollar Limit Waterproof warranty for the materials for the roofing system, and Contractor's warranty for workmanship for the roofing system. The warranty period shall be 30 years from the date of State’s acceptance of the work. The warranty shall provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or workmanship the repair or replacement of the defective materials and correction of the defective workmanship shall be the responsibility of the roofing system manufacturer. Warranty shall cover all trim, flashings, and penetrations associated with the roof, and failures of the roof system due to wind up to 115 mph. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty shall be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the

repairs performed by others and the cost billed to the manufacturer.

B. Provide Contractor's two-year workmanship guarantee.

C. The Surety will not be liable for damages 2-years after the project acceptance date.

PART 2 - PRODUCTS

2.01 ROOFING PANELS

A. Hydrostatic standing seam, metal roof system with 16" panel and minimum 2" high, "T" shaped vertical seam.

1. Basis of Design: R-Mer Span by The Garland Company

2. Approved Equal meeting specified requirements.

B. Material: Aluminum, 3105-H14 Alloy, smooth as per ASTM B 209, .040 inch thickness. Fascia, flashing, and flat stock material shall be fabricated as indicated on Shop Drawings of same material, thickness, and finish as roof system.

C. Finish: Two coat, coil-applied, baked on full strength (70 % resin) fluorocarbon coating system applied by roof system manufacturer's approved coil coating applicator. Color shall be as selected from the manufacturer's standard colors.

2.02 INTERMEDIATE SUPPORTS: Fabricate panel subgirts, subpurlins, T-bars, Z-bars and tracks from galvanized steel conforming to ASTM A 653, G 90, Grade A (18 gage and lighter); or steel conforming to ASTM A 36, ASTM A 570, or ASTM A 607 prime painted with zinc-rich primer. Size, shape, thickness and capacity as required to meet the load and deflection criteria specified.

2.03 ATTACHMENT CLIPS: 16 gauge stainless steel, alloy 316L. One piece clip allowing unlimited longitudinal thermal movement and 3/8 spacing between panel and substrate to allow ventilation and reduce condensation.

2.04 ACCESSORIES: Sheet metal flashings, trim, moldings, closure strips, pre-formed crickets, caps, equipment curbs, and other similar sheet metal accessories used in conjunction with preformed metal panels shall be of the same material as used for the panels. Provide metal accessories with a factory color finish to match the roofing panels, except that such items which will be concealed after installation may be provided without the finish if they are stainless steel. Metal shall be of a thickness not less than that used for the panels. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be as recommended by the manufacturer except that wood spacer blocks are not allowed.

A. Ridge Closures: Closed-cell or solid-cell synthetic rubber, or neoprene pre-molded to match configuration of roof covering. Material for closures shall not absorb water. Closure shall be enclosed in metal channel of same material as panels and mechanically

fastened to roof panels under ridge assembly.

B. Fasteners: As required by roof system manufacturer.

C. Self-Adhering Underlayment: As required by roof system manufacturer.

2.05 ROOF INSULATION

A. Roof insulation

1. Unfaced light density fiberglass blanket insulation

2. Flame Spread rating: Less than 25 and Smoke Developed Index: Less than 50 when tested in accordance with ASTM E84, NFPA 255, and UL 723

3. Certified R-Value: R-38

B. Fabric liner facing/ vapor barrier composed of woven high density polyethylene coated on both sides with polyethylene and complies with the following:

1. ASTM C1136, Types I through Type VI

a. Type I-IV exception for dimensional stability (value is <2.0%)

2. Perm rating $\leq$ 0.02 when tested in accordance with ASTM E 96 Procedure A

3. Flame Spread index < 25 and Smoke Developed Index < 50 when tested in accordance with ASTM E 84

4. Color

a. White

C. Vapor barrier adhesive. Complies with the flowing:

1. Application Temperature 10°F to 110°F

D. Double sided vapor barrier tape. Complies with the following:

1. Width 0.75”

2. Rubber based and free film

E. Patch tape. Complies with the following:

1. Adhesive added to one side

2. Installation Temperature 10°F to 110°F

3. 3” width

F. Metal Banding/ Straps. Complies with the following:

1. Coated Steel

2. 1.0” wide

3. Structural steel grade 50 per ASTM C 653

4. Exposed color to match vapor barrier

G. Thermal breaks:

1. Thermal spacer blocks. Complies with the following:

a. Extruded or expanded polystyrene

b. Minimum width 3.0”

c. Thickness 0.5” – 1’-0”

H. Light Gauge Steel fasteners:

1. Zinc plated cold forged steel

2. Color: Head color to match vapor barrier

3. Contain rubber sealing washer

2.06 LABORATORY TESTS FOR PANEL FINISH

A. Previously manufactured panels of the same type and finish as proposed for the project shall have been tested by an approved testing laboratory to ensure conformance to specifications. The term "appearance of base metal" refers to the aluminum base metal. Panels shall meet the following test requirements.

1. Salt Spray Test: Panels shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, coating shall receive a rating of 10, no blistering, as determined by ASTM D 714; and a rating of 7, 1/16 inch failure at scribe, as determined by ASTM D 1654, Rating Schedule No. 1.

2. Formability Test: For formability test, when subjected to a 180 degree bend over a 1/8 inch diameter mandrel in accordance with ASTM D 522, exterior coating film shall show only microchecking of the exterior film and there shall be no loss of adhesion.

3. Accelerated Weathering Test: Panels shall withstand an accelerated weathering test for a minimum of 2000 hours in accordance with ASTM G 154 or ASTM D 4587 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal.

4. Chalking Resistance: After the 2000-hour weatherometer test, exterior coating shall not chalk greater than No. 6 rating when measured in accordance with ASTM D 4214 test procedures.

5. Abrasion Resistance Test for Color Coating: When subjected to the falling sand test in accordance with ASTM D 968, coating system shall withstand a minimum of 80 liters of sand per mil of coating thickness before appearance of base metal.

6. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall pass requirements for ASTM D 714.

7. Fire Hazard: The finish on factory-fabricated panels shall have a flame spread rating of not more than 25 when tested in accordance with ASTM E 84.

8. Gloss: The gloss of the finish shall be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with ASTM D 523.

PART 3 - EXECUTION

3.01 EXAMINATION: Examine surfaces to receive standing seam metal roofing and flashing. Provide plumb and true surfaces, clean, even, smooth and as dry as possible. Ensure that surfaces are free from defects and projections which might affect the installation. Report unsuitable conditions to Contracting Officer.

3.02 INSTALLATION

A. Install in accordance with approved manufacturer's erection instructions shop drawings, and diagrams, except as specified otherwise herein. Provide panels in full and firm contact with clips. Obtain acceptance of Contracting Officer prior to installation on prefinished panels cut in the field, and factory applied coverings or coatings that were repaired after being abraded or damaged during handling or installation. Make repairs with material of same color as weather coating. Completely seal openings through panels. Correct defects or errors in materials in an approved manner. Replace materials which cannot be corrected in an approved manner with new materials. Provide molded closure strips where indicated and where necessary for weathertight construction. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened. Install self-adhering underlayment according to manufacturer recommendations.

B. Roof Panels: Apply roofing panels with standing seams parallel to slope of roof. Provide roofing panels in full lengths from ridge to eaves (top to eaves on shed roofs), with no transverse joints except at the junction of skylights and similar openings. Form panel seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to structure with concealed clips which are incorporated into the panel seams. Clip attachment shall allow roof to move freely and independently of the structure, except at fixed points as indicated on Shop Drawings.

C. Flashings: Provide flashing and related closures and accessories in connection with preformed metal panels [as indicated] and as necessary to provide a watertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal roof at ridge, eaves and rakes, at projections through roof, and elsewhere as necessary. Accomplish placement of closure strips, flashing, and sealing material in an approved manner that will ensure complete watertightness. Details of installation which are not indicated shall be in accordance with the NRCA CD, SMACNA ASMM, and panel manufacturer's printed instructions and details of the shop

drawings. Installation shall allow for expansion and contraction of flashing.

D. Flashing Fasteners: Fastener spacings shall be in accordance with the panel manufacturer's recommendations and as necessary to withstand the indicated design loads. Install fasteners as recommended by the manufacturer of the panels. Protect panels from hot metal shavings resulting from drilling or cutting. Remove all shavings immediately to protect the panels from staining. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tapes. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

E. Closure, Closure Strips: Set closure, closure strips in sealant material approved by roof system manufacturer.

F. Roof Insulation: Install liner system in accordance with manufacturer's installation instructions and approved Shop Drawings. Purlin and girt attachment surfaces should be clean and dry prior to attaching two-faced tape or sealing adhesive. Installed fiberglass insulation should fit snugly against purlin and girt walls in the cavity space. Avoid gaps, voids and any excess compression.

3.03 CLEANING: Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs on completion to prevent discoloration and harm to the panels and flashing. Remove grease and oil films, excess sealants handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

3.04 MANUFACTURER'S FIELD INSPECTION: Manufacturer's technical representative shall be on site the three times weekly during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative shall perform a field inspection of the installation at each site visit, at final completion and prior to issuance of warranty. After each site visit, a dated photographic report, signed by the manufacturer's technical representative, shall be submitted to the Contracting Officer noting the overall progress, quality of work, deficiencies and any other concerns, and recommended corrective actions in detail.

3.05 COMPLETED WORK: Completed work shall be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

END OF SECTION

SECTION 07900 - SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Completely close with sealant all joints specified or required to be sealed to a watertight condition.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Manufacturer's Data: Submit six (6) sets of manufacturer's product data and specifications for type of sealant required, to the Contracting Officer for approval.

C. Material Safety Data Sheets (MSDS): Submit MSDS for each sealant product.

D. Color Samples: Submit six (6) sets each of color finish samples of sealants.

E. Guaranty: Submit written guaranty as specified in paragraph entitled "GUARANTY" herein below.

1.03 JOB CONDITIONS

A. Examine joint surfaces and backing, and their anchorage to the structure, and conditions under which joint sealer work is to be performed, and notify Contractor in writing of conditions detrimental to proper completion of the work and performance of sealers. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer. On surfaces to be painted, install sealants prior to painting. Coordinate with SECTION 09901 - PAINTING.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when weather conditions are favorable for proper cure and development of high early bond strength.

1.04 PRODUCT HANDLING

A. Delivery: Deliver sealants to the jobsite in sealed containers labeled to show the designated name, formula, or specification number, lot number, color, date of manufacture, shelf life, curing time, manufacturer's directions, and name of manufacturer.

B. Storage: Carefully handle and store all materials to prevent inclusion of foreign materials. Remove from project site all damaged and deteriorated materials and materials exceeding shelf life.

C. All sealant materials shall be installed prior to expiration of shelf life.

1.05 GUARANTY

A. Provide a 2-year guaranty against leaks, air infiltration, cracks and other failures of the installation and materials.
   1. Repair or replace sealants to seal leaks caused by faulty materials or workmanship.

2. Repair or replace damage to the building or its finishes, equipment or furniture when occasioned by such leaks.

B. The Surety will not be held responsible beyond two (2) years of the project acceptance date.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene-jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by the sealant manufacturer to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibility of sealant extrusion when joint is compressed. Do not use oakum or other types of absorptive materials as backstops.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer.

C. Masking Tape: Non-staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

D. Primer for Sealants: Non-staining, as recommended by the sealant manufacturer.

E. Sealants at Exterior and Interior Vertical and Overhead Moving Joints: One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT. Provide one of the following, or approved equal:
   1. Dymonic; Tremco, Inc.
   2. Chem-Calk 900; Bostik Construction Products Div.
   3. Sikaflex 1a; Sika Corp.
   4. Dynatrol I; Pecora Corp.
   5. NP-1; Sonneborn.

F. Sealants at Interior Vertical and Overhead Non-Moving Joints: Non-Elastomeric Sealant; acrylic-emulsion type, conforming to ASTM C 834. Provide one of the following, or approved equal:
   1. AC-20 Acrylic Latex: Pecora Corp.
   2. Tremco Acrylic Latex 834; Tremco, Inc.
   3. Chem-Calk 600; Bostik Construction Products Div.
   4. Sonolac; Sonneborn.

G. Silicone Sealant: At Perimeter of All Plumbing Fixtures and Fittings: One-part mildew-resistant silicone sealant conforming to ASTM C 920, Type S, Grade NS, Class 25, Use NT, formulated with fungicide; intended for sealing interior joints with non-porous substrates. Provide one of the following, or approved equal:
   1. Dow Corning 786; Dow Corning Corp.
   2. SCS 1702 Sanitary; General Electric Co.
   3. Tremsil 600 White; Tremco, Inc.
   4. Omni Plus; Sonneborn.
   5. 898 or 893, No. 345; Pecora Corp.

H. Bedding Compound: For installation of thresholds and similar items indicated to be bedded in sealant, use a preformed butyl-polyisobutylene sealant tape. Size of tape as required for the specific application. Provide one of the following, or approved equal:
   1. Extru-Seal; Pecora Corp.
   2. 440 Tape; Tremco, Inc.
   3. Chem-Tape 40; Bostik Construction Products Div.

I. Acoustical Sealant: ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

3.02 EXAMINATION

A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.03 JOINT PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust, paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer, oil, grease, waterproofing, water repellants, water, and surface dirt.
   2. Clean concrete, masonry, and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to

produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Steel Surfaces in Contact with Sealant: Scrape and wirebrush to remove loose mill scale. Remove dirt, oil, or grease by solvent cleaning, and wipe surfaces with clean cloths.

5. Clean metal and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.04 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply. Do not apply sealant on wet surfaces or when the surface temperature exceeds 130 degrees F.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.

      b. Do not stretch, twist, puncture, or tear joint fillers.

      c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

   2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in

sealant failure.

3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

D. Primer: Immediately prior to application of the sealant, clean out all loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete, masonry units, wood, and other porous surfaces in accordance with compound manufacturer's instructions. Do not apply primer to exposed finish surfaces.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 5A in ASTM C 1193.

3.05 CLEAN UP

A. Immediately scrape off fresh sealant compound that has been smeared on masonry or porous surfaces and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of sealant compound application, remove all remaining smears and stains resulting therefrom and leave the work in a clean, uniform, and neat condition.

3.06 PROTECTION

A. Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

B. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of project acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION

DIVISION 8 - DOORS AND WINDOWS

SECTION 08100 - STEEL DOORS AND FRAMES

1.01 SUMMARY

Provide steel doors, frames and related components as indicated herein.

1.02 REFERENCES: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American National Standards Institute, Inc. (ANSI)

ANSI A250.3 – Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames

ANSI A250.6 - Hardware on Standard Steel Doors (Reinforcement - Application)

ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames

B. ASTM International (ASTM)

ASTM A 591 – Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications

ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM A 780 - Repair of Damaged Hot-Dip Galvanized Coating, Standard Practice for

ASTM C 578 - Preformed, Cellular Polystyrene Thermal Insulation

ASTM C 591 - Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation

ASTM D 2863 - Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

C. Steel Door Institute (SDI)

SDI 105 - Recommended Erection Instructions for Steel Frames

SDI 111-C - Recommended Louver Details for Standard Steel Doors

SDI 113 - Apparent Thermal Performance for Steel Door and Frame Assemblies

D. National Fire Protection Association (NFPA)

NFPA 80 - Fire Doors and Windows

NFPA 252 - Fire Tests of Door Assemblies

E. Underwriters Laboratories (UL)

UL 10B - Fire Tests of Door Assemblies

UL BMD - Building Materials Directory

1.03 SUBMITTALS

A. Shop Drawings: Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details. Include a schedule showing door and frame locations. Submit shop drawings for the following:
   1. Doors
   2. Frames
   3. Accessories

B. Manufacturer's Catalog Data: Manufacturer's descriptive literature for doors, frames and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. Submit manufacturer's catalog data for the following:

1.04 DELIVERY AND STORAGE

A. Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Strap welded frames in pairs, with one frame inverted, or provide temporary steel spreaders securely fastened to the bottom of each frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4-inch air space between doors. Remove damp or wet packaging immediately and wipe all affected surfaces dry. Replace damaged materials with new.

PART 2 – PRODUCTS

2.01 STEEL DOORS

A. ANSI/SDI-100, except as specified otherwise. Doors shall be either hollow steel construction or composite construction. Prepare doors to receive hardware specified in Section 08710 Door Hardware. Undercut doors for door bottoms as specified. Exterior doors shall have top edge closed flush. Doors shall be 1-3/4 inches thick, unless otherwise indicated.

B. Heavy Duty Doors: ANSI/SDI-100, Level 3, physical performance Level A, Model

1 or 2, with core construction Type a, d or f for interior doors, and Type b, c, e or f for exterior doors, of sizes and designs indicated. Where Type f cores are specified or scheduled, the space between the stiffeners shall be filled with mineral-fiber insulation as specified in paragraph 2.03, "INSULATION CORES."

2.02 ASTRAGALS AND MOLDINGS

A. Astragals: For pairs of exterior steel doors, provide overlapping steel astragals with the doors.

B. Moldings: Provide moldings around glass and louvers. Provide nonremovable moldings on the outside of exterior doors and on the corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to the stationary moldings or provide snap-on moldings.

2.03 INSULATION CORES: Insulated cores shall be type specified, shall provide maximum assembly U-value of 0.48 in accordance with SDI 113 and shall conform to:

A. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with an oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or

B. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or

C. Mineral Board: ASTM C 612, Type I.

2.04 STEEL FRAMES: ANSI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners.

A. Welded Frames: Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

B. Anchors: Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

1. Wall Anchors: Provide a minimum of three concealed anchors for each jamb. Locate anchors opposite top and bottom hinges and midway between.

2. Floor Anchors: Provide floor anchors drilled for 3/8-inch anchor bolts at bottom of each jamb member.

2.05 HARDWARE PREPARATION

A. Reinforce, drill, and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A250.8 and ANSI A250.6. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI A250.8, as applicable. Punch door frames to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for

each leaf in heads of double doors. Set lock strikes out to provide clearance for silencers.

2.06 FINISHES

A. Hot-Dip Zinc-Coated and Factory-Primed Finish: Fabricate doors and frames from hot dipped zinc coated steel, alloy type, that complies with ASTM A 924 and ASTM A 653. The coating weight shall meet or exceed the minimum requirements for coating having Designation G60 or A60 (galvannealed). Repair damaged zinc-coated surfaces by the application of zinc dust paint conforming to ASTM A 780, Annex A2. Thoroughly clean and chemically treat to ensure maximum paint adhesion. Factory prime as specified in ANSI A250.8.

2.07 FABRICATION AND WORKMANSHIP

A. Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable.

2.08 FIRE DOORS AND FRAMES

A. NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

B. Labels: Fire doors and frames shall bear the label of the Underwriters' Laboratories, Inc. (UL), Factory Mutual Engineering Corporation (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door and frame labels shall not be painted.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Frames: Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction.

B. Doors: Hang doors in accordance with clearances specified in ANSI A250.8. After erection, clean and dust hardware.

C. Fire Doors and Frames: Install fire doors and frames, including hardware, in accordance with NFPA 80.

3.02 PROTECTION

A. Protect doors and frames from damage. Repair damaged doors and frames prior

to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until all rust is removed, clean thoroughly, and apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.03 CLEANING

A. Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks. Touch-up finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 08710 - FINISH HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all finishing hardware required for doors, complete as specified.

B. It is the intent of this Specification to cover in general the class and character of all finish hardware required.

C. The hardware list specified has been made for the convenience of the Contractor and covers in general the necessary hardware for doors, etc., as shown on the Drawings and not covered by the general characterization shall be fitted with appropriate hardware of the same standards as the hardware described throughout these specifications.

D. Suppliers proposing substitutes of equivalent products of other than the manufacturers named shall submit schedules listing the product and manufacturer specified and the product and manufacturer of proposed substitute. This schedule shall be submitted in accordance with the GENERAL CONDITIONS.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Manufacturer's Data: Submit manufacturer's descriptive literature.

C. Tools and Maintenance Instructions: Furnish a complete set of special wrenches, tools, maintenance instructions applicable to each different or special hardware component.

D. Certification: After completion and inspection by hardware supplier of all construction work, certify on an approved form, that all items of finish hardware have been adjusted and are working properly.

E. Warranty: Submit written warranty as specified in paragraph entitled "WARRANTY" hereinbelow.

F. Keying Schedule: Submit Keying schedule for approval.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 101 as applicable.

B. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 3 years documented experience. Obtain each type of hardware (hinges, closers, kickplates, etc.) from a single manufacturer.

C. Hardware Supplier Personnel: Employ an experienced Architectural Hardware Consultant (AHC), or Contracting Officer accepted equal, who is available at reasonable times during the course of the Work, to the Contracting Officer and

Contractor for consultation about Project's hardware requirements, to verify specified hardware with door function and hardware finishes.

D. Where patching of existing doors and frames is necessary, patching compounds shall not be used. The patch shall consist of wood plugs secured with permanent adhesives.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for accessibility.

B. Definition: "Door Hardware" includes items known commercially as finish hardware which are required for swing and sliding doors, except special types of unique and non-matching hardware specified in same Section as door and door frame.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery, store, protect and handle products to prevent damage of any kind and to maintain security to site.

B. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at proper times to proper locations (shop or project site) for installation.

D. Package hardware items individually; label and identify each package with door opening code to match hardware per drawings.

E. Provide secure lock-up for hardware delivered to project but not yet installed. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the Work will not be delayed by hardware losses, both before and after installation.

1.06 WARRANTY

A. Provide one year warranty for all Contractor furnish and installed materials. Door closers shall have a minimum 10 year manufacturer's warranty. The Surety shall not be liable beyond 2 years of the project acceptance date.

1.07 OPERATION AND MAINTENANCE DATA

A. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

B. The manufacturer's representative shall instruct the User's staff on the hardware's maintenance procedures (type of lubricant needed and frequency of maintenance).

1.08 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

PART 2 - PRODUCTS

2.01 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware as indicated on the drawings and in HARDWARE GROUPS at end of this Section. Products are identified by using proprietary catalog numbers, and are used to establish quality and function of products desired.

B. Product numbers indicated in the HARDWARE GROUPS are those of the manufacturers listed and are used to establish the quality of products intended.

2.02 MATERIALS AND FABRICATION

A. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of indicated door.

B. Base Metals: Produce hardware units of basic metal and forming method specified, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated. Do not furnish optional materials or forming methods for those indicated, except as otherwise specified.

C. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated. Fasteners exposed to the weather shall be non-ferrous metal or stainless steel.

D. Furnish appropriate screws for installation, with each hardware item. Provide Phillips flat head screws except as otherwise indicated. Finish exposed screws to match hardware finish. If exposed in surfaces of other work, to match finish of such other work as closely as possible, including prepared-for-paint finish in surfaces to receive painted finish.

