

SECTION 01010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

- 1.01 GENERAL REQUIREMENTS AND COVENANTS: The General Conditions, General Specifications, Special Provisions, and other applicable documents preceding these specifications shall govern all work specified hereinafter in all Divisions and Sections.
- 1.02 APPLICABLE REGULATIONS: The Contractor shall comply with all local laws, ordinances, rules, and regulations about such work and must obtain all required permits, licenses, and certificates and publish and post all notices required.
- 1.03 DESCRIPTION OF THE WORK: These specifications are divided for convenience into titled divisions and sections as outlined in the TABLE OF CONTENTS preceding these specifications and shall not be considered accurate or complete segregation of the several units of labor and materials. No direct or implied responsibility is assumed by the Department of Hawaiian Home Lands (DHHL) for omissions or duplications of the subject matter. The Contractor will be held responsible for the complete work whenever or wherever the parts are described in one or more trade heads. Any mention in these sections or indication on the drawings of articles, materials, operations, or methods, require that the Contractor furnish each item so mentioned or indicated, of the kind, type, or design and quality of each item so mentioned on the drawings, and that the Contractor furnishes all labor, materials, equipment, incidentals, and supervision necessary to complete the work per the drawings and the true meaning and intent of these specifications, even though such mention of articles, materials, operations, methods, quality, qualifications or condition is not expressed in complete sentences.

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

The schedule of work included in these specification sections is given for convenience. It shall not be considered a comprehensive list of items necessary to complete the work of any team.

The Contractor shall employ the usual standard practice of coordinating the work covered in each section with the work of other sections. The necessary information and the items, accessories, anchors, connections, patterns, templates, etc., shall be delivered when required to prevent any delay in the progress and completion of the work.

- 1.04 PLANS AND SPECIFICATIONS: These specifications are intended to cover all labor, materials, and workmanship employed in work indicated on the plans and called for in the specifications or reasonably implied therein. The plans and specifications complement one another. Any part of the work mentioned in one and not represented in the other shall be done the same as if it had been mentioned or described in both.

The Contractor shall not alter the drawings and specifications. In the event of errors or discrepancies, the Contractor shall immediately notify the Engineer.

All figured dimensions take precedence over scaled measurements. No important dimension shall be determined by scale.

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

1.05 REFERENCE STANDARDS: All work shall be done per the current standards listed below as amended and/or amplified herein.

ASA American Standards Association

ASTM American Society for Testing and Materials

AISC American Institute of Steel Construction

ACI American Concrete Institute

UBC Uniform Building Code - current edition

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01430 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

- 1.01 **GENERAL:** This section covers the prevention of environmental pollution and damage during and as the result of construction operations under this contract and for those measures outlined in other sections of the TECHNICAL SPECIFICATIONS. For this specification, environmental pollution and damage are defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances of importance to the utility of the environment for aesthetic, cultural, and/or historical purposes. Controlling environmental pollution and damage requires consideration of air, water, and land and includes management of visual aesthetics, noise, solid waste, and other pollutants. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State, and County laws and regulations concerning environmental protection and pollution control and secure all necessary permits.
- 1.02 **SUBMITTALS:** The Contractor shall submit an environmental protection plan per the provisions as herein specified. Environmental protection plan shall include but not be limited to the following:
- A. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
 - B. Procedures to be implemented to provide the required environmental protection and comply with all applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accidents, natural causes, or failure to follow the guidelines set out per the environmental protection plan.
 - C. Drawings show locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of spoil material.
 - D. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
 - E. Methods of protecting surface and groundwater during construction activities.
 - F. Training for his personnel during the construction period.
- 1.03 **IMPLEMENTATION:** After receipt of Notice to Proceed, the Contractor shall submit the above environmental protection plan for the Engineer's approval within 15 days after Notice to Proceed. Acceptance of the Contractor's schedule will not relieve the Contractor's responsibility for adequate and continuing control of pollutants and their environmental protection measures.