E. Provide concealed fasteners for hardware units which are exposed when door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed in other work, except where it is not feasible to adequately reinforce the Work. In such cases, provide sleeves for each through bolt or use sex screws fasteners.

F. Expansion shields in concrete or masonry shall fill the depth and diameter of drilled holes.

2.03 HINGES

A. General: Hinges shall conform to ANSI/BHMA A156.1 and the requirements of this specification.

B. Screws: Furnish Phillips flat head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   1. Nonferrous Hinges: Stainless steel pins.

   2. Exterior, Out-swing Doors: Non-removable pins (NRP).

   3. Interior Doors: Nonrising pins.

   4. Tips: Flat button and matching plug, finished to match leaves.

D. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90-inches or less in height and one additional hinge for each 30-inches of additional height.

E. Size of hinges shall be as follows:

Door Thickness/Width	Hinge Height	Hinge Width
1-3/4 inches to 36-inches	4-1/2 inches	4-1/2 inches extra heavy ball bearing
1-3/4 inches over 36-inches	5-inches	4-1/2 inches extra heavy ball bearing
		ball bearing

Note: Hinge width shall be of sufficient size to clear frame and trim when door swings 180 degrees.

2.04 CLOSERS AND DOOR CONTROL DEVICES

A. General: Closers shall conform to ANSI/BHMA A156.4 and the requirements of this specification.

B. Size of Units: Comply with manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use. Where parallel arm closers are installed, provide closer unit one size larger than recommended for use with standard arms.

C. Provide parallel arm or regular arm closer as required to mount closer on door face least exposed to public traffic.

D. Closers shall have brass adjustment operating valves for closing speed, latching speed, and backcheck control as a standard feature.

E. Closer covers shall be rectangular, full cover type, high impact non-corrosive, and flame retardant.

F. Closer shall not require removal for adjustments to be made.

2.05 FINISHES

A. Finishes: Identified in schedule at end of Section.
   1. Designations used are those listed in ANSI/BHMA A156.18 “Materials and Finishes”, including coordination with traditional U.S. finishes shown by certain manufacturers for their products.

   2. If no BHMA finish is established, match specified product.

B. Provide matching finishes for hardware units at each door or opening to greatest extent possible, except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where base metal or metal forming process is different for individual units of hardware exposed at same door or opening.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer’s standards, but in no case less than specified for applicable units of hardware by referenced standards.

2.05 KEYING

A. Keying in accordance with ANSI/ BHMA A156.28

   1. Locks shall have seven (7) keys per door. All keys shall be stamped “DO NOT DUPLICATE” at the point of manufacturer. Proper certification of factory assembly of all locks and cylinders as well as factory master keying shall be furnished by the Contractor prior to final acceptance of this portion of the work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Pre-Installation Meeting: Before start of work under this contract, the Contractor, hardware installer, hardware manufacturer’s representative or supplier, the Contracting Officer, and a school representative shall meet to review hardware installation instructions, and installation conditions.

B. Verify that doors and frames are ready to receive Work and dimensions are as indicated.

3.02 INSTALLATION

A. Install each hardware item in compliance with manufacturer’s instructions and recommendations.

B. Mount hardware units at height indicated in the Door and Hardware Institute’s Recommended Locations for Builders Hardware for Standard Steel Doors and Frames, except:
   1. As otherwise indicated or as required to comply with governing regulations.

C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work. Do not install surface mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Operating parts shall move freely and smoothly without binding, sticking or excessive clearance.

G. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Protect hardware from damage or marring of finish during construction. Use strippable coatings, removable tapes or other approved means.

I. Ensure that hardware displays no evidence of finish paint after building cleanup with exception of prime coated hardware installed for finish painting. The Contractor may achieve this by sequencing installation, removing after fittings and reinstalling after painting is completed, providing protection, cleaning original hardware finish, or other approved means.

J. Latch and Bolt: Install latch and bolt to automatically engage in keeper, whether activated by closer or manual push. In no case shall additional manual pressure be required to engage latch or bolt in keeper.

K. Closers:
   1. Do not mount closers on corridor side of door except at exterior doors.

   2. Carefully adjust closers to operated noiselessly and evenly.

   3. Have manufacturer’s representative regulate closers prior to Contracting Officer’s acceptance of building.

3.03 FIELD QUALITY CONTROL

A. Required certified Architectural Hardware Consultant from door hardware supplier to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer’s instructions and as specified.

3.04 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace items which cannot be adjusted to operate freely and smoothly as intended for application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment:
   1. Clean operating items as necessary to restore proper function and finish of hardware and doors.

   2. Adjust door control devices to compensate for final operation of ventilating equipment.

   3. Lubricate bearings surface of moving parts and adjust latching and holding devices for proper function.

3.05 HARDWARE GROUPS

A. Door Hardware

Hardware Group No. 1

Qty		Description	Catalog Number	Finish	Mfr
8	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	MANUAL FLUSH BOLT	FB458 24"	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM SECURITY	L9071P 06A	630AM	SCH
1	EA	RAIN DRIP	142D	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	MEETING STILE	44STST	STST	ZER
1	EA	THRESHOLD	655A-223	A	ZER

END OF SECTION

SECTION 08919 – FIXED LOUVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes fixed, extruded aluminum and formed-metal louvers.

1.02 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. Product Data: For each type pf product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blades profiles, angles, and spacing.

D. Samples: For each type of metal finish required.

E. Product Test Reports: Based on test performed according to AMCA 500-L.

F. Windborne-debris-impact-resistance test reports

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design: Design louvers, including comprehensive engineering analysis by a qualified engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Winds Loads: Determine loads based on uniform pressure 30 lbs./ sq. ft. (1435 Pa), acting inward or outward.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1. Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the proper type, size, material and finish for application indicated to provide secure attachment, concealed where possible, and complying with applicable ANSI standards. Provide all fasteners and anchorages with a hot-dipped zinc coating (ASTM A 153). Fasteners at wet areas shall be Type 316 stainless steel.

2.02 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver

1. Basis of Design Product: Archtiectural Louvers Co.; Model E2D2. Subject to compliance with requirements, provide the specified product or comparable product by one of the following:

    a. Architectural Louvers Co.
    b. Ruskin
    c. The Airolite Company, LLC.

2. Louver Depth: 2 inches
3. Blade Profile: Drainable blade with front gutter for water diversion to jambs
4. Frame and Blades Nominal Thickness: Not less than 0.063 inches for blades and frames
5. Louvers Performance Ratings:
    a. Free Area: Not less than 7.91 sq. ft. for 48-inch wide by 48-inch high louver.
    b. Point of Beginning Water Penetration: Not less than 889 fpm (4.5 m/s)
    c. Air Performance: Not more than 0.12 wg (30-Pa) static pressure drop at 800 fpm (4.1 m/s) free-area velocity.
6. AMCA Seal: Mark units with AMC Certified Ratings Seal.

2.03 LOUVER SCREENS

A. General: Provide screen at each exterior louver
B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.
C. Louver Screening: Same kind of metal as indicated for louver.
    1. Insect Screening: Aluminum, 16x18 square mesh, 0.011-inch wire.
    2. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.

2.04 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6
B. Fasteners: Use types and sizes to suit unit installation conditions.
    1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
    2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
    3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
    4. For fastening stainless steel, use 300 series stainless-steel fasteners.
    5. For color-finished louvers, use fasteners with heads that match color of louvers.

C. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorage where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.02 ADJUSTING

A. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION

DIVISIONS 9 – FINISHES

SECTION 09901 - PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes surface preparation, caulking and field painting of exposed **new** exterior and interior surfaces, and areas damaged by the Contractor's operations.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint new exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Contracting Officer will select from standard colors and finishes available.
   1. New Interior and Exterior surfaces scheduled to be finished.

   2. Non Ferrous metals, plated or factory finished items specifically noted to be painted or when such items occur as accessories and appurtenance to surfaces required to be painted.

   3. Pipes, conduit, ducts, support apparatus and other exposed mechanical and electrical items in areas to be painted. Exterior mechanical and electrical equipment and items on the roof or building exterior.

   4. Touch-up paint areas damaged by the Contractor's operations.

C. Surfaces not to be finished, unless otherwise indicated.
   1. Concrete floors, paving walks stairs and sidewalk concrete. Other concrete surfaces scheduled not to be painted.

   2. Finish hardware, unless prime coated.

   3. Lighting fixtures, and electrical device plates.

   4. Concealed surfaces include walls or ceilings generally inaccessible spaces.

   5. Finished metal surfaces include the following:
      a) Anodized aluminum.
      b) Copper and copper alloys.
      c) Bronze and brass.

   6. Operating parts include moving parts of operating equipment.

   7. Labels: Do not paint over UL, FMG, or other code required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED SECTIONS

A. Division 16, identification marking of painting of electrical equipment and apparatus.

1.03 REFERENCES: The latest publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. ASTM International (ASTM)
ASTM D 16 – Definition of terms relating to Paint, Varnish, Lacquer and Related Products

ASTM D 2092 - Preparation of Zinc-Coated (Galvanized) Steel Surfaces for Painting

ASTM D 3273 - Resistance to Growth of Mold on the Surface of Interior Coating in and Environmental Chamber

ASTM D 3274 - Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation

B. Master Painters Institute (MPI)
MPI 5 – Prime, Alkyd/Oil for Exterior Wood

MPI 10 – Exterior Latex, Flat

MPI 11 – Exterior Latex, Semi-Gloss

MPI 50 - Interior Latex, Primer Sealer

MPI 52 - Interior Latex, Gloss Level 3

MPI 54 - Interior Latex, Semi-Gloss

MPI 72 - Polyurethane, Two Component, Pigmented, Gloss

MPI 79 - Marine Alkyd Metal Primer

MPI 80 - Vinyl Wash Primer

MPI 101 - Cold Curing Epoxy Primer

MPI 108 - High Build Epoxy Marine Primer

MPI 110 - Interior/Exterior High Performance Acrylic

MPI 119 – Exterior Latex, Gloss

C. Painting and Decorating Contractors of America (PDCA)
PDCA - Architectural Specification Manual

D. Steel Structures Painting Council (SSPC)
SSPC PA 3 - Safety in Paint Application

SSPC-SP 1 - Solvent Cleaning

SSPC-SP 6 - Commercial Blast Cleaning

1.04 DEFINITIONS AND ABBEVIATIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

B. DFT: Dry film thickness, the film thickness of the fully cured, dry paint or coating.

C. DSD: Degree of Surface Degradation, the MPI system of defining degree or surface degradation. Five levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

D. EPP: Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

E. EXT: MPI short term designation for an exterior coating system.

F. INT: MPI short term designation for an interior coating system.

G. Micron/microns: The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

H. Mil/mils: The English measurement for 0.001 inch or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

I. mm: The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

J. MPI Gloss Levels: MPI system of defining gloss. Seven gloss levels (G1 to G7) Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6. Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat	0 to 5	10 maximum
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 minimum
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

K. REX: MPI short term designation for an exterior coating system used in repainting projects over existing coating system.

L. RIN: MPI short term designation for an interior coating system used in repainting projects over existing coating system.

1.05 SUBMITTALS

A. Product Data:
   1. Materials List: Provide an inclusive list of required patching and coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
      a. For products with premixed colors, provide manufacturer's standard color chips for selection by Contracting Officer.

   2. Manufacturer's Information: Provide data on all listed materials, including:
      a. Thinning and mixing instructions
      b. Application instructions and required mil film thicknesses.
      c. Manufacturer's Material Safety Data Sheets.

B. Certifications: Provide a letter certifying paints and coatings are free of asbestos, lead, zinc-chromate, strontium chromate, cadmium, mercury, crystalline silica and other EPA regulated and hazardous materials. Provide a letter certifying the amounts of mildewcide added by both the paint manufacturer and paint supplier.

C. Schedule of Finishes: Provide finish schedule including paint spread rates required to achieve final dry film thickness indicated in the schedule.

D. Schedule of Operations: Provide a work schedule showing sequence of operation and installation dates.

E. Samples:
   1. Submit color and finish samples, at manufacturers normal paint chip size illustrating range of colors and textures available for each surface finishing product scheduled.

   2. After color and finish sample are returned, submit paint finish samples, 8.5" x 11" in size illustrating selected colors and textures for each selection. Divide sample in horizontal strips showing prime and overlapping second and finish coats. Show coat tinting. Prepare transparent finish samples on same material as that on which coating will be applied. Identify each sample.

F. Manufacturer's Instructions: Indicate special surface preparation procedures, and substrate conditions requiring special attention.

G. Samples for Initial Selection: For each type of finish coat material indicated.
   1. After color selection, Contracting Officer will furnish color chips for surfaces to be coated.

   2. Submit 3 samples on the following substrates for Contracting Officer's review of color and texture only:
      a. Painted Wood: 8-inch-square. Samples for each color and material on hardboard.
      b. Ferrous Metal: 3-inch- square samples of flat metal and 6-inch- long samples of solid metal for each color and finish.

H. Delivery Receipts: Provide 3 copies of the delivery receipt, signed by the School's Custodian, attesting to delivery of extra paint as required under Paragraph 1.10

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
   1. Exception: Alkali resistant primers if compatible with the intermediate coat paint products.

1.07 REGULATORY REQUIREMENTS

A. Comply with State OSHL (Occupational Safety and Health Law) and pollution control regulations of the State Department of Health, City and County of Honolulu, and the U.S. Environmental Protection Agency

B. Safety methods used during coating application shall comply with the requirements of SSPC-PA Guide 3.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's brand name and lot number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions and coverage.
   7. Color name and number.
   8. VOC content.

B. Storage
   1. Non-flammable Materials: Store materials not in use in tightly covered containers in a well ventilated area. Maintain storage containers in a clean condition, free of foreign materials and residue.

2. Flammable Materials:
    a. Store in such a manner as to prevent damage. No paint material, empty cans, paint brushes and rollers may be stored in the building(s). Store these items in separate storage facilities away from the building(s). Contractor may furnish a separate job site storage structure, if the structure complies with the requirements of the local Fire Department. Keep the storage area shall clean. Lock any storage structures when not in use or when no visual supervision is possible.

    b. All rejected materials shall be removed from the job site immediately.

1.09 PROJECT CONDITIONS

A. Do not apply materials when surfaces and ambient temperatures are outside the ranges required by the paint product manufacturer. Do not apply exterior coatings during rain or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

B. Protect public, pedestrians and tenants from injury. Provided, erect and maintain safety barricades around scaffolds, hoists and where constriction operations create hazardous conditions.

C. Completed Work: Provide necessary protection for wet paint surfaces.

D. Protective Covering and Enclosures: Provide and install clean sanitary drop cloth or plastic sheets to protect furniture, equipment, floor and other areas that are not scheduled for treatment. Remove any paint applied to surfaces not scheduled for treatment.

E. Fire Safety: Contractor and its employees shall not to smoke in the vicinity of the paint storage area. Exercise precautions against fire at all times and remove waste rags, plastic (polyester sheets), empty cans, etc. from the site at the end of each day.

1.10 EXTRA MATERIALS

A. Provide extra paint in each of the different colors, types and surface textures of exterior and interior paint to the Contracting Officer upon completion of the project. Paint shall be in unopened one gallon containers and labeled with color, type, texture, room locations, and date in addition to manufacturer's label.
    1. Provide 1 gallon of each color for paint used.

1.11 WARRANTY

A. Provide a two year guarantee that the work performed under this section conforms to the contract requirements and is free of any defect of material or workmanship.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under

conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Mildewcide
   1. Except for metal primers, paint shall contain the maximum amount of mildewcide permitted per gallon of paint by the manufacturer without adversely affecting the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfiguration rating or 8 or greater when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticide shall not be used in paint

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names in the Color Schedule indicated to designate colors or materials, is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed products to be used.

   2. Equivalency: Equivalent products to the specified products are listed in the Master Painter's Institute's "Architectural Painting Specification Manual."

   3. Substitution: Requests for substitution of a product or product if a manufacturer is not on the "Approved Product List" will be evaluated for equivalency based on product test results per the test criteria of the Master Painter's Institute.

D. Colors: Colors shall match adjacent painted surfaces.

E. EPA Regulated and Hazard Materials: Do not use paint or paint products containing lead, mercury, zinc chromates, strontium chromate, cadmium or the EPA regulated or hazard materials.

F. Human Carcinogens: All paints shall not contain confirmed human carcinogens or suspected human carcinogens as determined by the American Conference of Governmental Industrial Hygienist.

2.02 MISCELLANEOUS MATERIALS

A. Provide patching, caulking, sealant and repair materials. Compatible with paint finishes and substrates. Use weather resistant materials for exterior surfaces and surfaces exposed to moisture.

B. Accessories
   1. General: Provide other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2. Thinners: Thinning of paint shall be done using material recommended by the manufacturer. Mix proprietary products according to manufacturer's requirements. Do not use compound thinner, mineral oil, kerosene, refined linseed oil, or gasoline for thinning.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application. Comply with procedures specified in PDCA P4.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
      a) Ensure that concrete and masonry surfaces are cured and dried to meet paint manufacturer's recommendations.

   2. Start of painting will be construed as Applicator’s acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Contracting Officer about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove dust, oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer’s written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.

D. Surface Preparation Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC’s recommendations.

1. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.

2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

3. Touch up bare areas and shop applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat. Spot priming specified here shall be in addition to full prime painting scheduled in Part 3 below.

E. Surface Preparation Galvanized Surfaces: Clean galvanized surfaces with non-petroleum based solvents so surface is free of oil and surface contaminants in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brushed-off abrasive blast. New galvanized steel to be coated shall not be “passivated” or “stabilized.” If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D 2092, Appendix X2, and remove by one of the methods described therein. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Surface Preparation Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

   2. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.

   3. If transparent finish is required, backprime with spar varnish.

   4. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

   5. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

G. Material Preparation: Mix and prepare paint materials according to manufacturer’s written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

H. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

   2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

   3. Provide finish coats that are compatible with primers used.

   4. The term "exposed surfaces" includes areas visible when permanent or built in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

   5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only unless otherwise noted.

   6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

   7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

   8. Sand lightly between each succeeding enamel or varnish coat.

   9. Ensure primers are top coated within the times required by the paint manufacturers. Top coats not applied within the recoating window may be rejected.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
   1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

4. Be aware of the requirements for, and restrictions on, spray painting contained in PROJECT CONDITIONS Paragraph.

C. Application Procedures: Apply paints and coatings by brush, roller, or other applicators according to manufacturer's written instructions.
   1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

   2. Rollers: Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
   1. Uninsulated metal piping.

   2. Uninsulated plastic piping.

   3. Pipe hangers and supports.

   4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

   5. Duct, equipment, and pipe insulation having "all service jacket" or other paintable jacket material.

   6. Mechanical equipment that is indicated to have a factory primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:
   1. Panel boards.

2. Electrical equipment that is indicated to have a factory primed finish for field painting.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL TESTING

A. Inspection and Approvals: Obtain written approval upon completion of each phase of work (phases of work are: surface preparation and spot prime, prime, first finish coat, second finish coat) before proceeding into the next phase or work. For any particular area of work that deviates from the submitted work schedule, notify the Contracting Officer one day (24 hours minimum) in advance when completing any phase of work. Provide access to areas to be inspected.
   1. Failure to obtain approval of any phase of work for a work area may result in redoing the operation at no cost to the State.

   2. Right of Rejection: Non conforming work will be rejected by the Contracting Officer. Remove rejected material from the job site immediately. Redo rejected work at no cost to the State.

B. Thickness Testing: The Contracting Officer will require all paints and their applied thickness tested determine compliance with the Contract Documents. The State will select a laboratory, and the cost of testing shall be borne by the Contractor.
   1. Where the required paint thickness is deficient, provide additional coats to the affected surface(s) to meet the required paint thickness.

C. Moisture Testing: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.

D. Alkalinity Testing: Measure pH Level of surface to be painted. Notify Contracting Officer if alkalinity level is below the maximum permitted by the paint or primer manufacturer.
   1. Tests shall be paid by Contractor.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Contracting Officer.

B. Provide “Wet Paint” signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 SCHEDULE OF FINISHES

A. Structural Steel
   a. Stripe Coat welds, fasteners, hard corners, and other areas of concern: Amercoat 240 @ 8 -12 mils DFT
   b. Full Prime Coat: Amercoat 240 @ 8 -12 mils DFT
   c. Finish Coat: PSX 700 @ 5-7 mils DFT

B. Metal Accessories, conduits, etc.
   a. Prime coat: Pittech DTM Primer 90-712
   b. Two finish Coats: Pittech Industrial Gloss Enamel 90-374

C. Incidental/Miscellaneous PVC items
   a. Prime coat: Int/Ext , PPG SEALGRIP, Acrylic Universal Prime Sealer
   b. Two finish coats: SpeedHide, Interior Latex Enamel, Semi-Gloss

D. New Metal Doors and Frames:
   a. Prime coat: PPG Glidden, LIFEMASTER, Acrylic Interior No-VOC Primer
   b. Two finish coats: PPG Glidden, LIFEMASTER, Acrylic Interior No-VOC, Semi-Gloss

E. Concrete Masonry Units (CMU)
   a. Prime Coat: DFT 1.6 mils, 17-921 Seal Grip @ 390 s.f./gal. Exterior Acrylic Universal
      Primer
   b. Two finish Coats: Prime Coat: DFT 2.0 mils PITT-GLAZE WB1
      @ 296 s.f./gal. Pre-Catalyzed Waterborne
      Per coat Acrylic Semi-Gloss Epoxy

END OF SECTION

DIVISION 10 – SPECIALTIES

SECTION 10140 – SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: All labor, tools and equipment necessary to install all signage and miscellaneous related work as called for, or required by the drawings and specifications.

1.02 REFERENCES

A. The latest publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM International (ASTM).

ADA Standards for Accessibility Design.

ADAAG 2010 ADA Standards for Accessible Design.

1.03 GENERAL REQUIREMENTS

A. N/A

1.04 SUBMITTALS

A. Submit in accordance with SECTION 01330 – SUBMITTAL PROCEDURES.

B. Manufacturer's Catalog Data: Submit catalog data for each type of sign specified, include descriptions of materials, finishes, color, fastening and anchoring devices and appurtenances.

C. Samples: Submit three (3) representative sample of each type of signs specified for finish and workmanship for approval.

1.05 DELIVERY AND STORAGE

A. Deliver materials to the site in unopened containers, labeled with the manufacturer's names and brands, ready for installation. Store signs and accessories in safe, dry locations until needed for installation.

1.06 WARRANTY

A. The Contractor shall execute to the State a 2-year written warranty after the Project Acceptance Date that the installations of the Signs and Accessories are in accordance with the manufacturer’s requirements. Any damages which develop during that period which are not due to improper use or willful damage will be repaired at no cost to the State. The guarantee shall provide the following at no cost to the State.

1.07 ADAAG SIGNAGE REQUIREMENTS

A. General: Unless otherwise indicated or specified, signs shall comply with 703. Where both visual and tactile characters are required either one sign with both visual and tactile characters, or two separate signs, one with visual and one with tactile characters, shall be provided.

B. Raised Characters: Raised characters shall comply with ADAAG 703.2 and shall be duplicated in Braille complying with ADAAG 703.3. Raised characters shall be installed in accordance with ADAAG 703.4.
   1. Depth ADAAG 703.2.1: Raised characters shall be 1/32 inch (0.8 mm) above their background.

   2. Case ADAAG 703.2.2: Characters shall be upper case.

   3. Style ADAAG 703.2.3: Characters shall be sans serif, Characters shall not be italic, oblique, script, highly decorative, or other unusual forms.

   4. Character Proportions ADAAG 703.2.4: Characters shall be selected from fonts where the width of the uppercase letter “O” is 55 percent and 110 percent maximum of the height of the uppercase “I”.

   5. Character Height ADAAG 703.2.5: Character height measured vertically from the baseline of the character shall be 5/8 inch (10 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase “I”.

   6. Stroke Thickness ADAAG 703.2.6: Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.

   7. Character Spacing ADAAG 703.2.7: Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spaces between individual raised characters shall be 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16 inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8 inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8 inch (9.5 mm) minimum.

   8. Line Spacing ADAAG 703.2.8: Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

C. Braille: Braille shall be contrasted (Grade 2) and shall comply with ADAAG 703.3 and 703.4.

D. Installation Height and Location ADAAG 703.4: Signs with tactile characters shall comply with ADAAG 703.4.

E. Visual characters ADAAG 703.5: Visual characters shall comply with ADAAG 703.5.

F. Pictograms ADAAG 703.6: Pictograms shall comply with ADAAG 703.6.

G. Symbols of Accessibility ADAAG 703.7: Symbols of accessibility shall comply with ADAAG 703.7.

H. Finish and Contrast ADAAG 703.5.1:
   1. Characters and background of sign shall have matte or non-glare finish.

   2. Characters and symbols shall contrast with their background, either light characters on dark background or dark characters on a light background.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials and Fabrication: Tactile signs with raised letters shall be fabricated of photo polymer laminated to acrylic backing for a total thickness of 1/4" to match signs in layout and size, but copy is raised 1/32". Grade II Braille will be used as specified for compliance, ADAAG 703.2. Finish colors on sign face and finished edges. Each sign shall be secured to wall on the latch side of the door as indicated on drawings or as directed by the Contracting Officer. Signs shall be fastened with one-way, tamper-proof, non-corrosive fasteners. Shields shall be provided as required to suit the mounting conditions. The lettering of signs shall be as directed in schedule shown on drawings. All room signage shall conform to the ADAAG 2010 ADA Standards for Accessible Design, Section 703.5.1. Background and letter/character colors shall be contrasting. Colors shall be as selected by the Contracting Officer.

B. International Symbol of Accessibility (ISA) and Symbols of Accessibility Signs:
   1. ISA signs and Symbols of Accessibility signs shall be the same type as room signs except that the ISA and Symbols of Accessibility portion of the signs shall be 6" x 6" with proportionate raised handicap symbol. Conform with ADAAG, Section 703.6.

2.02 FABRICATION

A. All signs shall be fabricated according to specifications of approved construction drawings and submittals and will conform exactly to approved construction submissions in quality, fabrication and material.

B. All fasteners used to secure photo polymer laminated to acrylic backing pieces shall be inserted into drilled and tapped holes. Allow a minimum of l/8-inch over depth to prevent bottoming of fasteners. National coarse machine threads shall be used throughout.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrates are the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory. Exposed fasteners shall be fastened with one-way, tamper-proof,

non-corrosive fasteners. Shields shall be provided as required to suit the mounting conditions. Installed location and height of signs as indicated. Protect exposed surfaces of signs with strippable plastic or by other approved means until the installation is accepted. Coordinate sign manufacturer's mounting details with other trades as their work progresses, and with installation requirements of ADAAG 216 and 703. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

B. Signs ADAAG 703: Signs shall comply with ADAAG 703.

3.03 PROTECTION AND CLEANING

A. Check and clean all signage, replace damaged products before substantial completion.

B. At the completion of his work, the Contractor shall clean up and remove from the premises, all rubbish, debris and unused materials. He shall also clean and protect installed products until completion of project.

END OF SECTION

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13650 – PHOTOVOLTAIC SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS
As specified in Section 01100 – PROJECT REQUIREMENTS

1.02 SUMMARY
This section includes the following for installation of photovoltaic systems.

1.03 SUBMITTALS
A. General: Submit under provisions of Section 01300 – SUBMITTALS.

B. Shop Drawings: Submit complete shop drawings and manufacturer's literature for the Owner's review before any work is fabricated. Comply with all requirements of the Section 01300 – SUBMITTALS. Submit five sets of manufacturer's literature for the following:

1. Photovoltaic Modules
2. Inverters
3. Combiner Boxes
4. Raceways
5. Panel Mounting Hardware
6. One-line Diagram
7. Three-Line Diagram Shop Drawings. Show system details, devices, and circuiting.
8. Provide photovoltaic installation if layout is different than as shown on drawings. Indicate revised layout, wiring, panel and device locations, new equipment, etc.
9. Contractor's qualifications to indicate minimum experience.
10. Warning Signs

1.04 GUARANTEE AND CERTIFICATE
As specified in Section 16050 – BASIC MATERIALS AND METHODS.

1.05 GENERAL REQUIREMENTS
The Contractor shall furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all Electrical Work, complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment

furnished by the successful supplier. The work shall include but not necessarily be limited to, the following:

A. Complete photovoltaic system installation, including all necessary equipment, conduit, wiring, controls and accessories. Any omission in specified equipment will not relieve the contractor of the responsibility for providing a complete system, including all items required proper operation except for such items which are specifically noted as being furnished by others.

B. Before bidding on this work, carefully examine each of the drawings and the site. By submitting a proposal of the work included in this contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.
   1. Prior to ordering equipment, the Contractor shall examine the plans to verify the amount of space allocated for the electrical equipment and to determine if the material proposed will fit within the allotted space. It shall be the Contractor's responsibility to provide equipment that will fit within the allotted space.

   2. Contractor shall have a minimum of 5 years experience installing photovoltaic systems.

1.06 COORDINATION WITH OTHER TRADES

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

1.07 CODES, REGULATIONS AND STANDARD SPECIFICATIONS

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

B. Applicable rules, standards and specifications of following associations shall apply to materials and workmanship:
   1. AMSE PTC 50 (solar PV performance)

   2. ANSI Z21.83 (solar PV performance and safety)

   3. NFPA 853 (solar PVs near buildings)

   4. NEPA 70 (electrical components)

   5. IEEE 1547 (interconnections)

   6. National Electrical Safety Code – ANSI C2 – 2005

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Photovoltaic Modules:

1. High efficiency, poly or mono-crystalline modules.

2. Tempered glass low reflectance panel within a corrosion resistant anodized aluminum frame. Panel frame shall be provided with pre-drilled mounting and grounding holes.

3. Each panel shall have ratings as indicated on drawings.

4. Nominal panel size shall not exceed 40” x 77”.

5. Listed on the California Energy Commission’s PTC list.

6. Modules shall be certified to UL 1703 – “Flat-Plate Photovoltaic Modules and Panels”

7. 25-year minimum power output manufacturer’s warranty.

8. Canadian Solar, Grape Solar, Hyundai Heavy Industries Co. or approved equal.

C. Photovoltaic Panel Mounting Racks: Mounting racks shall utilize type anodized aluminum frames, and support members, and type 316 stainless steel hardware to secure the photovoltaic panels to the parking lot canopy system. Exposed bare aluminum on field cut frames or supports shall be coated with a corrosion inhibitor prior to installation. All frame members shall be provided with manufactured end caps.

D. Three-Phase Transformerless String Inverters:

1. LCD user interface.

2. 98% minimum CEC efficiency rating.

3. Maximum open circuit voltage of 1000VDC.

4. Nominal DC input voltage of 750VDC.

5. For exterior locations or locations exposed to moisture, the enclosure shall be NEMA 3R or NEMA 4, IP65.

6. Nominal AC voltage, phase, and maximum output power ratings as indicated on drawings.

7. Reverse-Polarity Protection.

8. Ground-Fault Isolation Detection.

9. Supports communication interfaces via RS485 and Ethernet.

10. DC disconnecting unit with DC surge protection and DC fuses on positive and negative DC inputs.

11. Minimum warranty of 10 years. Specify warranty extension modalities.

12. Must comply with the following requirements:

    a. UL 1741 – “Standard for Static Inverters and Charge Controllers for use in Photovoltaic Systems”

    b. Listed on the CEC list of eligible inverters

13. The inverter shall include provisions for connection to a web-based remote monitoring system. A third party monitoring system will be acceptable in lieu of an integrated monitoring solution.

14. Solaredge, SMA or approved equal.

D. Combiner Boxes: Rated for 1000VDC, integral fuse cover/puller. 16-circuit with fuses rated for 15A, with provisions to incorporate blocking diodes in series with each circuit, and an integral of aftermarket lighting arrester. The enclosure shall be lockable NEMA 4 rated.

E. Remote Inverter Monitoring System: The remote monitoring system shall provide access to the photovoltaic system performance data through any web browser. The remote monitoring system shall include the following features:
   1. Recording of daily, monthly and annual energy generated.

   2. Remote configuration of the photovoltaic system by authorized users.

   3. Remote diagnosis of the photovoltaic system.

F. Raceways:
   1. Conduits: Galvanized rigid steel and PVC schedule 40, 3/4" minimum diameter unless otherwise indicated, for exterior installations only. Electrical metallic tubing for interior installations. Aluminum conduits shall not be used.

   2. Flexible Conduit: 3/4" minimum, zinc-coated inside and outside; PVC coated, liquid-tight with factory compression fittings.

G. Wires and Cables: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric. All conductors for photovoltaic direct current systems shall be type USE-2.

H. Warning Signs: Engraved white lettering with red background, 1/2” high lettering minimum, stainless steel (316) screw type fasteners.

I. Nameplates: Bakelite nameplates shall be black finish with white core and shall have 1/4" high engraved letters indicating the name of the equipment being served by the device on which the nameplate is to be installed or the name of the device, etc.

J. Conduit and Equipment Supports: Conduit and equipment supports shall be fabricated from stainless steel type 316. All mounting hardware shall be stainless steel type 316.

K. Hardware, Supports, Backing, Etc.: All hardware, supports, backing and other accessories necessary to install electrical equipment shall be provided. Wood materials shall be "wolmanized" treated against termites, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze. Exterior materials shall be stainless steel (316) with the exception of mounting brackets for the photovoltaic panels which shall not produce electrolysis with the metal framing, corrosion resistant aluminum or brass.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall provide all the hardware and appurtenances as needed for a complete solar photovoltaic system.

B. All systems shall be installed in accordance with all applicable requirements of local electrical codes and the National Electrical Code (NEC), including but not limited to Article 690, "Solar Photovoltaic Systems" and Article 705 – "Interconnected Electrical Power Production Sources".

C. Systems shall be designed and installed using UL or ETL listed components, including mounting systems.

D. All Balance of Systems (wiring, component, wiring, conduits, and connections) must be suited for conditions for which they are to be installed. Inverters shall be installed in all-weather enclosures suitable for exterior location. An interval data meter must be installed to measure the AC output of the inverter.

E. Interconnection must comply with HECO "Net Energy Metering" (NEM) standards. The Contractor shall complete the HECO Net Energy Metering and Interconnection Agreement and provide all required submittals and proof of building permit to HECO for approval.

F. For a building with an existing fire alarm control panel (FACP), provide wiring as necessary from inverter to FACP. The FACP shall disable the operation of the inverter when alarmed. 3/4" minimum conduit.

G. For inverters connected to the emergency power of an emergency/standby generating system, provide wiring as necessary from inverter to the automatic transfer switch (ATS). The ATS shall disable the operation of the inverter when operating on emergency power. 3/4" minimum conduit.

3.02 INSTALLATION

A. Structural Supports:

1. All structures supporting photovoltaic and array systems shall be designed to resist dead load, live load, plus wind and seismic loads per IBC 2006 with City and County of Honolulu Amendments.

2. Photovoltaic systems, including rail support system, shall be designed to support all loading specified based on spacing of structural steel support framing shown on the drawings.

3. Thermal loads caused by fluctuations of component and ambient temperatures must be combined with all the above load combinations

4. All structural components, including array structures, shall be designed in a manner commensurate with attaining a minimum 30 year design life. Particular attention shall be given to the prevention of corrosion at the connections between dissimilar metals.

5. Construct concrete equipment pad for inverters and other equipment, if necessary.

B. Wiring System:

1. For exterior locations above grade where exposed to damage, use PVC schedule 80.

2. Above grade interior locations where not exposed to damage, use EMT with UL approved grounding connectors.

3. Conduit system shall be continuous from outlet to outlet or fitting to fitting so that electrical continuity is obtained between all conduits of the system.

4. Conduits cut square and inner edges reamed. Butt together evenly in couplings.

5. Make bends and offsets with hickey or conduit-bending machine. Do not use vise or pipe tee. Flattened or crushed conduit not acceptable.

6. Use of running threads not permitted. Where conduits cannot be joined by standard threaded couplings, approved water-tight conduit unions shall be used.

7. Cap conduits during construction with plastic or metal-capped bushings to prevent entrance of dirt or moisture. Swab all conduits and dry before installing wires.

8. Pull wires shall be placed in all empty conduits ten feet in length or longer.

9. Install insulating bushings and two locknuts on each end of every conduit run at enclosures and boxes. Provide grounding bushings as required.

10. Label wiring at combiner boxes with circuit or string numbers.

11. All support rails shall be closed ended with manufacturer supplied end caps.

C. Grounding:

1. All metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of NEC Article 250. Final connection to equipment, raceways and other metallic parts directly exposed to ungrounded electric conductors shall be No. 12 AWG minimum, copper, NEC type TW, green insulation.

2. All grounding wire runs within building shall be routed together with circuit conductors.

D. Cleaning and Repairing:

During the progress of work, all rubbish, waste lumber, displaced materials, etc. shall be removed as soon as possible and upon completion of the work, Contractor shall remove from the State's property and from all public and private property, at his own expense, all temporary structures, rubbish and waste material resulting from his operations.

E. Finishing:

1. All cutting or wall penetrations that may be required for complete installation of the electrical work shall be carefully performed, and all patching shall be finished in first-class condition by the Contractor.

2. Close unused knockouts in boxes or enclosures with metal cap.

3. Wipe clean all exposed raceways, enclosures and supports with rag and solvent. Unfinished raceways, enclosures and supports shall be prime-painted and finished to blend into background. (Do not cover nameplates.) Factory finished enclosures shall not be painted.

F. Miscellaneous Details:

1. Provide permanent labels on the top frame of each photovoltaic panel identifying the string and panel numbers (i.e. "A-6/5" would identify string 6, panel 5 in array A). The labels shall be embossed or engraved to prevent fading and shall be permanently attached to the panels. The panels may be engraved with the information in lieu of providing permanent labels.

2. Cut, drill and patch as required to install electrical system. Repair any surface damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Cutting, repairs and refinishing are subject to the approval of the Owner. Need for remedial work determined by Owner as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the Owner.

3. Attachment of electrical equipment to wood by non-ferrous wood screws. Attachment to concrete by expansion anchors. Powder-charge-driven studs and anchors permitted only with prior approval.

4. All grounding wire within building run in metallic conduit, and where practicable, routed together with circuit conductors.

5. Furnish necessary test equipment and make all tests necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.

6. Revise all panel circuit directories, using typewriter. Verify “use” designations before typing. Provide new nameplates on all new switchboard mounted circuit breakers.

7. Prime and paint all exposed conduits and junction boxes (including stainless steel junction boxes) to match exterior finish of the building.

8. Provide warning sign on the main building disconnect reading “WARNING: BUILDING IS FED BY PHOTOVOLTAIC GENERATING FACILITY”. Provide warning sign on the main distribution panel disconnect reading “WARNING: BUILDING IS FED BY MULTIPLE PHOTOVOLTAIC GENERATING FACILITIES”.

9. Provide warning sign on photovoltaic system AC disconnect circuit breaker reading “ATTENTION: PHOTOVOLTAIC GENERATING FACILITY”.

10. Provide warning signs on disconnecting means where all terminals may be energized in the open position reading “WARNING: ELECTRICAL SHOCK HAZARD, DO NOT TOUCH TERMINALS, TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION”.

3.03 TESTING AND INSPECTION

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

B. Installations, 600 volts and less shall be tested for insulation resistance after all wiring is completed and ready for connection to equipment. Using a 500V megger, measure and record the insulation resistance from phase to phase and phase to neutral. The above tests shall be witnessed by the Owner and the records turned over to him for proper disposition. The Contractor shall notify the Owner when this test is to be performed.

C. The Contractor shall retape splices which have been bared for inspection. The Contractor shall test all portions of the electrical system furnished by him for proper operation and freedom from accidental grounds. All tests shall be subject to the approval of the Owner.

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

3.04 OPERATION AND MAINTENANCE

A. Any item of material, apparatus, equipment furnished and installed, or construction by the Contractor showing defects in design, construction, quality or workmanship within one year from the date of final acceptance by the Owner shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the complete system conform to the

true intent and meaning of the specification and/or the drawings. Such repairs or replacement shall be made by the Contractor free of all expense to the Owner.

B. The Contractor shall provide notification to the Owner as early as practical, but in no event less than five working days, prior to any planned maintenance and repairs.

C. The Contractor will provide a minimum of ten working days notification to the Owner if any planned repairs or maintenance that will result in any disruption to electrical distribution system.

D. There shall be no interruption of power supply to any of the State's facilities as a result of the installation of the Solar Photovoltaic System. Contractor shall provide standby backup generation at its own cost if required to prevent interruption of the power supply.

END OF SECTION

DIVISION 15 - MECHANICAL

SECTION 15011 - GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Applies to all work of DIVISION 15 - MECHANICAL.

1.02 PLANS

A. The plans and specifications direct attention to certain required features of the materials and equipment but do not purport to cover all details entering into its design and construction. Nevertheless, the Contractor shall furnish and install the mechanical systems complete in all details and ready for operation. The mechanical systems shall be installed substantially as shown on the plans and as specified herein and shall be designed for installation in the area designated with proper space allowed for clearance and maintenance access.

B. Attention is directed to the fact that the plans are based upon certain equipment configurations and that equipment components of other approved equal manufacturers may differ from the arrangement indicated on the plans. If other approved equipment is accepted which require an arrangement different from that indicated on the plans or specified, the Contractor shall prepare and submit for approval, detailed civil, architectural, structural, environmental, mechanical and electrical drawings, layouts, calculations, and equipment lists showing all necessary changes and embodying all special features of the equipment which the Contractor proposes to furnish. The cost of such changes shall be borne by the Contractor at no increase in contract price or extension of contract time for the project.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01330 - SUBMITTAL PROCEDURES.

B. General Requirements

1. Data Required with the Submittal: The Contractor shall submit all data sufficient to demonstrate conformance to the requirements of the DIVISION 15 – MECHANICAL Technical Specifications. The submittal shall include, but not be limited to, manufacturer's name, catalog number or designation, and the electrical and physical characteristics of the equipment. The submittal shall be in the form of printed data sheets, catalog cuts and shop drawings. Reference to manufacturer's literature without enclosing a copy of the referenced document will be considered insufficient.

   Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Incomplete packages will be returned without a review.

2. Approval Requirements: Approval of material and equipment will be based on manufacturer's published data. Where materials or equipment are specified

to be constructed and/or tested in accordance with the Standards of the American Society of Mechanical Engineers, National Electrical Manufacturers Association, or Underwriters' Laboratories, Inc.; the Contractor shall submit proof that the items furnished under the contract drawings and specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the requirements of the American Society of Mechanical Engineers. A certificate or published statement that the item is in accordance with the referenced Standard by the manufacturer will be sufficient evidence that the item conforms to the requirements of the Standard. In lieu of such stamp, certificate, or statement, the Contractor may submit a written certificate from any nationally recognized testing agency that the item has been tested and that the unit conforms to the requirements listed hereinbefore, including methods of testing of the specified agencies.

3. Identification: All submittals covering equipment shall be identified with the equipment numbers shown on the contract drawings and the system served.

4. Substitutions
   a. Substitutions shall be subject to the requirements of the GENERAL CONDITIONS. Supporting data shall be furnished for all substitutions. Redesign of civil, architectural, structural, environmental, mechanical, electrical, or any other feature made necessary by the use of substitutions shall be the responsibility of and at the expense of the Contractor, and subject to approval by the Project Manager.

   b. Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, equipment or hazardous material abatement from that specified or indicated on the drawings, the Contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, or hazardous material abatement at no additional cost to the State.

5. Samples: When called for in DIVISION 15 - MECHANICAL, furnish samples of materials that truly represent the materials to be used. Where samples are specified to demonstrate method of installation, furnish all materials and tools. Samples shall also be furnished when materials are proposed as substitutions for those specified. Materials used in the work shall be identical to samples that have been approved by the Project Manager.

C. List of Material and Equipment: The Contractor shall submit to the Project Manager for approval eight (8) sets of a complete list of proposed material or equipment. This list shall include manufacturer's name and material or equipment identification such as styles, types, or catalog numbers, to permit ready and complete identification. Catalog numbers specified herein are given for reference only. The Contractor shall furnish the latest model manufactured.

D. Shop Drawings: The Contractor shall submit to the Project Manager for approval eight (8) sets of prints of shop drawings in accordance with the requirements of

the GENERAL CONDITIONS. Shop drawings shall be submitted for equipment not completely identifiable by information contained in the list of materials and equipment.

1. The Contractor shall submit detailed shop drawings of all equipment and all materials required to complete the project. No material or equipment may be delivered to the job site or installed until the Contractor has in his possession the approved shop drawings for the particular material or equipment. The shop drawings shall be complete as described herein.

2. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not mean that drawings have been checked in detail; said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the contract drawings and specifications.

3. Failure of the Contractor to submit shop drawings in ample time for checking shall not entitle him to an extension of contract time, and no claim for extension by reason of such default will be allowed.

4. Shop drawings shall be submitted for, but not limited to, the following:
   a. Seismic Requirements.

   b. Plumbing System.

   c. All items described in specifications and on drawings.

   d. Other items as the Project Manager may direct.

5. Shop drawings shall include as applicable:
   a. Identification of each piece of equipment and component.

   b. Dimensioned layouts and arrangement of equipment.

   c. Operating performance and electrical characteristics.

   d. Foundation and mounting data.

   e. Equipment clearances required for servicing and proper operation.