- 1.04 SUBCONTRACTORS: Subcontractors' assurance of compliance with this section will be the Contractor's responsibility.
- 1.05 NOTIFICATION: The Engineer will notify the Contractor in writing of any observed non-compliance with the Federal, State, or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. After receiving such notice, the Contractor shall inform the Engineer of the proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

- 3.01 PROTECTION OF ENVIRONMENTAL RESOURCES: The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications.
- 3.02 PROTECTION OF LAND RESOURCES: Before beginning any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources, including trees, shrubs, vines, grasses, topsoil, and landforms without special permission from the Engineer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless expressly authorized. Where such particular emergency use is permitted, the Contractor shall provide adequate protection for land and vegetation resources as defined in the following subparagraphs.
- A. Work Area Limits: Before any construction, the Contractor shall mark the areas not required to accomplish all work under this contract. Isolated areas within the general work area, which are to be saved and protected, shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. The tags shall be visible where construction operations are conducted during darkness. The Contractor shall convey to his personnel the purpose of marking and/or protecting all necessary objects.
- B. Protection of Landscape: Trees, shrubs, vines, grasses, landforms, and other landscape features indicated and defined on the drawings to be preserved shall be identified by marking, fencing, or wrapping with boards, or any other approved techniques.
- C. Reduction of Exposure of Unprotected Erodible Soils: Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure

to unprotected soils. Runoff from the construction site shall be controlled by constructing diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

- D. Disposal of Solid Waste by Removal From Property: The Contractor shall transport all solid waste off State property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.
- E. Disposal of Chemical Waste: Chemical waste shall be stored in corrosion-resistant containers, removed from the work area, and disposed of per Federal, State, and local regulations.

3.03 PROTECTION OF WATER RESOURCES: The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and groundwaters. Special management techniques shall be implemented to control water pollution.

- A. Protection of Waterways: Construction of drainage facilities and performance of other contract work that will contribute to the control of siltation shall be carried out in conjunction with the earthwork operations or as soon as thereafter as is practicable.

Before or during any suspension of construction operations for any appreciable time, the Contractor shall provide for any temporary erosion control measures deemed necessary. Such efforts shall continue until the permanent drainage facilities have been constructed and, when called for, the protective ground cover is sufficiently established to be an effective erosion deterrent. Should such measures fail and an appreciable quantity of material begins to erode into the natural waterway, the Contractor shall act immediately to bring the siltation under control.

- B. Pollution: The Contractor shall exercise every reasonable precaution throughout the project's life to prevent pollution of rivers, streams, or impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage, and other harmful waste shall not be discharged into or alongside the stream or into natural or manmade channels leading to it. The Contractor shall also comply with the applicable regulations of the State Department of Land and Natural Resources and other statutes relating to the prevention and abatement of pollution.

The Contractor shall conduct his operations near harbors, bays, swimming, and water recreation areas, to avoid and minimize pollution. He shall comply with the applicable regulations of the United States Department of Interior, State Department of Health, and other authorities having jurisdiction.

Monitoring of water areas affected by construction activities shall be the Contractor's responsibility. The Contractor shall monitor all water areas affected by construction activities.

3.04 PROTECTION OF FISH AND WILDLIFE RESOURCES: The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance, and damage of fish and wildlife.

3.05 PROTECTION OF AIR RESOURCES: The Contractor shall keep construction activities under surveillance, management, and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be strictly according to the State of Hawai'i Public Health Regulations, Chapter 43, "Air Pollution Control." Special management techniques as set out below shall be implemented to control air pollution by the construction activities included in the contract.

A. Particulates: Dust particles, aerosols, and gaseous by-products from all construction activities and processing and preparation of materials shall be controlled, including weekends, holidays, and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates that would cause the air pollution standards mentioned above to be exceeded or which would cause a hazard or a nuisance. Sprinkling or other methods approved by the Engineer will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

B. Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits.

C. Odors shall be controlled for all construction activities, processing, and preparation of materials.

D. Monitoring of air quality shall be the responsibility of the Contractor. The Contractor shall monitor all air areas affected by the construction activities.

3.06 PROTECTION FROM SOUND INTRUSIONS: The Contractor shall adhere to the requirements of the Department of Health and shall implement acceptable noise abatement methods to minimize the construction noise level.

Noise shall be kept within acceptable levels in conformance with Title II, Administration Rules, Chapter 43, Community Noise Control, State Department of Health, Public Health Regulations. The Contractor shall obtain the pay for a community noise permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.