E. MSDS: The Contractor shall submit to the Project Manager for approval eight (8) sets of MSDS for materials used in this project. Contractor shall perform all work in accordance with the recommendations of the MSDS, including all tests.

F. Test and Balance Reports: The Contractor shall submit to the Project Manager for approval eight (8) sets of Plumbing System Test and Balance Reports with all test data procedures and descriptions.

G. As-Built Drawings: Submit field posted and as-built drawings as described in SECTION 01770 - CLOSEOUT PROCEDURES.

H. Certificates: The Contractor shall submit to the Project Manager for approval eight (8) copies of certificates, acceptance and compliance with regulations of agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Project Manager. Certificates shall include the following:
   1. Sterilization of domestic water piping and pumping system.

   2. Pressure testing of domestic water piping.

   3. Pressure testing of sanitary piping.

   4. Pressure testing of pressure washer water piping.

   5. Pressure testing of rinse water piping.

   6. Pressure testing of compressed air piping.

   7. All wetted materials used in the potable water system shall be lead-free and NSF 372 certified.

I. One Year Guarantee And Maintenance Service Contract
   1. Contractor shall submit eight (8) copies of a written Guarantee that all work is as specified, and shall be bound to replace material or equipment defective due to workmanship or materials. Contractor shall not be responsible, however, for defects proven to the Project Manager's satisfaction to be due to misuse, accident, [lack of maintenance], improper operation, or negligence by other parties.

   2. Further, Contractor shall be held responsible for all damages to any part of the premises, building or contents caused by leaks or other defect in pipe, equipment or materials provided under the contract drawings and specifications.

   3. Terms of this Guarantee are in addition to other guarantee provisions of the specifications, and do not substitute for other more stringent terms, if any.

   4. In addition to the Guarantee on material and workmanship, the Installer shall submit eight (8) copies of the Maintenance Service Contract, countersigned by the Contractor that will validate the Guarantee.

   5. The Guarantee and Maintenance Service Contract shall commence immediately after the system/equipment startup date and extend for a period of one (1) year commencing after thirty (30) consecutive days of trouble-free operation after the acceptance date. The Guarantee and the Maintenance Service Contract shall include all labor, materials, equipment and parts necessary to service the complete system, in accordance with the attached Schedule of Maintenance Service Attachment No. 1 so as to assure proper operation and function of the system. All costs for the periodic maintenance, including emergency calls, shall be borne by the Contractor. The guarantee

and maintenance periods shall run concurrently (same start and end dates). However, should the Contractor default on the maintenance service contract and must restart or complete the service, then the entire guarantee and maintenance period shall be extended by the period of time that the maintenance service contract was in default. Similarly, should equipment fail and require repair, the entire guarantee and maintenance period shall be extended by the period of time it takes to repair the equipment. Furthermore, the Project Manager has the option to reject any installed equipment if the Contractor violates any of the corresponding equipment manufacturer's guarantee or warranty terms including maintenance requirements. All rejected equipment shall be replaced with new equipment at no cost to the State.

6. Trouble-free operation is defined as a non-disabling condition, non-recurring failure or disruption, and the following:
   a. The system shall be free of all discrepancies, contamination and debris, which require correction in excess to those described for the monthly service included in the Schedule of Maintenance Service.

   b. The system is maintaining operational conditions and other parameters as measured during the acceptance test.

7. The Installer shall include a list of the following items along with the Maintenance Service Contract:
   a. Name of the service contractor and documentation that field service personnel are manufacturer or union trained, qualified, and certified to service the equipment.

   b. Equipment startup date(s).

   c. Project Acceptance Date.

   d. Completion of thirty (30) consecutive calendar days of trouble-free operation date.

   e. Service contract expiration date.

   f. Service schedule for the maintenance period.

   g. Itemized list of equipment covered under the service contract, including a description of the equipment identified, its model and serial number(s) and manufacturer’s name(s).

8. Maintenance service contractor shall have a local office, staffed with competent, qualified and manufacturer or union trained and certified field service personnel and stocked with full inventory of replacement repair parts, to perform specified service and maintenance tasks on all equipment in accordance with the One-Year Maintenance Service Contract and terms and conditions of all equipment manufacturer’s warranties and recommendations. Field service personnel shall be fully capable of providing routine

maintenance and emergency maintenance service on all system equipment components.

9. The Maintenance Service Contract shall be submitted along with the Operation and Maintenance Manual on/or before the Project Acceptance Date.

J. Operation and Maintenance Manual
   1. The Contractor shall submit to the Project Manager for approval eight (8) hardbound (heavy-duty, "D" type, 3-ring binder) copies and eight (8) compact disks (CD-R) of the Operation and Maintenance Manual on all equipment and the system as a whole. Operation and Maintenance Manual files on CD-R shall be searchable PDF files. The manual shall identify project name and number, contractor, consultant, date and all equipment provided. It shall include the equipment manufacturer's name and contact information (phone, facsimile, e-mail, website, and address), model and serial number, tag number, capacity, quantity of units, startup date, and their location and area (room) served.

   2. Operation and Maintenance Manual shall be submitted for, but not limited to, the following:
      a. Plumbing System.

      b. All items described in specifications and on drawings.

      c. Other items as the Project Manager may direct.

   3. Operation and Maintenance Manual shall be submitted to the Project Manager for approval prior to acceptance of each installation. Manual shall include the following in addition to the requirements of SECTION 01770 - CLOSEOUT PROCEDURES:
      a. Manufacturer's Literature: Adequately indicate, highlight, arrow, etc. project related information and delete, "X" or cross out non-applicable information.

      b. Parts List: Submit a parts list and assembly diagrams showing location, number required and identification for each part and subassembly. Submit source of service and replacement parts.

      c. Control and Wiring Diagrams: Submit control and wiring diagrams.

      d. Operation Instructions: Submit a brief description of the system(s) with information on the proper control of the system(s) by the operator.

      e. Maintenance Instructions: Submit a list of each item requiring inspection, lubrication or service with the description of the proper performance of such maintenance.

f. Maintenance Schedule: Submit a recommended schedule of maintenance activity broken down by recommended frequency of performance (i.e. weekly, monthly, quarterly, semi annually and annually).

g. Installation Instructions: Submit installation instructions.

1.04 MANUFACTURER'S INSTRUCTIONS

A. General: Furnish manufacturer's instructions and data covering installation, operation and maintenance of all materials and equipment. Submittals shall be in eight (8) bound copies each.

B. Installation instructions for materials shall include precautions for handling, storage and preparation for field application. Description of other materials and tools required to complete the installation shall be included. Installation instructions for equipment shall include assembly, recommended supports, aligning and connecting for service. The instructions shall include illustrations, diagrams and step-by-step procedures. Instructions should indicate if delegated design services are recommended/required.

C. Operation and maintenance instructions shall include instructions for operation, maintenance, repair, recommended inspection points and periods for inspection in a practical, complete and comprehensive manner. The information shall be arranged in a logical, orderly sequence, including a general description of the equipment and significant technical characteristics. Test, adjustment and calibration information shall be furnished and identified to specific equipment. The instructions shall include illustrations, diagrams, and step-by-step procedures.

D. Spare Parts Data: Spare parts data shall be furnished for each item of equipment. The data shall include a complete list of parts and supplies, to assure efficient operation for a period of one (1) year, current unit prices and source of supply. Components not manufactured by the equipment company such as bearings, seals, and packing shall be identified as to trade name and part and identification number. The foregoing shall not relieve the manufacturer of any responsibilities under the guarantee specified hereinbefore.

E. Identification: The data shall have complete identification throughout using equipment numbers shown on the drawings and indicating the system to which the data pertains.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment shall conform to the requirements of applicable Technical Specifications and publications specified therein and shall be as shown. Materials and equipment shall be new and shall be the products of manufacturers regularly engaged in the manufacture of such products. All items shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years in the State of Hawaii prior to bid opening and shall be

supported by a service organization that is, in the opinion of the Project Manager, reasonably convenient to the site of installation.

2.02 NAMEPLATES

A. Each item of equipment shall have manufacturer's nameplate of corrosion resistant metal attached in a conspicuous location. Nameplate data shall include manufacturer's name, address, model number, capacity, rating and such other performance data as required to completely identify the item. In addition, the Contractor shall provide a separate corrosion resistant metal tag to carry the equipment designation as shown on drawings and the installation date. Nameplate lettering shall be stamped upper case. Nameplate shall be fastened by means of corrosion resistant metal screws or wire, 14-gage.

2.03 TOOLS AND SUPPLIES

A. Where specified in DIVISION 15 - MECHANICAL, special tools and supplies shall be provided. The items shall be packaged or boxed to provide protection in storage, and shall be identified as to use. Tools and supplies shall be accompanied by information as to source of supply.

2.04 FACTORY-APPLIED PAINT

A. Ferrous surfaces of equipment shall have baked enamel or galvanized finish as standard with the manufacturer. Special coating shall be applied when specified in the DIVISION 15 – MECHANICAL Technical Specifications.

PART 3 - EXECUTION

3.01 QUALITY CONTROL

A. The work shall be performed by workers skilled in the type of work involved under experienced supervision. Where methods of application or installation are specified by commercial standards in the DIVISION 15 – MECHANICAL Technical Specifications, no departures will be permitted except as specified or as directed by the Project Manager.

3.02 INSPECTION AND TESTS

A. The Contractor shall give the Project Manager written notice a minimum of seven (7) calendar days prior to inspection and tests. Tests shall be performed as required in the DIVISION 15 – MECHANICAL Technical Specifications. All work rejected by the Project Manager shall be repaired or replaced by the Contractor at no additional cost to the State.

3.03 VERIFICATION OF DIMENSIONS

A. The Contractor shall check all dimensions at the site and shall establish all lines and levels. Equipment shall be located to assure proper grade for piping. The Contractor shall be responsible for correctness of all dimensions and fitting of piping and equipment into the available space. Should field measurements show conditions that require relocation of any work, such conditions shall be reported to the Project Manager in advance of installation, and the work shall proceed in accordance with his decision.

3.04 PROTECTION DURING STORAGE

A. All materials and equipment shall be stored in a safe manner, secured from weather. All materials shall be stored above the ground or floor level to avoid damage by moisture.

3.05 PROTECTION OF WORK IN PROGRESS

A. Pipe openings shall be closed with caps or plugs until connections are made. Equipment shall be securely covered for protection against physical or chemical damage. In areas exposed to weather, materials unused at the end of each day's work shall be stored in weather-protected locations. Damage to materials or equipment due to the Contractor's neglect shall be repaired or replaced to the satisfaction of the Project Manager by, and at the expense of, the Contractor. Trenches and excavations shall be properly shored, protected and covered if left open.

3.06 PROGRESS OF WORK AND COORDINATION

A. The work shall be coordinated with the work of other contractors and other trades to avoid interferences, preserve headroom and operating clearances, and to expedite completion of the project.

3.07 INSTALLATION OF EQUIPMENT

A. Installation and adjustments shall be in accordance with the equipment supplier's written instructions. All accessories required shall be properly installed and connected. Supports shall be adequately anchored and vibration isolation shall be installed where required.

3.08 PERMITS, LICENSES AND INSPECTIONS

A. The Contractor shall obtain all permits and licenses required to perform the work, pay all required fees, and shall cooperate with all inspections required by authorities having jurisdiction. Inspections specified in the DIVISION 15 – MECHANICAL Technical Specifications shall be permitted without interference. Corrections to work as a result of inspections shall be made promptly.

3.09 LOCAL TECHNICAL SUPPORT

A. The mechanical equipment supplier shall have an office in the State of Hawaii, staffed with factory trained representatives fully capable of providing instruction on routine and emergency maintenance service on all system components supplied for this project.

3.10 FIELD TESTS

A. The Contractor shall be responsible for testing of the installed work, shall provide all labor, equipment and instruments, and shall conduct pressure tests and operating tests on the piping systems and equipment. During pressure tests, all items in piping systems not designed for test pressures shall be removed from, or isolated from the system and shall be reconnected or unblocked after tests are completed. Should operating tests require the presence of manufacturer's representatives, the Contractor shall cooperate with them and shall place at their disposal all assistance, materials and services required to perform such tests. Testing shall be as specified hereinafter.

3.11 PAINTING

A. The Contractor shall be responsible for complete coverage in painting all exposed ferrous metal. Painting shall be in accordance with SECTION 09901 - PAINTING as applicable for ferrous metal surfaces.

3.12 TESTING AND BALANCING

A. Prior Tests: Leave concealed or insulated work uncovered until required tests have been completed, but if construction schedule requires it, arrange for prior tests on parts of system as approved.

B. Preliminary Tests: As soon as conditions permit, conduct preliminary or "turn-over" tests of certain equipment as directed to ascertain compliance with specified requirements. Make needed changes, adjustments or replacements as preliminary tests may indicate, prior to acceptance tests.

C. Acceptance Tests: Conduct pressure, performance and operating tests as specified for each system or equipment unit, in the presence of the Project Manager or other accredited representative of the State, as well as representatives of agencies having jurisdiction.

D. Costs: Furnish labor, materials, instruments and bear costs in connection with all tests. Installed instruments may be used for tests, if calibrated and approved for the purpose.

E. Defects: All defects disclosed as a result of the following or other tests or operations shall be promptly repaired by and at the expense of the Contractor and to the Project Manager's satisfaction. Contractor shall supply all instruments, labor and tools required by tests. Any defective material, equipment and/or work shall be repaired, adjusted and replaced by new, like materials and equipment, and retested/reinspected before acceptance. Caulking of screwed joints or holes will not be accepted.

F. Certificates: Obtain certificates of approval, acceptance and compliance with regulations of agencies having jurisdiction. Work shall not be deemed complete until such certificates have been delivered to the Project Manager.

G. Instructing Operating Personnel: When equipment have been placed in permanent operation, instruct operating personnel in operation and maintenance of equipment. Instruction shall include all normal operations of the system, troubleshooting, review of the O&M Manual and how to obtain replacement parts. Instruction shall also include answering all questions posed by staff.

H. Pressure Tests: Before testing piped systems, remove, or otherwise protect from damage, control devices, air vents and other parts, which are not designed to stand pressures used in testing piping.

I. Hydrostatically test piping for all services to one and one-half times the maximum working pressure, but in no case to less than 50 psi, for at least four (4) consecutive hours, during which time pressure shall remain constant without pumping.

J. Do not paint, cover or conceal piping, nor connect fixtures or equipment before testing and obtaining approval.

K. Test piping that will be concealed, in sections as approved. Perform tests in a manner that will not leave any pipe or joint untested.

L. Testing procedures and conditions stated above shall also apply to all of the following tests:
   1. Plumbing Systems Test

   2. Operating Test

3.13 PLUMBING SYSTEMS TEST

A. Test plumbing work as specified herein and according to local Code Regulations. Latter shall govern if they conflict with former.

B. Provide test pump, gauges, instruments, materials and labor as required.

C. Clean piping, equipment and specialties before testing.

D. Water-Supply System Pressure Test: Service pipe shall be subjected to water test under pressure and for duration as directed by agency having jurisdiction. Conduct tests when the roughing-in is completed and before insulation is applied and fixtures are set. Water piping system shall be tested at a hydrostatic pressure of not less than 120 psig and proved tight at this pressure for not less than 30 minutes in order to permit inspection of all joints. Where a portion of the water piping system is to be concealed before completion, this portion shall be tested separately as specified for the entire system.

E. Drainage System Pressure Test: Drainage and venting system piping shall be tested with water or air before backfilling and installation of fixtures. Water test shall be applied to the drainage and venting system either in its entirety or in sections. If the entire system is tested, all openings in the pipes shall be tightly closed except the highest opening, and the system shall be filled with water to point of over-flow. If the system is tested in sections, all openings except the highest opening of the section under test shall be tightly plugged and each section shall be filled with water and tested with at least a ten (10) foot head of water. After the plumbing fixtures have been set and their traps filled with water, the entire drainage and venting system shall be submitted for a final test with smoke or peppermint.

F. Pressure Washer System Pressure Test: Hydrostatically test each system at 3,750 psig for a period of 30 minutes.

G. Rinse Water System Pressure Test: Hydrostatically test each system at 275 psig for a period of 30 minutes.

H. Defective Work: If inspection or test show defects, such defective work or materials shall be replaced or repaired as necessary and inspection and test repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be accepted.

I. Make adjustments, repairs, and alterations, as required to meet specified test results. Correct defects disclosed by tests or inspections. In case of pipe defect, replace with same length as defective piece. Repeat tests after defects have been corrected and parts replaced, as directed until pronounced satisfactory.

J. Test and set relief valves to specified relief pressures. Test and adjust gauges, thermometers, meters and instruments after installation to assure accurate operations.

3.14 OPERATING TEST

A. After installation work has been completed, tested and approved, test equipment and fixtures under normal operating conditions for periods as directed to check capacities and other details as required demonstrating that they fulfill requirements of the plans and specifications, and that they operate satisfactorily.

B. Where evidence of stoppage appears in piping, fixtures or equipment, disconnect, clean, repair, and reconnect obstructed parts. Contractor shall bear costs of cutting, patching adjoining work necessitated by such cleaning and repairing.

END OF SECTION

ATTACHMENT NO. 1

SCHEDULE OF MAINTENANCE SERVICE

PART 1 - EQUIPMENT MAINTENANCE

1.01 SUMMARY

A. All services performed by the Contractor shall include applicable items listed but shall not be limited to the following maintenance tasks: Contractor shall also be responsible for performing all maintenance tasks recommended by the equipment manufacturer(s) whether listed below or not.

1.02 PUMPS

A. Quarterly Service
   1. Lubricate and check pump and motor bearings for abnormal temperature and unusual noise or vibration and repair as needed.

   2. Check seals for excessive leakage. Adjust, tighten or replace as required.

   3. Certify performance of quarterly pump maintenance service. Correct and report all discrepancies.

B. Semi-Annual Service
   1. Check and blow down strainer at pumps. Remove and clean strainer if excessive debris is noted.

   2. Log suction and discharge pressures.

   3. Clean and remove all dust and foreign matter. Clean all rust spots and scratches and touch up paint with matching color.

   4. Certify performance of semi-annual pump maintenance service. Correct and report all discrepancies.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.03 PRESSURE WASHERS

A. Monthly Service
   1. Submit maintenance report in writing to the Contract Administrator.

B. Semi-Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.04 SOAP SOLUTION DISPENSER (FOAMER) SYSTEM

A. Monthly Service
   1. Submit maintenance report in writing to the Contract Administrator.

B. Semi-Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.05 AIR COMPRESSOR

A. Monthly Service
   1. Submit maintenance report in writing to the Contract Administrator.

B. Semi-Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.06 OIL WATER SEPARATOR

A. Monthly Service
   1. Submit maintenance report in writing to the Contract Administrator.

B. Semi-Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.07 DIVERSION VALVE

A. Monthly Service
   1. Submit maintenance report in writing to the Contract Administrator.

B. Semi-Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

C. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

1.09 VALVES, PIPES, EQUIPMENT AND SUPPORTS

A. Monthly Service
   1. Wirebrush, prime and paint rust from valves, pipes, equipment and support surfaces, then prime and paint to prevent further rusting. Paint rust immediately upon discovery or notification.

   2. Certify performance of monthly valves, pipes, equipment and supports maintenance service. Correct and report all discrepancies.

B. Annual Service
   1. Exercise all equipment shut-off valves for proper operation and tightness.

2. Certify performance of annual valves, pipes, equipment and supports maintenance service. Correct and report all discrepancies. Submit maintenance report in writing to the Contract Administrator.

1.10 CLEANING OF MECHANICAL EQUIPMENT ROOMS OR ENCLOSURES

A. Monthly Service
   1. Vacuum or wipe clean all equipment surfaces and all related appurtenances.

   2. Vacuum clean or sweep complete floor platform areas. DO NOT wet floors and platform area where there is no waterproofing.

   3. Wet wash complete floor area with tap water where allowed. Remove all used, deteriorated, replaced, discarded parts and related debris. CAUTION: DO NOT splash water onto the electrical and mechanical equipment.

   4. Notify Project Manager and Manager-in-Charge of any dangerous conditions, improper storage of furniture, materials and supplies which impact maintenance/repair work within rooms and enclosures, including vandalism.

   5. Certify performance of monthly cleaning of mechanical equipment rooms or enclosures maintenance service. Correct and report all discrepancies.

B. Annual Service
   1. Submit maintenance report in writing to the Contract Administrator.

PART 2 - MAINTENANCE SCHEDULE AND REPORTING

2.01 WORK SCHEDULE

A. All maintenance work shall be performed between the hours of 7:30 a.m. and 4:00 p.m. on normal working days, Monday through Friday, excluding State Holidays.

2.02 TROUBLE CALLS

A. Emergency service and repairs required between regular service calls shall be rendered within 24 hours after the Contractor is notified, State non-work days excluded. The Contractor shall call the Facility representative the next working day after being notified of a problem and report the status of repairs.

2.03 MAINTENANCE REPORT/CHECKLIST

A. The Contractor shall prepare and maintain a maintenance service report/checklist, which shall include the following:
   1. Date maintenance service was performed.

   2. Type of maintenance performed (i.e., monthly, quarterly, semi-annual, annual).

   3. The name of the mechanic who performed said maintenance.

4. The type and cost (labor, materials, parts and equipment) of repair work performed on the unit, if any.

5. Documents and other data pertaining to the maintenance performed.
   a. It shall be the responsibility of the Contractor to maintain the report/checklist by recording the above noted data after each scheduled maintenance and emergency repair, and have the checklist available for inspection at the Facility. The report shall be sufficiently detailed to properly reflect the past maintenance history of the equipment.

   b. Reports shall be certified by a representative of the facility being served and shall be submitted to the Facility and the Project Manager immediately after the completion of the maintenance service or service trouble call.

2.04 CLEANUP AND WORK PRACTICES

A. The Contractor shall keep the job site free of debris, litter, discarded parts, etc. and shall clean all oil drippings during the daily progress of work. The Contractor shall remove all tools, parts and equipment from the service areas upon completion of the work.

B. The Contractor shall exercise caution during the progress of his maintenance and repair work to prevent damage to roof, roofing, or other existing building elements and equipment. The Contractor shall restore all damages, caused by his negligence, to its original condition at his own expense.

END OF ATTACHMENT

SECTION 15400 - PLUMBING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers the following items:
   1. Water, waste and vent systems
   2. Pressure washing system
   3. Rinse water system
   4. Compressed air system
   5. Soap Solution Dispenser (Foamer) system
   6. Plumbing fixtures and trim.

1.02 GENERAL REQUIREMENTS

A. Contractor shall inform Project Manager of testing date a minimum of seven (7) calendar days prior to testing system and closing in walls and/or trenches.

B. Provide all necessary labor, delegated design, materials, operations, equipment, tools and techniques required to furnish and install complete the plumbing work as and within the limits indicated.

C. Submit written request for interruption of the existing plumbing system not less than seven (7) calendar days prior to the time for which the interruption is requested.

D. Prospective bidders shall visit the premises and familiarize themselves with all work details and conditions before submitting a bid. Reasonable modifications to indicated arrangements to suit actual conditions shall not constitute a basis for requesting additional funds from the State.

E. Prior to ordering materials and equipment, the Contractor shall field verify all existing conditions, materials, sizes and dimensions that affect their work, and shall coordinate their work with all trades involved.

F. Obtain all permits and pay the costs thereof. Arrange for inspections in sufficient time to avoid delay to the project. Provide copies of inspection reports and disinfection certificates.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. SECTION 05500 - METAL FABRICATIONS

B. SECTION 07920 - SEALANTS

C. SECTION 09901 - PAINTING

D. SECTION 15011 - GENERAL MECHANICAL PROVISIONS

E. DIVISION 16 - ELECTRICAL

1.04 LAWS, RULES, REGULATIONS AND REFERENCES

A. The entire installation shall comply with the latest applicable rules and regulations of the City and County of Honolulu, the State of Hawaii, and any other applicable laws, codes, rules and regulations whether or not specifically mentioned hereinafter.

B. Codes
   1. Plumbing Code, City and County
   2. Building Code, City and County
   3. Energy Code, City and County
   4. Hawaii Administrative Rules, Title 11, Chapter 11, Sanitation
   5. Wastewater Management Regulations, City and County
   6. Water System Standards, 2002

C. References
   1. American National Standards Institute (ANSI) Publications
      a. Z358.1-14 — Standard for Emergency Eyewash and Shower Equipment
   2. American Society for Testing and Materials (ASTM) Publications
      a. A53-12 — Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
      b. A126-04(2014) — Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
      c. B32-08(2014) — Standard Specification for Solder Metal
      d. B62-17 — Standard Specification for Composition Bronze or Ounce Metal Castings
      e. B88-16 — Standard Specification for Seamless Copper Water Tube
      f. B306-13 — Standard Specification for Copper Drainage Tube (DWV)
      g. C564-14 — Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

h. D2665-14 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

i. F891-16 Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core

3. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) Publications
   a. 90.1-16 Energy Standard for Buildings Except Low-Rise Residential Buildings

4. American Society of Mechanical Engineers (ASME) Publications
   a. B16.1-15 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

   b. B16.18-12 Cast Copper Alloy Solder Joint Pressure Fittings

   c. B16.22-13 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

   d. B16.23-16 Cast Copper Alloy Solder Joint Drainage Fittings - DWV

   e. B16.26-13 Cast Copper Alloy Fittings for Flared Copper Tubes

5. American Society of Sanitary Engineering (ASSE) Publications
   a. 1003-2009 Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

6. American Welding Society (AWS) Publications
   a. A5-All A5 Filler Metal Specifications Series

7. American Water Works Association (AWWA) Publications
   a. C105-10 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

   b. C550-17 Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

8. Cast-Iron Soil Pipe Institute (CISPI) Publications
   a. 301-12 Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications

9. Institute of Electrical and Electronics Engineers (IEEE) Publications
   a. 841-09 Petroleum and Chemical Industry--Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-

Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)

10. International Association of Plumbing & Mechanical Officials (IAPMO) Publications
    a. PS 117-2016 Press and Nail Connections

11. International Safety Equipment Association (ISEA) Publications
    a. Z358.1-2014 American National Standard for Emergency Eyewash and Shower Equipment

12. Manufacturers Standardization Society (MSS) Publications
    a. SP 58-09 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

13. NSF International (NSF) Publications
    a. 61-16 Drinking Water System Components - Health Effects

    b. 372-16 Drinking Water System Components - Lead Content

14. Plumbing and Drainage Institute (PDI) Publications
    a. WH 201-2010 Water Hammer Arresters Standard

1.05 SUBMITTALS

A. General: The Contractor shall submit submittals in accordance with SECTION 15011 - GENERAL MECHANICAL PROVISIONS.

B. Shop Drawings: The Contractor shall submit shop drawings showing the entire work with inverts, sleeves and dimensions. Contractor shall field verify and check project drawings to avoid interferences with structural features and with work of other trades. No plumbing or piping work shall commence until such plans have been approved and accepted by the Project Manager. Any deviations from the shop drawings shall require approval by the Project Manager.

C. Submit the following:
    1. Manufacturer’s product data

    2. Shop drawings

    3. MSDS

    4. Test reports

    5. As-built drawings

    6. Certificates

7. One-Year Guarantee and Maintenance Service Contract

8. Operation and Maintenance Manual

1.06 PLUMBING EQUIPMENT MANUFACTURER'S REPRESENTATIVE AND SERVICE CAPABILITIES

A. Furnish the services of a manufacturer's representative who is factory authorized and trained to perform the services specified. The manufacturer's representative shall furnish recommendations and shall be on-site to provide assistance on the following matters:
   1. Technical direction of the erection including disassembly and reassembly if required, alignment and testing.

   2. Starting equipment and furnishing instruction as to its proper care, operation and maintenance.

1.07 ELECTRICAL WORK

A. Contractor shall supply and mount all motors and provide all wiring, conduits, controls, and disconnects for equipment. Contractor is responsible for coordination of size, voltage, phase, auxiliary contacts, etc. For 1/2 HP and smaller motors, the control shall include thermal overload protection consisting of an external thermal trip switch mounted in an easily accessible location. For motors larger than 1/2 HP the control shall include magnetic starter with low voltage release and thermal cutouts sized on full load motor current. Starter enclosure shall include a H-O-A switch and pilot light. Should any equipment require electrical service or wiring other than as shown on the electrical drawings, inform the Project Manager and advise the Electrical Contractor of such changes. All control devices must be installed to operate within the manufacturer's rated current and voltage. All control circuits must be through the respective equipment's disconnect to insure the control circuit being off when equipment disconnect is off. All motors, switches, starters, wiring devices and controls mounted where exposed to weather shall have NEMA 4X enclosures. Wiring materials and methods shall conform to DIVISION 16 - ELECTRICAL, applicable National Electrical Codes, and NEMA standards.

B. Motor characteristics and Drives: Electrical motor voltages shall be as indicated and to be verified with the electrical drawings and Contractor. Motors shall be furnished in accordance with the IEEE-841-2009 Standard and the NEMA Premium Efficiency Standard, service factor of 1.15 not to exceed 1,800 RPM, unless otherwise indicated. Non-contacting bearing isolators conforming to IP 55 shall be supplied for all motor ball bearings. V-belt drives shall be designed for 150% of motor horsepower with provisions made to adjust belt tension.

PART 2 - PRODUCTS

2.01 SOIL, WASTE, DRAIN AND VENT PIPING, BURIED

A. Cast Iron Pipe: CISPI 301, hubless, service weight, with ASTM C564 neoprene gaskets, Type 304 stainless steel corrugated shield with a minimum thickness of

0.015 inches, Type 304 stainless steel clamps, and Type 305 stainless steel screws.

B. Copper Tube: ASTM B306, type DWV with ASME B16.23 cast copper or wrought copper fittings and lead free solder joints.

2.02 SOIL, WASTE, DRAIN AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight, with ASTM C564 neoprene gaskets, Type 304 stainless steel corrugated shield with a minimum thickness of 0.015 inches, Type 304 stainless steel clamps, and Type 305 stainless steel screws.

B. Copper Tube: ASTM B306, type DWV with ASME B16.23 cast copper or wrought copper fittings and lead free solder joints.

C. PVC Pipe: ASTM D2665 or F891 with solvent weld joints.

2.03 DOMESTIC WATER, RINSE WATER AND COMPRESSED AIR PIPING, BURIED

A. Copper Tubing: ASTM B88, NSF 61, Type K, annealed with ASME B16.18 or ASME B16.22 solder joint copper fittings. Provide lead free solder joints.

2.04 DOMESTIC WATER, RINSE WATER AND COMPRESSED AIR PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, NSF 61, Type L, hard drawn, with ASME B16.18 or ASME B16.22 solder joint, ASME B16.26 flared joint, or IAPMO PS 117 press fit copper fittings. Solder joints shall be lead free. Sealing elements for press fittings shall be EPDM.

2.05 SOAP SOLUTION PIPING

A. PVC Pipe: ASTM D1785, Schedule 80 with solvent cement welded joints.

2.06 PRESSURE WASHER PIPING

A. Type 316 Stainless Steel Pipe: ASTM A312, Schedule 80 with welded joints.

2.07 POLYETHYLENE ENCASEMENT

A. Polyethylene Encasement shall be AWWA C105 polyethylene tube or sheet.

2.08 FLANGES, UNIONS, AND COUPLINGS

A. Pipe Size 2-Inches and Under: Malleable iron unions for threaded ferrous piping; bronze unions for soldered copper pipe joints.

B. Pipe Size Over 2-Inches: Forged steel flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets.

C. Dielectric Connection: Union, with galvanized or plated steel threaded end and copper solder end, with water impervious isolation barrier. Epco model FX or approved equal. Flange, with full faced isolation gasket and bolt sleeves. Watts or approved equal.

2.09 BALL VALVES

A. 2-Inches and under: Two piece silicon bronze body, 600 psi nonshock cold working pressure, 100 psi at 300 degrees F maximum pressure/temperature, full port, stainless steel ball, stainless steel trim, Teflon seats and stuffing box ring, blowout-proof stems, lever handle, solder or threaded ends. Valves shall comply with MSS SP-110.

2.10 SWING CHECK VALVES

A. 2-Inches and under: ASTM B62 bronze swing disc, 125 psi steam working pressure, 200 psi nonshock cold working pressure, Buna-N seat disc, and solder or screwed ends. Valves shall comply with MSS SP-80.

2.11 WATER PRESSURE REDUCING VALVES

A. 2-Inches: ASSE 1003, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer and threaded and single union ends.

B. Over 2-Inches: ASSE 1003, cast iron body, bronze fitted, elastomeric diaphragm and seat disc and flanged ends.

2.12 RELIEF VALVES

A. Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.13 SOLENOID VALVE

A. 2-inches: Brass body, 2-way, normally closed, 150 psi max, 120 VAC. ASCO 8221G013 or approved equal.

2.14 STRAINERS

A. 2-Inches and under: Screwed brass or iron body, Y pattern with stainless steel perforated screen.

2.15 WATER HAMMER ARRESTORS

A. PDI WH-201 precharged suitable for operation in temperature range 40 to 180 degrees F and minimum 150 psig working pressure.

2.16 PLUMBING FIXTURES

A. All exposed piping at fixtures and equipment shall be chrome plated.

B. Furnish all traps, stop valves, escutcheons, tail pieces, trap arms and other items as required for installation and connection of fixtures and equipment furnished under this or other sections. Coordinate with other trades and disciplines as required.

C. For each item specified, products of one manufacturer are identified to establish a standard of comparison. Products of other manufacturers will be considered if submitted for approval.

D. Fixtures List:

1. Service Sink (typical) shall be wall mounted with trap standard, 24 by 20 inches, enameled cast iron with backsplash, flat grid strainer, stainless steel rim guard and backsplash mounted rough brass threaded hose faucet with stops, pail hook, and integral vacuum breaker. Trap standard shall be three-inch cast iron enameled inside, with cleanout plug.

Item	Manufacturer	Model
fixture	Kohler	K-6716
faucet	Kohler	K-8906-RP
trap standard	Jay R. Smith	9120
faucet(cold water only)	Chicago	952
hole cover	Pasco	1275

2. Combination emergency eyewash/shower shall have a 10-inch ABS plastic showerhead in safety green. Shower shall be activated by a stainless steel pull rod. Eyewash shall have an 11-inch stainless steel receptor. Heads shall be ABS plastic anti surge type eyewash heads in safety green and shall be equipped with dust covers. Eyewash shall be activated by a stainless steel push flag and foot treadle. Combination emergency eye wash shower shall be equipped with dust cover assembly and corrosion resistant coating. Combination emergency eye wash/shower shall meet the requirements of ANSI/ISEA Z358.1.

Item	Manufacturer	Model
emergency eye wash/shower	Haws	8300[.157]
dust cover assembly	Haws	9101

3. Floor Drain shall be cast iron with flashing ring and clamping device, flat round polished strainer fastened with screws, adjustable top, inside caulk outlet. Provide funnel integral with grate where indicated on drawings.

Item	Manufacturer	Model
floor drain	Jay R. Smith	2010-A

4. Trap primer shall be electronic type with solenoid, vacuum breaker, double distribution manifold and Type 316 stainless steel wall-mounted cabinet and access door. Primer shall be listed and certified to ASSE 1044 and equipped with an ASSE 1010 arrester.

Item	Manufacturer	Model
trap primer	Sioux Chief	695-E

5. Interior Hosebibb shall be polished chrome plated brass, 3/4 inch hose thread outlet, equipped with non-removable type vacuum breaker and concealed loose key stop.

Item	Manufacturer	Model
hosebibb	Chicago	952-CP
stop	Chicago	1771

2.17 CLEANOUTS

A. Floor cleanouts shall be cast iron floor cleanout with taper thread bronze plug, polished bronze or nickel bronze rim and scoriated floor plate with “CO” cast in the plate. Secure floor plate with countersunk screws for installation flush with finished floor.

B. Cleanouts exterior to buildings in paved and concrete areas shall be cast-iron cleanouts with round flanged housing, heavy duty secured scoriated cast iron cover with lifting device, and taper thread bronze plug. Provide 24 by 24 inch concrete slab with cleanout located in center of slab. Slab thickness indicated on drawings.

2.18 WASH RACK SYSTEM

A. The wash rack system shall include a water cannon pump skid, pressure washer, soap solution dispenser (a.k.a. foamer), air compressor, water holding tank, hose reels, hoses and nozzles, and controls. The equipment and controls shall be furnished and installed by the wash rack equipment supplier (Supplier). The Supplier shall provide equipment testing and commissioning, user training and one year of preventative maintenance. The Contractor shall be responsible for coordinating the procurement and installation of materials and equipment with the Supplier to provide a complete and operational system.

B. Water Cannon Pump System (WCPS): Skid mounted pumping system shall include pumps, motors, piping, valves, gauges, and controls. The system shall consist of a powder-coated skid, four (4) vertical pumps and premium efficiency motors, four (4) discharge check valves, four (4) inlet and four (4) discharge isolation ball valves, four (4) inlet and four (4)discharge pressure gauges, a suction piping manifold, a discharge piping manifold and four (4) discharge pressure relief valves and a bypass piping manifold. The pump system main control panel shall be wall mounted, Type 316 stainless steel NEMA 4X. Four (4) Type 316 stainless steel NEMA 4X remote control panels shall be post mounted at the wash bays.

C. Pressure Washer (PW): Stationary cold-water pressure washer shall be electric type and furnished with belt driven pump, premium efficiency motors, Type 316

stainless steel frame and panels and non-corrosive float tank. Two (2) Type 316 stainless steel NEMA 4X remote control panels shall be post mounted at the wash bays.

D. Air Compressor (AC): The air compressor shall be rotary screw type, continuous duty with a 120-gallon receiver tank and integral NEMA 4X control panel.

E. Soap Solution Dispenser (SSD): The soap solution dispenser (a.k.a. foamer) shall include a polypropylene dosing panel with water-driven dosing pump, water filter, water regulator, flow restrictor, and pressure gauge. The dispenser shall also include a wall-mounted 15-gallon holding tank with fill valve. Furnish dispenser with appurtenances such as proportioner, ball valves

F. Detergent: Detergent used for soap solution shall be biodegradable, non-toxic, near-neutral pH, low-VOC, low emulsion type heavy duty aircraft equipment cleaner for use with gravity oil water separators and shall comply with MIL-PRF-87937D Type IV aerospace equipment cleaning specification. Detergent shall be supplied in a 55 gallon barrel on a minimum 60 gallon spill containment pallet. Penair HD-4 or approved equal.

G. Water Storage Tank: Vertical tank with dome top and 505-gallon capacity. Tank shall be constructed of high-density polyethylene with U.V. inhibitors. Tank walls shall be translucent with gallon indicators. Tank shall be equipped with a 16-inch manway and bulkhead fittings for pump suction connection and makeup water connection. Ace Roto-Mold Model No. VT0505-46 or approved equal.

H. Hose Reels, Hoses, and Nozzles: Furnish four (4) water cannon hose reels, two (2) pressure washer hose reels, and one (1) foamer hose reel. Hose reels shall be constructed of Type 304 stainless steel and have a manual rewind feature. Each water cannon hose reel shall be furnished with 100 linear feet of 1-inch hose rated for 500 psi. Each pressure washer hose reel shall be equipped with 100 linear feet of 1/2” hose rated for 3,000 psi. The foamer hose reel shall be equipped with 100 linear feet of 1-inch hose rated for 500 psi. Water cannon hoses shall be equipped with a fire nozzle with adjustable stream. Pressure washer hoses shall be equipped with high pressure dual wands and adjustable pressure nozzles. Foamer hose shall be equipped with fire nozzle with fixed stream.

I. Diverter Valve and Actuator: Diverter valve shall be plug type with cast iron ASTM A126 Class B body, ductile iron ASTM A-536 plug, Buna N reslilient seating and ANSI B16.1, Class 125 flanges. Valve bearings shall be permanently lubricated sleeve type bearings constructed of Type 316 stainless steel. Shaft seals shall be “U” cup type, in accordance with AWWA C517. Seals shall be self-adjusting and repackable without moving the bonnet from the valve. Pratt Ballcentric Plug Valve or approved equal.

Actuator shall be part turn type for open/close operation with swing angles from 75 degrees to 105 degrees, 90-degree operating time ranges from 4 seconds to 100 seconds, a handwheel for manual operation and a mechanical position indicator. Actuator shall provide open, closed and fault feedback signals to wash

system control panel. Actuator shall be housed in a NEMA 4X enclosure. Auma SQ or approved equal.

2.19 COMPRESSED AIR DRYING STATION

A. The point-of-use, four-stage drying system shall include a dual stage integral filter/regulator, a coalescing filter and a desiccant air dryer. First stage shall consist of a particulate filter with 5 micron cleanable sintered bronze element. Second stage shall consist of a pressure regulator. Third stage shall consist of a 0.01 micron coalescing filter with pop-up indicator to alert a required element change. The fourth stage shall consist of a desiccant dryer with 70 micron element, a 40 micron filter element and a clear indicator sight glass to show a desiccant color change from blue to pink, indicating a required desiccant recharge. StageAire Drying System Model No. 7510XL or approved equal.

2.20 OIL WATER SEPARATOR

A. The oil water separator shall be double-wall, cylindrical type rated for maximum burial of 120 inches and UL 2215 listed. The separator shall consist of a sediment chamber, parallel/corrugated coalescer plates, oil/water separation chamber, petro-screen coalescer, transfer pipes, baffles, striker plates, manways, vent pipe connections, level sensor connections and flanged inlet/outlet connections. The separator shall be constructed of mild carbon steel with lap fit and welded exterior seams. Exterior surfaces shall be SSPC No. 6 blast cleaned and both exterior and interior surfaces shall have a UL listed polyurethane coating. Separator and coatings shall be compatible with MIL-PRF-87937D Type IV low-emulsion aircraft equipment cleaner. Furnish separator with Type 316 stainless steel NEMA 4X alarm panel with level alarms and leak detection alarms. Highland Tank HTC-G or approved equal.

2.21 PIPING IDENTIFICATION AND WARNING

A. Aboveground Piping: For pipes 3/4 inch OD and larger, provide printed legends to identify contents of pipes and arrows to show direction of flow. Color code label backgrounds to signify levels of hazard. Make labels of plastic sheet with pressure-sensitive adhesive suitable for the intended application. For pipes smaller than 3/4 inch OD, provide brass identification tags 1-1/2 inches in diameter with legends in depressed black-filled characters.

B. Buried Piping: Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility line. Provide tape in rolls, 6-inches minimum width, color coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification to read, "CAUTION BURIED (intended service) LINE BELOW" or similar working. Color and printing are to be permanent, unaffected by moisture or soil.

Warning Tape Color Code

Red: Electric power lines, cables, conduit and lighting cables.

Yellow:	Gas, oil, steam, petroleum or gaseous materials.
Orange:	Communication, alarm or signal lines, conduit, telephone, fiber optic cable.
Purple:	Reclaimed water, irrigation and slurry lines (non-potable).
Pink:	Temporary survey markings.
Blue:	Potable water.
Green:	Sewer and drain lines.
Grey:	Compressed air.
White:	Proposed excavation.

2.22 MISCELLANEOUS METALS

A. Interior Installation: Preformed slotted channel system components used in supports and brackets shall be Unistrut Corporation P 1000 DS or approved equal, galvanized. Touch-up cut portions with zinc rich coating. Prepare surface and apply coating in accordance with coating manufacturer's printed instructions.

B. Exterior Installation: Preformed slotted channel system components used in supports and brackets shall be Type 316 stainless steel, Unistrut Corporation or approved equal.

C. Other metal components not specified elsewhere shall be in accordance with SECTION 05500 - METAL FABRICATIONS.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Comply with applicable codes of the City and County of Honolulu and with regulations of the State of Hawaii.

B. Defective work or materials shall be removed by the Contractor and corrected without extra compensation.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside piping before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.

E. Review millwork shop drawings. Verify location and size of fixtures and openings before rough-in and installation.

F. Verify adjacent construction is ready to receive rough-in work of this Section.

G. Locate existing water and sewer lines and proposed points of connection thereto, and verify that the lines can be connected to the existing piping. Connect new piping to existing laterals approximately where indicated.

3.03 INSTALLATION

A. Install all plumbing work in accordance with the manufacturer's instructions and as indicated and as specified herein. Furnish delegated design services when recommended by manufacturer's instructions. Arrange for access to the site by written request submitted not less than seven (7) calendar days prior to the time at which access is requested. Coordinate installation with other trades so as to eliminate or avoid conflicts and delays to the progress of the work.

B. Installation of plumbing systems including fixtures, equipment, materials and workmanship shall be in accordance with the Plumbing Code.

C. Review manufacturer's rough-in sketches to verify pipe connection sizes and locations of all fixtures and equipment. Make final connection to all equipment furnished and/or installed under other sections.

D. Provide traps, tailpieces, stops, escutcheons and all other items required to complete installation. Install items furnished under other sections but specified for installation under this Section.

E. Completely encase buried copper and stainless steel water piping and cast iron DWV piping with polyethylene tube or sheet in accordance with AWWA C105.

F. Copper pipe shall be insulated from direct contact with ferrous piping connections by approved insulating (dielectric) unions, couplings or flanges.

G. Provide transition union connection or threaded gate valve between copper and CPVC piping.

H. Plastic piping shall not penetrate fire walls or fire floors and shall not be used closer than 6-inches to the penetration.

I. Vent thru roof shall protrude no less than 6-inches above the roofline. The vent flashing shall extend 10-inches all around the base of the vent and up along the vent pipe to form a collar turned down 2-inches into the vent pipe at the top. All joints shall have a completely watertight seal.

J. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations.

K. Install piping to allow for expansion and contraction without stressing pipes, joints, or connected equipment.

L. Provide clearance for installation of insulation and access to valves and fittings.

M. Slope water piping and arrange to drain at low points.

N. Install bell and spigot pipe with bell end upstream.

O. Install specialties in accordance with manufacturer's instructions.

P. Extend cleanouts to be flush with finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

Q. Air chambers shall be provided on each hot and cold water fixture supply extending to a minimum of 12-inches above fixture outlet. Each air chamber shall be located where it will empty and refill with air when the water is drained from piping. Chamber shall be the same size as the piping.

R. Install water hammer arrestors complete with accessible isolation valve.

S. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.

T. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

U. Provide air cock and drain connection on horizontal pump casings.

V. Provide line sized gate valve and strainer on suction and line sized soft-seated check valve and globe valve on discharge of pumps.

W. Install valves with stems above horizontal.

X. Have piping treated, inspected and approved before it is furred in, buried or otherwise hidden.

Y. Slope soil, waste and drain lines at 1/4-inch per foot unless otherwise indicated. Install hubless cast-iron pipe accordance with CISPI pamphlet 100, stainless steel couplings shall be installed in accordance with manufacturer's written instructions.

Z. Vent pipes shall be sloped to expel water.

AA. Escutcheons: Shall be installed around all exposed pipe passing through a finished floor, wall or ceiling. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening, shall fit snugly around the pipe and shall be furnished with set screws.

BB. Excavation, Backfill and Concrete Work: All excavation and backfill in connection with plumbing work shall be accomplished in accordance with the Plumbing Code. Provide proper support along the pipe length and where rocks are encountered, provide a minimum of 3-inches of backfill properly tamped for pipe. Pipes shall be buried a minimum of 12-inches below and 3-feet horizontally from all footings.

CC. Hose Bibbs: Hose bibbs shall be installed 18-inches above grade or floor unless otherwise indicated. Locate a service cock on the hose bibb supply, 6-inches above grade, on exterior hose bibbs only.

DD. Identification of Piping: Identify piping aboveground using adhesive-backed or snap-on plastic labels and arrows. In lieu of labels, identification tags may be used. Apply labels or tags to finished paint at intervals of not more than 25 feet.

3.04 APPLICATION

A. Use dielectric connections only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Install ball valves for throttling, bypass, or manual flow control services.

F. Provide spring loaded check valves on discharge of water pumps.

G. Provide access panels for indirect waste receptors, trap primers and water hammer arrestors.

H. Provide fire stop material for pipe thru fire rated walls and slabs.

I. PVC and ABS pipe shall not be used in fire rated plenums.

3.05 PIPE SLEEVES

A. Provide where pipe passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs and partitions. Provide not less than 0.25-inch space between exterior of pipe or pipe insulation and interior of sleeve. Firmly pack space with an approved fire stop material in rated walls, floors and partitions, and install in accordance with the manufacturer's recommendations. Space between pipe and sleeves (both ends) shall be sealed in accordance with SECTION 07920 - SEALANTS.

B. Sleeves in masonry and concrete walls and floors shall be ASTM A53, Schedule 40 or standard weight, hot-dip galvanized steel pipe. Extend sleeves in floor slabs 2-inches above the finished floor.

C. Sleeves for piping that pass through foundations and are below the ground shall be cast iron pipe.

D. No cutting or drilling of any structural members will be permitted without the approval of the Project Manager.

3.06 PLUMBING FIXTURES

A. Furnish, install and properly connect all plumbing fixtures and fittings and/or trims herein specified.

B. Setting of all fixtures shall be done in an approved workmanlike manner. See architectural drawings and elevations for mounting location and height. Joints between fixtures and wall shall be neatly pointed up with plaster of paris.

C. Fastenings: Where trimmings and fixtures are secured to concrete, they shall be fastened with 1/4-inch minimum brass machine screw type expansion bolts sufficiently long to insure that the shield shall be wholly within sound concrete. Where trimmings and fixtures are to be mounted on concrete block, each fixture shall have the proper cast iron fixture bracket set anchored to the masonry wall with 1/4-inch diameter toggle bolts. Where fixtures are mounted on metal stud walls, provide 1/4-inch x 5-inch steel backing plates, spot welded to at least 2 studs. All exposed bolt heads and nuts shall be chrome plated hexagon brass with round tops. All escutcheons on walls and floors shall be chrome plated cast brass with chrome plated set screws.

D. No wood grounds shall be used for supports of plumbing fixtures.

3.07 PIPE SUPPORTS, HANGERS AND INSERTS

A. Provide all necessary design, calculations, labor, materials, operations, equipment, tools and techniques required to furnish and install complete the pipe supports, hangers and inserts work.

B. Install hangers and supports for all piping to provide for expansion and contraction, prevent vibration and maintain required grading by proper adjustment.

C. Refer to structural drawings and as-built drawings for type of construction from which piping and/or equipment is to be suspended/supported.

D. Drilled in Threaded Inserts: Where supports in beams and joists are required after concrete has been poured, Phillips "Redhead" Drilled-In Threaded Inserts shall be provided and installed in accordance with manufacturer's recommendations.

E. Support horizontal overhead pipes with clevis hangers, adjustable turnbuckle, rods, inserts, clamps, on suspension suitable for type of building construction. Trapazee hangers may be used where multiple pipes are grouped. Pipe hangers and supports shall conform to MSS SP-58.

F. Support horizontal pipes that are close to floor with pipe rest and floor flange or pipe roll stand on piers.

G. Support horizontal pipes from walls with "J" hooks, hangers suspended from wall brackets or struts.

H. Support vertical pipes at base of the pipe on every floor and at 10-foot intervals maximum with steel pipe clamps, special cast iron pipe rests, base fittings, or by other approved methods suitable for type of building construction. Pipes shall be supported at all elbows, branches and ends.

I. Provide additional hanger pipe supports at concentrated loads in piping between supports, such as for inline water pumps and flanged valves. Maximum of 5-feet apart at valves and pumps.

J. Grind and smooth all sharp metal edges including struts and fabricated metal supports.

K. Horizontal Piping Support Schedule:
   1. Support horizontal steel piping per following schedule. Pipes shall be supported at all elbows, branches and risers.

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
Up to 1-1/4	3/8	7-0
1-1/2 and 2	3/8	9-0
2-1/2 and 3	1/2	11-0

   2. Support horizontal lines of copper tubing per following schedule. Pipes shall be supported at all elbows, branches and risers. Support straps shall be copper, brass or copper plated. Copper pipe shall be insulated from contact with dissimilar metals outside of system by taping at point of contact with two (2) layers of [plastic electrician's tape] [10 mil, PVC, UPC pipe tape]. [Use pre-manufactured non metallic clamps with strut supports.]

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
1/4 to 3/4	3/8	5-0
1 to 1-1/2	3/8	6-0
2	3/8	8-0

   3. Support horizontal cast iron hub and spigot soil pipe with compression gasket joints at every other joint. Pipe exceeding 4-feet in length shall be supported at every joint. Support spacing adjacent to joint shall not exceed 18-inches. Brace pipe at maximum 40-foot intervals to prevent horizontal movement. Support at each horizontal branch connection.

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
1-1/2 to 2	3/8	10-0

3	1/2	10-0
4 and 5	5/8	10-0
6	3/4	10-0

5. Support horizontal cast iron hubless soil pipe with shielded couplings at every joint. Pipe exceeding 4-feet in length shall be supported at every joint. Support spacing adjacent to joint shall not exceed 18-inches. Brace pipe at maximum 40-foot intervals to prevent horizontal movement. Support at each horizontal branch connection. Hangers shall not be placed at the coupling.

Pipe Size	Rod Diameter	Maximum Spacing
(Inch)	(Inch)	(Feet)
1-1/2 to 2	3/8	10-0
3	1/2	10-0
4 and 5	5/8	10-0
6	3/4	10-0

6. Support horizontal PVC and ABS pipe with solvent cemented joints no more than 4-feet center-to-center. Allow for expansion every 30-feet. Pipes shall be supported at all elbows, branches and risers.

3.08 DOMESTIC WATER LINES

A. Domestic waterlines shall be disinfected by one of the methods prescribed in the Plumbing Code. Disinfection may be limited to new work only if existing piping is not contaminated during construction. Contractor shall submit certificate of disinfection completed by a licensed testing laboratory to the Project Manager.

3.09 PROTECTION

A. Provide planking, plastic sheeting, or other protective covering as required to prevent damage during construction to roof, roofing, or other existing building elements and equipment. Damage to materials, equipment or building due to the Contractor's neglect shall be repaired or replaced to the satisfaction of the Project Manager by, and at the expense of, the Contractor. Be prepared to immediately repair any damage that does occur during any operations, so as to avoid damage to building or contents or interruption of State’s operations.

3.10 INSPECTION

A. Acceptance of the work will not take place until after discrepancies noted by the Project Manager have been corrected to the satisfaction of the Project Manager.

3.11 PAINTING

A. Painting of interior and exterior metal surfaces shall be in accordance with SECTION 09901 - PAINTING.

3.12 LOCAL TECHNICAL SUPPORT

A. The plumbing and wash rack equipment suppliers shall have an office in the State of Hawaii, staffed with factory trained engineers fully capable of providing

on-site instruction on routine and emergency maintenance service on all system components supplied for this project.

B. The wash rack control system supplier shall have an office in the State of Hawaii, staffed with factory trained engineers fully capable of providing on-site instruction on routine maintenance and emergency maintenance service on all system components supplied for this project.

3.13 CLEANUP

A. Upon completion of this work, remove all debris and excess materials, tools, etc., resulting from this work from the job site and leave the location of this work broom-clean in an acceptable manner as per the Project Manager. All work including plumbing fixtures, traps and mechanical equipment shall be thoroughly cleaned and ready for use.

END OF SECTION

DIVISION 16 - ELECTRICAL

SECTION 16050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

As specified in Section 01100 – PROJECT REQUIREMENTS

1.02 SUMMARY

Furnish all labor and materials required to complete all electrical work and provide complete and operable photovoltaic (PV) systems indicated on the drawings and specified herein.

1.03 SUBMITTALS

A. Submit in accordance with SECTION 01300 – SUBMITTALS.

B. Shop Drawings: Submit complete shop drawings and manufacturer's literature for Engineer's review before any work is fabricated. Submit manufacturer's literature for the following:

1. Panelboards
2. Circuit Breakers
3. Junction Boxes
4. Safety Switches
5. Conductors
6. Conduits and Fittings
7. Nameplate

C. Intent of Shop Drawing and Catalog Cut Review: Shop drawing and catalog cut submittals processed by the Owner are not Change Orders. The purpose of the submittals by the Contractor is to demonstrate to the Engineer and the Owner that he understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use; If deviations, discrepancies or conflicts between shop drawings and Specifications are discovered either prior to or after shop drawing submittals are processed by the Owner, the design drawings and specifications shall control and shall be followed.

D. Shop drawings and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall

be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalog cuts shall not release Contractor from complying with intent of Drawings and Specifications.

E. Warranty: Submit warranty as noted under item entitled "WARRANTY" hereinbelow.

1.04 WARRANTY

A. Any item of material, apparatus, equipment furnished and installed, or construction by the Contractor showing defects in design, construction, quality or workmanship within one year from the date of final acceptance by the Owner shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the complete system conform to the true intent and meaning of the specification and/or the drawings. Exceptions shall be fluorescent lamps which shall be guaranteed for one half the manufacturer's listed life time. Such repairs or replacement shall be made by the Contractor, free of all expense to the Owner.

B. The Surety shall not be liable beyond 2 years from the project acceptance date.

1.05 GENERAL REQUIREMENTS

The Contractor shall furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all Electrical Work, complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier. The work shall include but not necessarily be limited to, the following:

1. Installation of electrical distribution system components to support the new PV system.

2. Installation of electrical distribution system for the new storage building and wash rack islands, including equipment connections for all mechanical equipment provided by the mechanical contractor.

3. Connection and testing of appliances and equipment furnished by others requiring electrical connections.

4. Before bidding on this work, carefully examine each of the drawings and the site. By submitting a proposal of the work included in this contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.

5. Prior to ordering equipment, the Contractor shall examine the plans to verify the amount of space allocated for the electrical equipment and to determine if the material proposed will fit within the allotted space. It shall be the Contractor's responsibility to provide equipment that will fit within the allotted space. The Contractor shall also verify existing conditions to confirm specified materials are compatible with the existing electrical equipment.

1.06 COORDINATION WITH UTILITY COMPANIES AND OTHER TRADES

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

PART 2 - PRODUCTS

2.01 MATERIALS

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

1. Panelboard: Surface mounted as noted, 480Y/277V or 208Y/120V as noted, 3-phase, 4WSN, copper bussing, circuit breaker complement as shown, complete with door, trim, typed directory, and NEMA 4X (316) stainless steel enclosure. Locks shall be keyed alike. Square D, General Electric, Cutler-Hammer, Siemens or approved equal.

2. Individual Circuit Breaker: Shall consist of molded plastic case circuit breaker with toggle operated mechanism and thermal-magnetic overload trips. Interchangeable trip shall be provided when available. Toggle positions "On" and "Off", engraved or embossed on body.

3. Dry-type Transformer: General purpose, dry-type, ultra low loss, constant potential, full capacity winding, indoor use, ventilated enclosure, Class H insulation, average sound level not to exceed 55 dB, DOE 2016 compliant, KVA rating as noted on drawings. Enclosures shall be NEMA 3R (316) stainless steel.

4. Equipment Disconnect and Fused Switch: Heavy-duty safety switch, ampacity, number of poles, and voltage as indicated on the drawings. Horsepower rated when used as motor disconnect. Contacts shall be lever operated, spring loaded. Fused disconnect switches, in addition, shall have NEC standard fuse rejection type holders when used with current limiting fuses. Siemens, Cutler Hammer, General Electric and Square-D or pre-approved equal. Enclosures shall be NEMA 4X (316) stainless steel.

5. Raceways:
   a. Conduits: EMT, 3/4" minimum diameter.

   b. Non-Metallic Conduit: PVC schedule 40, 3/4" minimum diameter, nominal wall thickness.

   c. Flexible Conduit: Zinc-coated inside and outside; for wet or moist areas, liquid tight with factory compression fittings. Cast fittings will not be acceptable.

5. Electrical Conductors:
   a. Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric. Conductors installed above grade shall be type THHN-THWN. Conductors installed below grade shall be type RHW-USE.

b. Provide color coding for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals, except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

(1) 480Y/277-volt, 3-phase

(a) Phase A – brown

(b) Phase B – orange

(c) Phase C – yellow

(2) 208Y/120-volt, 3-phase

(a) Phase A – black

(b) Phase B – red

(c) Phase C – blue

(3) 120/208-volt, single-phase: Red and black.

6. Outlet and Small Junction Boxes: In all conditions and for all cases, outlet and junction boxes shall be increased in size to conform with NEC Article 314 fill requirements.

a. For dry interior locations - Pressed, zinc-coated steel, minimum nominal size 4”, minimum depth 2-1/8”.

b. Boxes exposed to wet or moist conditions, weather exposed boxes, and stem mounted boxes shall be cast iron, prime painted and enamel finished, with threaded hubs for conduit connection. All screws shall be stainless steel.

7. Large Junction Boxes and Wireways: All boxes and wireways shall have minimum dimensions to accommodate pulling per NEC Article 314 requirements. For dry interior locations, boxes shall be fabricated from NEC gauge galvanized steel with matching screw-on type cover, field punched knockouts. For exterior locations, wet locations, and under portables, boxes shall be NEMA 4X (316) stainless steel with matching gasketed cover, stainless steel screw clamps, heavy-duty continuous hinge, and padlock hasp with sealing hole provision. All screws shall be tamper resistant stainless steel. Padlocks shall be provided and keyed alike per Owner’s requirements.

8. Circuit Breakers: Circuit breakers shall be of the molded case type with toggle operated mechanism and thermal-magnetic overload trips, with voltage, phase, and AIC ratings matching the panelboard that the circuit breaker is being installed in. Adjustable trips shall be provided when normally available.

Circuit breakers for use in existing panelboards shall be suitable for such use.

9. Manufacturers: Square-D, Cutler Hammer, Siemens and General Electric Company, or pre-approved equal shall be acceptable for all protective devices.

10. Hardware, Supports, Backing, Etc.: All hardware, supports, backing and other accessories necessary to install electrical equipment shall be provided. Wood materials shall be "wolmanized" treated against termites, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze.

11. Convenience Single and Duplex Receptacles:

    a. Single and Duplex, 20 ampere, 125-volt, back and side wired, 3 wires, grounding type in ivory plastic body with parallel and ground U-shaped slots. Enclose in outlet box and device plate. Hubbell, Leviton, or pre-approved equal.

    b. Ground Fault Interrupting (GFI) receptacles shall have test and reset switches. Maximum allowable leakage current shall be 5 milli-amperes.

12. Device and Cover Plates:

    a. Plates for interior flush construction shall be type 302 stainless steel dull finish with suitable hole for device unless otherwise indicated.

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

13. Nameplates: Laminated nameplates shall be provided for panelboards, enclosed circuit breakers and equipment cabinets. Nameplate shall be 1/8-inch thick Melamine plastic, black and white center core. Size of nameplate shall be 1-inch by 2-1/2-inches minimum. Lettering shall be 1/4-inch high block lettering. Equipment designations shall be as indicated on the drawings.

14. Enclosures and Cabinets: Enclosures and cabinets for panelboards and circuit breakers shall be NEMA type, fabricated from galvanized steel, or as indicated, prime painted and enamel finished according to NEMA specifications. For dry interior locations, enclosures shall be NEMA 1. For exterior, damp, or wet locations, enclosures shall be NEMA 4X stainless steel (316) with continuous seamless welds. Bolted sections will not be allowed.

15. All exterior anchors, fasteners, pipe clamps, pipe hangars, channel struts, nuts, bolts, washers, and all-thread rod, shall be compatible with the specified non-metallic conduit or type 316 stainless steel.

PART 3 – EXECUTION

3.01 GENERAL

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

B. Qualification of Installers:

1. For actual fabrication, installation and testing of the Work of this section, use only thoroughly trained and experienced workmen completely familiar with items required and with manufacturers' recommended methods of installation. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workmen.

2. Workmanship shall meet the approval of Owner who shall be afforded every opportunity to determine skill and competency. Concealed work shall be reopened at random during formal inspection at the Owner's request.

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

D. Record Drawings: The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered. As-built drawings shall be prepared in accordance with the requirements in SECTION 01330 – SUBMITTAL PROCEDURES.

E. Plans and Specification: This specification is intended to cover all labor, materials and standards of workmanship to be employed in the work indicated on the plans and called for in the specification or reasonably implied therein. The plans and specification supplement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it has been mentioned in both. The Contractor shall not make alterations in the drawings and specification.

F. Discrepancies and Interpretations:

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

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

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

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

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

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

3.02 INSTALLATION

A. Grounding:

1. All services, metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of NEC Article 250. At each building, 5/8" x 8' copper ground rods, Copperweld Steel Company or equal shall be driven with top 12" below finished grade and shall be connected together with bare copper wire buried 12" below finished grade to obtain a ground of 25 ohms or less as measured by three point pot. method with an electric ground megger. Connect ground to nearest cold water pipe and to building entrance equipment with bare copper. Final connection to equipment, raceways, grounding type receptacles and other metallic parts directly exposed to ungrounded electric conductors shall be No. 12AWG minimum, copper, NEC type TW, green insulation. Use approved bonding terminal at panels.

2. All grounding wire runs within building shall be routed together with circuit conductors.

3. Bond and ground all feeder conduit to panelboard enclosures.

B. Wiring System:

1. PVC schedule 80 conduit shall be used in all locations where exposed to the weather and under eaves.

2. EMT may be used where indicated to be exposed in interior locations.

3. Galvanized rigid steel conduit shall be used in exposed locations on building roofs.

4. Connections to equipment subject to vibration shall be made with flexible metallic conduit.

5. Conduit shall be cut square and inner edges reamed. Butt together evenly in couplings.

6. Bends and offsets shall be made with hickey or conduit bending machine. Do not use vise or pipe tee. Bends shall be made so that interior cross-sectional areas will not be reduced. Radius of curve of inner edge of field bend shall not be less then ten times internal diameter of conduit.

7. Use of running threads is not permitted. Where conduit cannot be joined by standard threaded couplings, approved watertight conduit union shall be used.

8. Cap conduit, during construction, with plastic or galvanized pipe caps to prevent entrance of dirt or moisture. All conduits shall be swabbed out and dried before wires or cables are pulled in.

8. Conduit shall be mounted clear of other piping, valves or mechanical equipment.

9. Pullwires installed during conduit installation shall be #12 AWG Type TW insulated wire or nylon pull line.

12. Insulating bushings and two locknuts shall be installed on the end of every run of conduit at sheet metal enclosures and boxes.

13. Securely fasten conduit to outlet boxes and to structure support. Project adequate number of conduit threads through box for bushings. Anchorage for 1-1/2” and smaller conduit shall be made with two-hole galvanized conduit straps or clamps. Two-inch and larger conduits shall be anchored with galvanized wrought iron one-hole clamps or equal fittings.

14. Exposed conduit shall be parallel with, or at right angles to, structural or architectural elements, and securely fastened in place with two-hole galvanized pipe straps with screws, or with approved beam clamps, or approved single or gang pipe hangers spaced not more than five feet apart, as conditions required. Vertical runs shall be supported at intervals not exceeding five feet approved clamp hangers.

15. Pullwire shall be installed in all empty conduit. Pullwires shall be tagged at conduit terminations to identify conduit use (i.e., power, telephone, data, etc.).

16. Conduits installed on the surface of the roof deck shall be elevated by the use of conduit support blocks.

D. Conductors:
   1. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.

   2. Pulling tension shall not exceed wire manufacturer's recommendations.

   3. Where necessary, powdered soapstone may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.

   4. Form neatly in enclosures for minimum of crossovers. Tag all feeders.

E. Splicing of Wire and Cable:
   1. Wires shall be formed neatly in enclosures and boxes.

   2. Splices made with copper compression splice connectors or insulated multiple tap connectors and be in compliance with the requirements of NEC Article 110.

   3. Splices shall be reinsulated. Remove all sharp points that can pierce tape. Use Minnesota Mining and Manufacturing Co. "Scotch" #33 tape, or equal. Splices in pull boxes shall be water-tight.

F. Boxes and Enclosures: Exposed surface mounted boxes shall be mounted parallel or perpendicular to existing architectural elements.

G. Finishing:
   1. All cutting that may be required for complete installation of the electrical work shall be carefully performed, and all patching shall be finished in first-class condition by the Contractor.

   2. Close unused knockouts in boxes or enclosures with metal cap.

   3. Wipe clean all exposed raceways and enclosures with rag and solvent. Unfinished raceways and enclosures shall be primed and painted to match surroundings. Factory finished enclosures shall not be painted.

H. Miscellaneous Details:
   1. Cut, drill and patch as required to install electrical system. Repair any surface damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Cutting, repairs and refinishing subject to the approval of the Owner. Need for remedial work determined by the Owner as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the Owner.

   2. Attachment of electrical equipment to wood by non-ferrous wood screws. Attachment to concrete by expansion anchors. Powder-charge-driven studs and anchors permitted only with prior approval.
   3. Revise all affected panel circuit directories, using typewriter. Verify "room" and "use" designations before typing.

4. Furnish necessary test equipment and make all test necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.

5. Tag all empty conduit in terminal cabinets and boxes giving destination. Use fiber disc tags in bushing.

3.03 TESTING AND INSPECTION

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

B. Interior installations, 600 volts and less shall be tested for insulation resistance after all wiring is completed and ready for connection to fixtures and equipment. Using a 500V megger, measure and record the insulation resistance from phase to phase and phase to neutral. The above tests shall be witnessed by the Owner and the records turned over to the Owner for proper disposition. The Contractor shall notify the Owner when this test is to be performed.

C. The Contractor shall retape splices which have been bared for inspection. The Contractor shall test all portions of the electrical system furnished by him for proper operation and freedom from accidental grounds. All tests shall be subject to the approval of the Owner.

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

E. Provide all labor, materials and equipment necessary for startup and commissioning of new and existing equipment.

END OF SECTION

SECTION 16301 - UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

As specified in Section 01100 – PROJECT REQUIREMENTS

1.02 SUMMARY

A. In general, provide complete electrical system within project boundaries. The Contractor shall furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all Exterior Electrical Work, complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier.

B. Related Sections:
   1. Section 16050 – BASIC MATERIALS AND METHODS

1.03 SYSTEM DESCRIPTION - DESIGN INTENT

The work shall include but not necessarily be limited to, the following:

1. Complete electric and/or lighting system including trenches, ducts, cables, and enclosures.

2. Connection and testing of equipment furnished by others requiring electrical connections.

3. Pass test mandrel through all new ducts and conduits, and make corrections as directed by inspectors and Director.

4. Provide pulling wire, No. 12 AWG galvanized steel or polypropelene cord, in all empty ducts and conduits, unless indicated otherwise.

5. Obtain and pay for electrical permits, arrange for periodic inspections by local authorities and the Owner, and deliver certificate of final inspection to the Owner.

6. Contractor shall check and test the installation for completeness and functional operation as described by the drawings and specified herein. Final test shall be in the presence of the Owner and representatives of the utility companies. Contractor shall arrange and pay for all testing costs. Should intermediate or final inspections of the duct system reveal crushed, damaged or impassable ducts, the Contractor shall repair those sections of duct system, including repairs to paved surfaces and concrete structures, at no additional cost to the Owner.

7. Immediately report and pay for damages to existing equipment.

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

1.04 SITE VISITATION

A. Visit project site, carefully review each section of the Specification and all Drawings of this Contract, and obtain and review the standards, drawings and specifications of the local utility companies. By submitting a proposal of the work included in this contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.

B. Report any error, conflicts or omissions to the Owner at least one week before submission of bids for interpretation or clarification. If errors or omissions are not reported, Contractor shall provide necessary work at no cost to the Owner to properly complete intent of Specification and Drawings.

C. Should any discrepancy arise from the failure of the Contractor to notify the Director, the higher quality or larger quantity of item shall prevail. The Owner shall make the final interpretation and judgement.

1.05 COORDINATION

During pricing and construction, Contractor shall coordinate his work with utilities and other trades to avoid omissions and overlapping of responsibilities. The Contractor shall include all utility fees/charges in his cost.

1.06 SPECIAL CONDITIONS

A. Electrical outages (including power and communications) shall be scheduled at the State's convenience. Contractor shall obtain the State and Owner’s acceptance for all electrical outages a minimum of 3 weeks prior to work.

B. The Contractor shall employ flagmen, as necessary, to direct traffic while work is in progress.

C. Equipment utilizing electricity shall be provided by respective sections of Specification. Furnishing of equipment controllers (motor starters, etc.), unless otherwise specified, and providing complete control and interlock is provided by respective section supplying equipment. Installation of complete feeder or branch circuit system, and power wiring to equipment and controllers shall be part of Electrical Work.

D. The existing underground electric/communication lines are in-use and must remain in operation during the construction until the new permanent facilities are completed and energized. The Contractor shall schedule the work accordingly and allow the utility companies 24 hour access to their equipment. Costs for any temporary systems or relocations arising during construction shall be borne by the Contractor. Work by the Contractor in areas with energized electrical equipment or conductors shall be performed with extreme caution to prevent accidents and to avoid disturbing or damaging this equipment or conductors or

any temporary supports or protective guards that are constructed. The Contractor shall have the sole responsibility for maintaining safe and efficient working conditions and procedures in these areas.

1.07 CODES, REGULATIONS AND STANDARD SPECIFICATIONS

A. Work shall conform to ordinances of the City and County of Honolulu; latest edition of National Electrical Code; National Electrical Safety Code (NESC); General Order No. 10, Public Utilities Commission, State of Hawaii.

B. References: Construction shall conform to construction practices as recommended by:

National Electrical Code (NEC)
The American Electricians Handbook by Croft (latest edition)
Edison Electric Institute
General Orders, State of Hawaii (GEO)
National Electrical Safety Code (NESC)
American National Standards Institute (ANSI)
National Board of Fire Underwriters (NBFU)
National Electrical Manufacturer's Association (NEMA)
National Fire Protection Association (NFPA)
Underwriters' Laboratories, Inc. (UL)

Applicable instructions of manufacturers of equipment and material supplied for this project.

1.08 PLANS AND SPECIFICATIONS

A. This specification is intended to cover all labor, materials and standards of workmanship to be employed in the work indicated on the plans and called for in the specification or reasonably implied therein. The plans and specification supplement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it has been mentioned in both. Specification and Drawings are intended to specify nature, quantity and quality of electrical work. The Contractor shall not make alterations in the drawings and specification.

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

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

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

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

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

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

E. Record Drawings: Work shall be in accordance with the drawings and specification. Exceptions, changes and deviations from the work intended may be made only with the acceptance of the Owner. Submissions for acceptance shall consist of drawings, written explanation and reason for request; six copies. The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered. Changes and additions shall be recorded daily on copy of contract specification and drawings, which shall be maintained at job site. Within two weeks of acceptance of work by the Owner, Contractor shall transfer changes and additions from job site drawings to a fresh set of prints, and submit them to the Owner.

1.09 SUBMITTALS

A. Shop Drawings: Submit complete shop drawings and manufacturer's literature for the Director's review before any work is fabricated. Comply with all requirements of the Section 01300 – SUBMITTALS. Submit six sets of manufacturer's literature for the following:
1. Precast Concrete Handholes/Pullboxes.

2. Wiring Devices.

B. Brand names, manufacturer's names and catalog numbers indicate standard of design and quality required. Substitute materials may be used if qualified by written permission from the Owner.

Submission shall be as follows:

EXAMPLE:

Manufacturer and Catalog	Substitute Manufacturer

Item	Number Specified	and Catalog Number
Cable	John Doe - No. 3200	King - No. 2200

C. Qualifying data to include catalog cuts, shop drawings and/or specifications to show equality with material specified herein.

Shop Drawing and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalog cuts shall not release the Contractor from complying with intent of specifications and drawings.

D. Intent of Shop Drawing and Catalog Cut Review:

1. Shop Drawing and Catalog Cut submittals processed by the Director are not Change Orders. The purpose of the submittals by the Contractor is to demonstrate to the Owner and Engineer that he understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

2. If deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing submittals are processed by the Owner, the design Drawings and Specifications shall control and shall be followed.

3. The fact that a manufacturer does not offer a specific option or meet a minimum guaranteed performance specification, called for herein or in a formal bid specification, is not deemed proprietary when such is available from one or more manufacturers.

4. Shop Drawing Acceptance: Acceptance rendered on shop drawings shall not be considered as a guarantee of measurements or site conditions. Where drawings are accepted, said acceptance does not relieve the Contractor from his responsibility for furnishing materials or performing work as required by Contract Drawings and Specifications.

1.10 INSPECTION

Skill and competency of workmanship shall be subject to the acceptance of the Owner, inspectors of the utilities and the City and County of Honolulu. Notification for inspection shall be given the respective companies or agencies three working days in advance of work.

1.11 GUARANTEE AND CERTIFICATE

Any item of material, apparatus, equipment furnished and installed, or constructed by the Contractor showing defects in design, construction, quality or workmanship within one year from the date of final acceptance by the Owner shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the complete system conform to the true intent and meaning of the specification and/or the drawings. Such repairs or replacement shall be made by the Contractor, at no cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. As specified in Section 16050 – BASIC MATERIALS AND METHODS.

B. All materials shall be new, and shall bear the label of Underwriters' Laboratories whenever standards have been established and label service is normally and regularly furnished by the agency.

C. Contractor shall afford every opportunity for the Owner to ascertain skill and competency of labor. Concealed work shall be reopened at random as directed during formal inspections by the Owner or Utility Company Inspector.

2.02 MATERIALS

As specified in Section 16050 – BASIC MATERIALS AND METHODS.

A. Raceways:

1. Concrete Encased Ducts: Ducts for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic or equal acceptable to the Director.

2. Direct Buried Ducts:

   a. Direct Buried Under Sidewalk or Protective Concrete Topping: Ducts for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic or equal acceptable to the Director.

   b. Direct Buried Under Road Pavement or in Grassed Areas: Ducts for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 80 plastic or equal acceptable to the Director.

3. Conduit and Duct Accessories: Couplings, spacers, bonding agents, plugs, and accessories shall be as recommended by the manufacturer of conduits and ducts.

B. Concrete: Concrete for ductline jackets shall be 3,000 psi minimum compressive strength in 28 days with aggregates of #3 fine size, provided in accordance with

the "Concrete Section".

C. Backfill Material:
   1. Backfill Material, Type "A": Backfill material shall be non-expansive and shall consist of earth and gravel mix with gravel content consisting of 1-inch diameter maximum and not exceeding fifty percent (50%) by volume of the mix. Controlled Low Strength Material (CLSM), if used, shall cornform with Section 314 of Hawaii Standard Specifications for Road and Bridge Construction dated 2005. 28-day compressive strength to be 150 psi. This fill shall be used over concrete encased and direct buried ducts after backfill Type B has been placed.

   2. Backfill Material, Type "B": Backfill material shall be non-expansive and shall consist of earth and gravel mix with gravel content consisting of 1/2-inch diameter maximum and not exceeding twenty percent (20%) by volume of the mix. This fill shall be used all around direct buried ducts.

   3. Any existing underground piping or conduit that is encountered shall be properly shored and protected from damage. Any damage to existing utilities resulting from the Contractor's operations shall be repaired by him at his own expense.

D. Caulking Compound: Compound for the sealing of conduits, ducts, pipes, and sleeves shall conform with Fed. Spec. SS-S-210 and shall be of a putty-like consistency workable with the hands at temperatures as low as 35 degrees F., shall not slump at a temperature of 300 degrees F., and shall not harden materially when exposed to air. The compound shall readily calk or adhere to clean surfaces of the following: asbestos-cement conduit; vitrified clay tile; fiber conduit; fire-clay cement conduit; plastic conduit; concrete; masonry; lead; rubber; polyethylene polychloroprene; or polyvinyl-chloride sheaths of cables; and the common metals. The compound shall form a seal with the foregoing without dissolving, noticeably changing characteristics, or removing any of the ingredients. The compound shall have no injurious effect upon the hands of workmen or upon the materials.

E. Ground Rods: UL 467. Diameter shall be adequate to permit driving to full length of the rod, but not less than _" in diameter unless otherwise indicated. Ground rods shall be 5/8" x 8'-0" copper-cladded steel core unless otherwise indicated.

F. Wire Mesh: Welded steel wire fabric for reinforcing concrete, galvanized, conforming to ASTM Specification A-185.

G. Wires and Cables: Shall be copper unless indicated otherwise. Insulated conductors shall bear the date of manufacture imprinted on the wire insulation with other identification. Wire and cable manufactured more than six months before delivery to the job site shall not be use.

1. Wires and Cables, 600 Volts and Below: Shall be copper, single conductors, No. 12 AWG minimum. No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric. Insulation type shall be RHW-USE or type THW with neoprene jacket. Ground wire may be type TW. Remote-control and signal circuits shall be type TW, THW or TF.

2. Bare copper wire for grounding, bonding and other uses when not specified otherwise shall conform to Fed. Spec. QQ-W-343.

3. Control cables for remote control of power equipment shall be multi-conductor type having a rating of not less than 600 volts, and shall conform to IPCEA publication No. S-19-81, or S-61-402 or S-66-524. Wires shall be stranded copper conductors.

H. Identification Tags: Each set of cables in pullboxes, handholes and manholes shall be identified by a noncorrosive metal tag. Letters shall be minimum ¼- inch high identifying the cable as to use and/or voltage. Tags shall be wrapped around the cables and taped. Tags for power cables shall be red.

I. Connectors and Terminals: Shall be designed and approved for use with the associated conductor material, and shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on all stranded conductors. Crimp type connectors will be acceptable, however, the type which makes only one indentation will not be acceptable. The crimping tool shall make a minimum of four indentations around the circumference of the cable. In addition, crimp type connectors to be used on 250 MCM and larger conductors shall have adequate length for two sets of indentations on each half of the connector.

J. Waterproof Connection Kits: Shall be quick disconnect in-line fuse holder (6 ampere fuse link unless indicated otherwise) fused for hot leg. The fuse holder body shall be molded plastic made in two sections where lead side section shall have a captive nut and waterproofing ring. Fuse holder shall be TRON and manufactured by BUSSMANN, or equal acceptable to the Owner.

PART 3 - EXECUTION

3.01 GENERAL

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

B. Materials and Workmanship: All labor and materials of every kind shall be subject to the acceptance of the Owner, who shall be afforded every facility for ascertaining the competence of such labor and examining such materials as he may deem necessary. Concealed work shall be reopened at random as directed during formal inspections by the Owner or Utility Inspector.

C. Qualification of Installers: For actual fabrication, installation and testing of the work of this Section, use only thoroughly trained and experienced workmen who are completely familiar with items required and with manufacturers' recommended methods of installation. In acceptance or rejection of installed work no allowance will be made for lack of skill on part of workmen.

D. Before installation, verify all dimensions, conditions and sizes of equipment at job site. Installation shall be complete in every detail as specified and ready for use.

3.02 INSPECTION

Inspect work of previous trades and verify work as acceptable to receive work as specified herein.

3.03 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.

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

3.04 CONSTRUCTION METHODS

A. Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition); Edison Electrical Institute; National Electric Safety Code; General Order No. 10, Public Utilities Commission, State of Hawaii; and applicable instructions of manufacturers of equipment and material supplied for this project.

B. Electrical Outages: The Contractor shall schedule his work to minimize electrical outages. All electrical outages including, but not limited to, power and telephone systems shall be scheduled with and accepted by the State and Owner a minimum of three weeks prior to scheduled occurrence. Electrical outages shall be granted at the convenience of the State and the Contractor is encouraged to schedule such outages after normal business hours and on weekends.

C. Existing Underground Utilities: Underground utilities indicated on plans are approximate in location. It is not the intention of plans to imply that all existing utilities are drawn and located. It shall be the responsibility of Contractor to coordinate locations of existing utilities prior to doing any excavation work. Any damage to existing utilities shall be promptly repaired by Contractor at no cost to the Owner. In any event, the Contractor shall immediately notify the Owner of any such damage.

D. Trench Excavation:
   1. Dimensions and locations of trenches for ductlines shall be as indicated on drawings. Trench width and depths shall be sufficient to accommodate proper installation of conduit banks.

   2. Should material at bottom of trench for direct buried conduits not be equal to backfill material Type "B", the trench shall be excavated an additional 3" to permit backfilling with Type "B" backfill.

   3. Where a trench is excavated on slope, sides are to be vertical, and depth measured at lowest side. All measurements are to be based on final grades.

   4. Bottom of trenches to be flat and smooth.

   5. Sheathing and bracing as required shall be provided to support sides of excavations from cave-ins.

   6. Provide drainage and pumps to keep trenches dry.

   7. Saw cut all edges of existing sidewalks and pavement before trenching.

   8. Excavated material may be placed alongside trench; however, it shall not interfere with vehicular or pedestrian traffic.

   9. Cover all trenches with suitable bridging material; trenches shall not be left uncovered overnight or over the weekend.

E. Backfill:
   1. Duct installations shall be accepted by the Owner prior to backfilling.

   2. Should material below direct buried conduits not be equal to 3" (thickness) of backfill material Type "B", trench shall be deepened by 3", and backfilled with Type "B" backfill.

   3. Backfilling shall be to finished grades indicated on accompanying drawings, and matching existing conditions.

   4. Backfill material shall be completely free of wood or other debris.

   5. Backfill material shall be placed in maximum of 8" layers in loose thickness before compacting. Backfill shall be thoroughly compacted with hand or mechanical tampers to 95% of ASTM D1557 maximum dry density. In no case shall tamping be accomplished by using the wheels or tracks of a vehicle.

   6. Backfill over conduit bends at transformer pads shall be Type A or better.

   7. Backfill over direct buried conduits shall be 8" thickness of backfill Type "B".

8. Backfill over concrete encased ducts and balance of fill over backfill Type "B" (over direct buried conduits) shall be backfill Type "A".

9. At road crossings, backfill shall be 8" thickness of backfill Type "B" and remaining backfill may be normal road base course.

F. Installation of Conduit and Duct Bank:

1. Bottom of trench shall be clean, smooth, well-graded.

2. Saw cut, ream and taper ducts and conduits with manufacturers' approved tool.

3. Couplings and bells shall be tight to prevent entry of dirt or concrete into ducts and conduits.

4. Apply thin coat of sealing compound on ducts and conduits at couplings and bells.

5. Stagger the joints of the conduits by rows and layers so as to provide a ductline having the maximum strength.

6. Provide spacers to maintain proper separation between ducts.

7. Except at conduit risers, changes in direction of runs exceeding a total of ten degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet, unless indicated otherwise. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.

8. Duct lines shall have a continuous slope downward toward manholes and away from building(s) with a pitch of not less than three inches in 100 feet.

9. Ducts shall be clean and free from debris and rubbish.

10. After each day's work, provide temporary conduit plugs at the end of conduit banks to prevent entry of dirt, rubbish, debris, or concrete.

11. Mandrel Test: Pass a test mandrel conforming to the utility company or the Owner's requirements, through the entire length of each duct or conduit to test for burrs and obstructions. Unless indicated otherwise, mandrel shall be 14" long and shall have diameter of ½" less than inside diameter of duct. If burrs or obstructions are encountered, that section shall be replaced at no additional cost to the Owner.

12. Unless indicated otherwise, install #12 AWG galvanized iron pulling wire or polypropylene cord in each conduit after testing.

13. Ducts Ending in Handholes and Pullboxes: Shall be terminated with conduit end bells. End bells, terminators or ducts shall be flush to inside wall surfaces; duct extension into boxes is not acceptable.

14. Conduits Stubbed for Future Connections: Shall be plugged and marked with concrete marker.

15. Securely anchor duct banks prior to pouring concrete encasement to prevent ducts from floating.

16. When pouring concrete, prevent heavy masses of concrete from falling directly on ducts. If unavoidable, protect ducts with plank.

17. Direct flow of concrete down sides of duct bank to bottom, allowing concrete to rise between ducts, filling all open spaces uniformly.

18. To insure against voids in concrete, work a long, flat splicing bar or spatula liberally and carefully up and down the vertical rows of ducts. Mechanical vibrators shall be used for stacked duct banks of three ducts or higher.

19. Cure concrete for a minimum of 72 hours before permitting traffic and/or backfilling.

20. Warning Tapes: Provide warning tapes about twelve inches below the top of the trench in the backfill. For electric ducts, provide a 6-inch wide warning tape, red in color with a black imprinted message "CAUTION -- ELECTRIC LINE BURIED BELOW, placed 12" below finish grade over electric ducts or the concrete jacket for electric ducts for the entire length of ductline installation. Warning tape shall be constructed with a metallic core sandwiched between the printed polyethylene tape above and a clear polyethylene tape below.

21. Ducts Entering Existing Handholes and Pullboxes: The Contractor shall exercise due care in constructing the new duct openings into the existing handholes. Existing reinforcing steel in the handhole wall shall be cut and bent so that maximum strength can be obtained in joining the new concrete work to the existing concrete. The new rebars in the new ductlines shall be extended to within two inches of the inside face of the concrete handhole wall. Suitable patching shall create a waterproof joint between the new and existing concrete.

G. Concrete and Brick Work:
1. Concrete, ready mixed according to ASTM C94.

2. Concrete shall be composed of fine aggregate, coarse aggregate, Portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded

from 3/16-inch to 1-inch. The fine and coarse aggregates shall be free from dirt, vegetable matter, soft fragments or other deleterious substances.

a. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete shall have compressive strength as indicated. Slump shall not exceed three inches.

b. Retampering of concrete will not be permitted. Exposed uniformed concrete surfaces shall be given a smooth, wood float finish.

3. Convey concrete from mixer to forms rapidly to prevent segregation. Free drop shall be limited to five feet, unless authorized by inspector.

4. Placing:
   a. Clean and remove all debris from inside forms and trenches before placing concrete.

   b. Place concrete only on clean damp surfaces, free from water.

   c. Place concrete in forms, in horizontal layers not exceeding 18" thickness.

   d. Place concrete to avoid segregation of materials and displacement of ducts, inserts and reinforcing.

   e. Vibrate structural concrete thoroughly during and immediately after placing to insure dense watertight concrete.

5. Forming:
   a. Forms shall be of good sound lumber with sufficient strength and conforming to shapes and dimensions indicated on drawings.

   b. Forms shall be treated with non-staining form oil immediately before each use.

6. Patching: Patch all voids, pour joints and holes before concrete is thoroughly dry. Use mortar of same proportions as original concrete.

7. Curing: Curing of concrete shall be accomplished by impervious membrane method with liquid membrane compound. Apply two or more coats to obtain a total of one gallon for each 150 square feet of concrete surface.

8. Reinforcing Steel:
   a. Clean reinforcing of mill or rust scale and form to dimensions indicated.

   b. Install reinforcing in proper locations and secure in place to prevent movement during concrete placing or vibrating.

9. Concrete Brick and Hollow Concrete Block Work:
   a. Concrete brick and hollow block shall be laid in full bed of mortar, both horizontally and vertically.

b. Mortar shall be one part (by volume) cement and three parts (by volume) fine aggregate, thoroughly mixed and used when fresh. Retampering will not be allowed. Mortar shall have a minimum 28 days strength of 2,500 psi.

c. Setting bed shall be of depth required to bring top of blocks flush with finish line.

G. Core Drilling for New Conduits: Core drilling of existing concrete to facilitate the installation of new conduits shall be accomplished in a good and workmanlike manner to ensure straight, parallel, horizontal or vertical holes, as required. Where two new borings are to accommodate one new conduit run, they shall be in line with each other to ensure ease of installation of the conduit. Diameters of the holes shall be adequate to accommodate the conduits shown. Following installation of the conduits, the holes shall be sealed at both ends to prevent future undue corrosion of the existing reinforcing steel which may be exposed as a result of the core drilling.

H. Structural Steel and Miscellaneous Metal Work: Structural steel work including bolts, nuts, anchors, pulling-in irons, etc. shall be galvanized by hot-dipped process after fabrication into largest practical sections.

I. Boxes and Enclosures: Boxes and special purpose cabinets shall be formed without knockouts and shall be weatherproof zinc-coated cast iron with threaded hubs and mounting lugs. Boxes shall be installed plumb and exactly flush.

J. Installation of Wiring System:
1. Secondary electrical system materials and installation shall be in accordance with Section 16050 – BASIC MATERIALS AND METHODS, and as specified herein and on the Drawings.

2. Unless otherwise indicated or specified herein, wiring shall consist of single conductor cables installed in conduit/duct in areas where permitted by the NEC and NESC.
   a. Below or in slab, use Schedule 80 PVC, unless indicated otherwise. For distribution feeder banks, provide Schedule 40 PVC with 3" concrete encasement.

   b. Conduit system shall be continuous from outlet to outlet or fitting to fitting so that electrical continuity is obtained between all conduits of the system.

   c. Conduits cut square and inner edges reamed. Butt together evenly in couplings.

   d. Changes in direction shall be made with symmetrical bends or cast metal fittings. Make bends and offsets with hickey or conduit-bending machine. Do not use vise or pipe tee. Flattened crushed or deformed conduit not acceptable. Trapped raceways shall be avoided.

e. Use of running threads not permitted. Where conduits cannot be joined by standard threaded couplings, approved water-tight conduit unions shall be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered.

f. Cap conduits during construction with plastic or metal- capped bushings to prevent entrance of dirt or moisture. Swab all conduits and dry before installing wires.

g. Pull wires shall be placed in all empty conduits for ten feet in length and as indicated.

h. Install insulating bushings and two locknuts on each end of every conduit run at enclosures, boxes and conduit stub-outs. Provide grounding bushings as required.

3. Conductors:
   a. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.

   b. Pulling tension shall not exceed wire manufacturer's recommendations.

   c. Where necessary, powdered soapstone may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.

   d. Form neatly in enclosures and boxes for minimum of crossovers. Tag all feeders.

   e. Thoroughly swab out existing ducts to remove foreign material before the pulling of cable..

4. Splicing of Wire and Cable:
   a. Splices made according to NEC Article 110.

   b. Splices for 600 Volt Class Cables: The conductors shall be joined securely both mechanically and electrically by the use of solderless or crimp type connectors with properly sized tools.
      (1) Splices for cables No. 10 AWG and smaller in underground systems shall be made only in accessible locations using a compression connector on the conductor, taped watertight.

      (2) Splices for cables No. 8 AWG and larger in underground systems shall be made only in accessible locations using a compression connector on the conductor and by insulating and waterproofing suitable for continuous submersion in water.

c. Splices reinsulated according to wire manufacturer's instructions. Splice insulation shall be 150% in thickness of original wire insulation and of the same electrical and mechanical characteristics. Insulating type (600V use) shall be neoprene, Okoprene by Okonite Company or equal acceptable to the Owner. Jacketing and insulating tape shall be high density cold setting polyethylene adhesive tape, Scotch No. 33 by Minnesota Mining and Manufacturing Company or equal acceptable to the Director. Splices in manholes, handholes and pullboxes shall be water-tight.

d. Control Cable Splices:
   (1) Multiconductor control cable splices shall be made using a "kit" which shall be the product of one manufacturer. The "kit" shall be suitable for the number of conductors and conductor size indicated.

   (2) Compression connector shall be provided for individual conductors and taped or covered with a heat shrinkable tubing suitable for the rated voltage of the conductor.

   (3) Splice insulation thickness shall be equal to or greater than the conductor insulation. The outer covering of the individual conductor splices shall be re-enterable type forming a watertight connection.

5. Cable Terminations: Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials.
   a. Install all terminations of insulated power and lighting cables in accordance with the manufacturer's requirements.

   b. Make terminations using materials and methods as indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer.

6. Protection of Wire and Cable Ends: The ends of wire and cables in handholes, pullboxes, and in other wet locations, as defined by the NEC, that are not to be spliced or connected to equipment shall be protected from moisture and other damage.
   a. The ends of wires and cables shall be protected by applying not less than six half-lapped wraps of electrical insulating tape beginning three inches from the end of the wire or cable and continuing over the exposed conductor to form a watertight seal.

   b. The ends of wires and cables that are to be left unspliced or unconnected temporarily during construction shall be protected to prevent moisture from getting into the cable.

   c. Where the ends of wires and cables are to be left unspliced or unconnected temporarily during construction, they shall be protected as specified above to prevent moisture from getting into the cable.

K. Cable Tags: Cables provided in the manholes, handholes, and pullboxes shall be provided with cable tags to identify the cables. Tags shall be fabricated of lead strips long enough to fit loosely around the cables after the tag ends have been soldered together. Data to be stamped on the tags shall include feeder designation, voltage, quantity of conductors, conductor size and type of insulation. Where two different sizes of cable are spliced together, separate markers shall be provided at each end of the splice.

L. Finishing:

1. Structural and architectural elements cut or drilled for installation of electrical work shall be patched, repaired, and restored. Drilling, cutting, patching, repairing, and restoring subject to acceptance of the Owner. Need for remedial work determined by the Owner as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the Owner and at no cost to the Owner.

2. Attachment of electrical equipment to wood by wood screws. Attachment to concrete by embedded or expansion inserts and bolts. Powder charge driven with prior acceptance only.

3. Close unused knockouts on boxes or expansion with metal cap.

4. Wipe clean all exposed raceways and enclosures with rag and solvent. Unfinished raceways and enclosures prime painted and finished by "Painting Section". Factory finished enclosures shall not be painted. Panelboards identified by stenciling with paint on back of doors the voltage and designation. Voltage ratings stenciled on the front of disconnect switches and junction boxes where wires are terminated for connection to equipment that are not part of this contract.

5. Update panel circuit directories, using typewriter.

6. Furnish necessary test equipment and make all test necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.

7. Verify continuity of all grounding.

8. Tag all empty conduits in terminal cabinets and boxes, giving destination. Use fiber disc tags in bushing.

9. Provide duct seal in all duct entries into manholes, handholes and pullboxes to prevent moisture from entering boxes.

M. Cleaning and Repairs:

1. During the progress of work, all rubbish, waste lumber, displaced materials, etc. shall be removed as soon as possible. Upon completion of the work, Contractor shall remove from the State's property and from all public and

private property, at his own expense, all temporary structures, tools, rubbish and waste material, etc., resulting from his operations, and leave the premises in broom clean condition.

2. The Contractor shall restore all removed or damaged pavement, gutters, curbs, sidewalks, walls, sign posts, trees and landscape damaged by his operations to as near their original condition or better.

3. Concrete sidewalks, curbs and gutters shall be repaired using 3,000 psi concrete as specified herein. Sidewalk thickness and curb and gutter cross-sections shall match existing, but shall be at least six inches.

4. Graded aggregate base course shall have maximum aggregate size of 1-½ inches. Thickness of base course shall match existing, but shall be at least six inches. Base course shall be primed with emulsified asphalt prior to paving.

5. Asphalt concrete shall be hot plant mixed and hot laid. Maximum aggregate size shall be ½-inch and match existing. Pavement thickness shall match existing, but shall be at least six inches.

6. Contractor shall begin sodding no more than one week after ground has been compacted. In the areas where seeding is recommended, the process for seed shall begin within the same time frame. The Contractor shall be responsible for complete restoration of the re-landscaped area until such time as the area has returned to the normal conditions that were present before construction.

N. Grounding:

1. All services, motors, metallic enclosures, raceways, and electrical equipment shall be grounded according to requirements of National Electric Code. At buildings, 5/8" x 8' copperweld ground rods, Copperweld Steel Company, shall be driven with top 12" below finished grade and shall be connected together with bare No. 3/0 copper wire buried 12" below finished grade to obtain a ground of 25 ohms or less as measured by three point potential method with an electric ground megger. Connect ground to nearest cold water pipe and to electrical service equipment, raceways, equipment, grounding type receptacles, and other metallic parts directly exposed to ungrounded electric conductors. Connection shall be made by continuous metal raceways or with conductors.

2. Make grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which access for periodic testing is required, by exothermic type process. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. No mechanical connector is required at exothermic weldments.

In lieu of an exothermic type process, a compression ground grid connector of a type which uses hydraulic compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3. All grounding wire runs shall be run together with circuit conductors.

4. Resistance to solid earth ground for noncurrent carrying metallic parts associated with electrical equipment shall not exceed the following:

	Ohms
Ground in handholes	10
Grounding other metal enclosures for electrically operated equipment	10
Grounding secondary distribution system neutral and noncurrent carrying metal parts associated with distribution systems and grounds not otherwise covered.	25

3.05 TESTING AND INSPECTION

A. As specified in Section 16050 – BASIC MATERIALS AND METHODS and herein after.

B. If the Owner (or its representative) discovers any errors, the Contractor, at his own expense, shall go over all similar portions of the entire job, taking the necessary or directed remedial action.

C. The Contractor shall show by demonstration in service that all circuits and devices are in operating condition. Tests shall be such that each item of control equipment will function not less than five times.

D. Installations, 600 Volts and Less: Shall be tested for insulation resistance after all wiring is completed and ready for connection to fixtures and equipment. Using a 500V megger, measure and record the insulation resistance from phase to phase and phase to neutral. The above tests shall be witnessed by the Owner and the records turned over to him for proper disposition. The Contractor shall notify the Owner when this test is to be performed.

E. The Contractor shall retape splices which have been bared for inspection. The Contractor shall test all portions of the electrical system furnished by him for proper operation and freedom from accidental grounds. All tests shall be subject to the acceptance of the Owner.

F. Ground-Resistance Measurements: Ground-resistance measurements for each ground rod shall be made and certified by the Contractor. Upon completion of the project, Contractor shall submit in writing to the Owner the measured ground resistance of each ground rod and grounding system, as well as the resistance and soil conditions at the time the measurements were made. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. Ground resistance shall also me measured from each piece of equipment to the ground electrode.

G. Wherever test or inspection reveals faulty equipment or installation, the Contractor shall take corrective action, at his own expense, repairing or replacing equipment or installation as directed. The materials or installation shall then be retested.

H. The Contractor shall remove, and reinstall switchboard covers for pre-final and final inspections by the Owner.

END OF SECTION

SECTION 16500 – LIGHTING

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS
As specified in Section 01100 – Project Requirements.

1.02 SUMMARY
A. This section provides the specifications for the lighting system work.

B. The Contractor shall furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all electrical work, complete, as indicated on the drawings and/or as herein specified. The drawings note various sizes of equipment as determined for basis of design; the electrical work, however, shall be installed to comply with the equipment furnished by the successful supplier. The work shall include, but not necessarily be limited to, the following:

1. Area light poles

2. Interior and exterior lighting systems.

3. Before bidding on this work, carefully examine each of the drawings and the site. By submitting a proposal of the work included in this contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.

1.03 SUBMITTALS
A. Submit in accordance with Section 01300 – SUBMITTALS.

B. Shop Drawings and Manufacturer's Literature: Submit complete shop drawings and manufacturer's literature for review by the Contracting Officer before any work is fabricated. Partial or incomplete submittals will be returned without review. Submit manufacturer's literature for the following:

1. Light Fixtures

2. Area light poles and bollards

4. Ballasts.

5. Lighting contactors.

6. Time switches.

7. Light switches.

8. Lighting control systems.

C. Shop drawings and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as “as good as”; and “achieve the same end use and results as materials formulated in accordance with the referenced publications”. Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalogue cuts shall not release Contractor from complying with intent of specification and drawings.

1.04 GUARANTEE AND CERTIFICATE

Any item of material, apparatus, equipment furnished and installed, or constructed by the Contractor showing defects in design, construction, quality or workmanship within 2 years from the date of project acceptance by the Contracting Officer shall be replaced by such new material, apparatus or parts as may be found necessary to make such defective portion of the complete system conform to the true intent and meaning of the specification and/or the drawings. Exceptions shall be high intensity discharge, and fluorescent lamps which shall be guaranteed for one half of the manufacturer's listed life time. Such repairs or replacement shall be made by the Contractor, free of all expense to the State. The surety shall not be held liable after 2 years from the date of project acceptance by the Contracting Officer.

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Area Light Standards: Lighting materials shall be as specified herein and on the Drawings, and manufacturer's recommendations.

1. Light Standard: Each standard shall be an assembly of pole, anchor base, luminaire and anchor bolts, in separate pieces, capable of withstanding 105 mph sustained winds and 130 mph gusts as computed in accordance with the International Building Code, 2006 edition, using Exposure Category C and a vertical load of approximately 100 pounds per luminaire and accessories without permanent deformation. The maximum deflection at the top of the pole in winds indicated above shall be 9.35 inches.
    a. Light Pole: Round tapered spun aluminum pole with cast aluminum base; provided with clear anodized undercoat and finish. Verify color/texture of finish with the Director and submit five cip samples for acceptance prior to application.

    b. Base Plate: Anodized aluminum plate, sized per manufacturer’s requirements and meeting ASTM specification.

c. Pole Top Tenon: Pole top tenons shall be sized as indicated on the drawings.

d. Anchor Bolts: Minimum 4 each, steel anchor bolts meeting ASTM A307 specifications shall be furnished with each pole. Hot-dipped galvanized entire length. Shall be provided with 6" of thread complete with two nuts and two leveling lugs per bolt. Lower end with 90 degree bend extending 4" Galvanizing at anchor bolts area shall be brushed to allow easy running of nuts.

e. Finish: Verify color/texture of finish with Director and submit five cip samples for approval prior to application.
   (1) All steel parts of standard shall be hot-dipped galvanized after fabrication, internally and externally to comply with ASTM Designations as follows:

   ASTM A153 for bolts and hardware
   ASTM A123 for poles and shafts

   Double dipping shall not be allowed.

   (2) All aluminum parts shall be anodized after fabrication.

C. Light Emitting Diode (LED) Light Fixtures:
   1. Provide light fixtures complete with necessary LED, drivers, starters, and accessories, according to the "Light Fixture Schedule". All light fixtures shall be supplied complete with LEDs.

   2. Driver: The electronic driver module shall be one-piece unit installed inside the electrical compartment of the luminaire and mounted to the luminaire housing. The driver shall have a rated lifetime of 100,000 hours at less than 60ºC. The driver's maximum allowable case temperature is 80ºC and shall have built-in thermal protection in case temperature exceeds 85ºC. The driver shall tolerate sustained open circuit and short circuit output conditions without damage. The driver shall be UL listed for operation in dry/damp locations (Outdoor Type 1) and have an IEC rating of IP65. Wiring shall be 600 volts rated at 105ºC.
      a. Input voltage: Shall be 120 volts.

      b. Input frequency: Shall be 50/60 Hz.

      c. Full load efficiency at 120 volts: Shall be >88%.

      d. Power factor: Shall be >90%.

      e. Total harmonic distortion (THD): Shall be <20%.

      f. Weight: Shall be <1.5 lbs.

g. Operating temperature: Shall be -40ºC to 80ºC.

h. Electromagnetic interference (EMI): Compliant with FCC CFR Part 15 Class A.

i. Surge protection: Shall be 10 kV/5KA per IEEE/ANSI C136.2-2015 Location C or IEEE/ANSI C62.41.2-2002.

j. UL standards: Unit – 8750 Class 1 or 1310 Class 2.

k. Dimming: Shall be 0 – 10 volts.

D. Lighting Contactors: Contactors shall be continuous-duty, minimum 30 amperes, 600 volts, T-rated, unless otherwise indicated, enclosed, with 120-volt coil. Number of poles as shown on plans.

E. Time Switches: Digital astronomical type arranged to turn “ON” at sunset, “OFF” at sunrise, automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. The switch shall be provided with a battery backup to keep the switch on time for a minimum of 8 hours following failure of normal power. The time switch shall be provided with a manual on-off by-pass switch. Housing for the time switch shall be surface mounted.

F. Digital Lighting Control Devices:
1. Occupancy sensors:
a. Ultrasonic sensor: Utilizes omni-directional ultrasonic technology, high frequency (40 kHz), wall or ceiling mount as indicated, 24 VDC, user-adjustable sensitivity, user-adjustable time delay of up to 30 minutes and LED indicator for occupancy detection. Sensors shall be connected to a room controller via 4-pair unshielded twisted pair (Category 5e minimum) cable. Wattstopper LMUC series or approved substitute acceptable to the Contracting Officer.

b. Dual technology sensor: Utilizes both passive infrared and ultrasonic technology, high frequency (40 kHz), wall or ceiling mount as indicated, 24 VDC, user-adjustable sensitivity, user-adjustable time delay of up to 30 minutes, built-in light level sensor and LED indicator for occupancy detection. The 24 VDC sensors shall be connected to a room controller via 4-pair unshielded twisted pair (Category 5e minimum) cable. Wattstopper LMDC series or approved substitute acceptable to the Contracting Officer.

c. Combination wall switch/occupancy sensor: Utilizes both passive infrared and ultrasonic technology, high frequency (40 kHz), wall mounted, 120 VAC, user-adjustable time-delay of up to 30 minutes, built-in light level sensor and LED indicator for occupancy detection. Wattstopper DSW series or approved equal acceptable to the Contracting Officer.

2. Digital switches: Low voltage pushbutton switches in 1,2,3,4 or 5-button configurations as indicated, 24 VDC, white, LED status indicators on each button, infrared receiver for configuration and optional remote control, 2-RJ45 ports for connection via 4-pair unshielded twisted pair (Category 5e minimum) cable. Wattstopper LMSW series or approved substitute acceptable to the Contracting Officer.

3. Room controllers: On/Off Room Controllers: Shall be 120-volt input, one or two 120-volt output relays as indicated, 20 amperes, LEDs for indicating load status and configuration, RJ45 ports for connection to dimmer switches or sensors and connection to up to 3 additional room controllers via 4-pair unshielded twisted pair (Category 5e minimum) cable. Wattstopper LMRC-100 Series or approved substitute acceptable to the Contracting Officer.

G. Light Switches: Single or double pole, 3- or 4- way, as required, non-mercury, quiet, 20 amperes, 120-volt, UL labeled alternating current (AC) type, silvered contacts, ivory, tumbler switch with endurance of 10,000 make-breaks. Enclose in outlet box and device plate. Hubbell No. 1200 series, Bryant No. 4900 series, Arrow Hart No. 1990 series or approved substitute.

H. Wiring: As specified in Section 16050 – BASIC MATERIALS AND METHODS.

PART 3 – EXECUTION

3.01 GENERAL

As specified on Section 16050 – BASIC MATERIALS AND METHODS.

3.02 INSTALLATION

A. Street Light and Area Lighting Systems:

1. Lighting installation including wiring shall be as specified herein and on the drawings, and manufacturer's recommendations. Complete light assembly shall be capable of withstanding 105 mph winds with 1.3 gust factor.

2. Lighting systems shall provide illumination along length of project roadway(s) and/or parking areas. System shall be completely tested and ready for use.

   a. Before trenching or excavating, structural outlines and center lines of ductlines and street light foundations shall be clearly staked, and approval received from the Contracting Officer. Staking shall be with steel or wood pegs or paint.

   b. Base foundations for light standards shall consist of cast-in-place reinforced concrete complete with anchor bolts, sized and placed in accordance with pole manufacturer's requirements and installation template. Length of base shown on drawings shall be considered as minimum and shall be lengthened to suit the soil conditions encountered and to adequately support the pole and lighting fixture

assembly. Relocation of any existing irrigation lines, sprinkler heads, valve boxes, control wiring, root trimming, and repair of surrounding area to match existing conditions shall be considered incidental to the construction of the foundation.

c. Light standards shall be field adjusted for vertical alignment. Tree trimming shall be considered incidental to the installation of the street light standard and/or luminaire.

d. After pole is set, grease (or bituminous coat) ends of all anchor bolts and bottom of pole base plate.

e. All tapped holes and stainless steel screws shall be sprayed with “thread-eze” by Chemsearch or approved substitute prior to assembling, shipping or installation. Grease all exposed screws and bolts.

3. Provide duct seal in duct entries into handholes and pullboxes to prevent moisture from entering light fixtures

.

4. Contractor shall furnish computerized footcandle arrays to show initial and maintained (0.76 maintenance factor) footcandle level and distribution for parking lot area.

B. Fixture Supports:

1. Every outlet box or other support for light fixtures shall be of sufficient strength to support at least 4 times the weight of the fixture.

2. Support all fixtures weighing more than 50 lbs independently of the outlet box.

3. Fixtures shall be securely and safely supported by means of fixture studs in the outlet boxes or other approved means. Ceiling fixtures shall be arranged to hang vertically unless otherwise directed by Contracting Officer. Provide accessories such as straps, mounting plates, nipples, or brackets for proper installation. Provide additional suspension wires and channels for mounting on suspended ceilings as recommended by fixture manufacturer. Fixtures shall not be hung from outlet box “ears”.

4. Where ceiling construction is such that mounting channels, strongbacks, braces, etc., are required to properly support fixtures, provide these supports at no additional cost to the City. Refer to architectural drawings for type of ceiling construction.

C. Wiring: As specified in Section 16050 – BASIC MATERIALS AND METHODS.

D. Lamps: Burn-in lamps for a minimum of 100 continuous hours prior to turn over.

3.03 TESTING AND INSPECTION

As specified in Section 16050 – BASIC MATERIALS AND METHODS.

END OF SECTION