All internal combustion engine-powered equipment shall have mufflers to minimize noise and be adequately maintained to reduce noise to acceptable levels.

3.07 POST CONSTRUCTION CLEANUP: The Contractor shall clean up areas used for construction.

3.08 RESTORATION OF LANDSCAPE DAMAGE: The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the

approved work areas. Such restoration shall be per the plan submitted for approval by the Engineer. This work will be accomplished at the Contractor's expense.

- 3.09 MAINTENANCE OF POLLUTION CONTROL FACILITIES: The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.
- 3.10 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL: The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarizing with pollution standards, both statutory and contractual, and installing and care of facilities (vegetative covers and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

END OF SECTION

SECTION 01440 - ARCHAEOLOGICAL FINDINGS

PART 1 - GENERAL

- 1.01 PRESERVATION AND RECOVERY OF HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES: Existing historical, archaeological, and cultural resources within the Contractor's work area will be designated by the Engineer if any have been identified. The Contractor shall take precautions to preserve all such resources as they existed when pointed out to him. The Contractor shall provide and install all protection for these designated resources and be responsible for their preservation during this contract. Suppose during excavation or other construction activities in areas with existing or known resources and any other work area, any previously unidentified or unanticipated resources are discovered or found. In that case, all activities that may damage or alter such resources shall be temporarily suspended. Such temporary suspension of work shall not be attributable to the Contractor. These resources of cultural remains (prehistoric or historic surface or subsurface) include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, parings, wall, or other constructed features; and any indication or agricultural or other uses. The Contractor shall immediately notify the Department of Hawaiian Home Lands (DHHL) upon such discovery or find. The DHHL will notify the State Historic Preservation Officer (SHPO) for further direction when so notified.

As directed by the DHHL, the Contractor may be allowed to continue any operation which would not further disturb the site(s); however, all work within the protected area shall be suspended until the SHPO notifies the Engineer that all investigations or salvage operations have been completed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01750 - GUARANTEE

PART 1 - GENERAL

1.01 GENERAL:

- A. The Contractor guarantees all materials and equipment furnished to be in operable condition upon final acceptance of the work. All such materials and equipment conform to the requirements of this contract and be fit for the intended use.
- B. He further guarantees all such materials and equipment against defects and poor workmanship. To the extent that he is responsible for the design, the Contractor guarantees the design meets the criteria and operating requirements specified against failure to perform per such criteria and operating requirements.
- C. This guarantee period shall commence upon the appropriate agency's acceptance of the work. It shall extend through the project performance evaluation period not to exceed one year for all materials and equipment. This period shall be extended from the time of correction of any defect or failures, corrected under the terms of this guarantee, for a like period for the updated work.
- D. The Contractor shall correct all defects or failures discovered within the guarantee period. The appropriate agency will give the Contractor prompt written notice of such defects or failures following their discovery. The Contractor shall commence corrective work within five (5) days following notification and diligently prosecute such work to completion. The Contractor shall bear all costs of remedial work, including necessary disassembly, transportation, reassembly and retesting, repair or replacement of the defective material or equipment, and any necessary disassembly and adjacent work.
- E. Any period when special equipment is not operable due to failure shall not be considered part of the guarantee period. The guarantee period shall be extended for a like period. If the equipment cannot perform its intended function due to the loss of other equipment, the guarantee period shall be extended for a like period. The equipment's time operating shall be counted as applying to the warranty. Such time shall be determined by using the plant operator's log or other suitable documentation.
- F. If the Contractor fails to perform corrective work in the manner and within the time stated, the Hawaiian Home Lands (DHHL) may proceed to have such work performed at the Contractor's expense, and his sureties will be liable therefore. The DHHL shall be entitled to reasonable attorney's fees and court costs incurred by the Contractor's refusal to honor and pay such costs of corrective work.
- G. The Contractor's performance bond shall continue in full force and effect during this guarantee period.
- H. The rights and remedies of the DHHL under this provision do not preclude the exercise of any other rights or remedies provided by this contract or by law

concerning unsatisfactory work performed by the Contractor.

- I. This guarantee shall be deemed supplemental to guarantee provisions provided in other sections of the specifications for the individual units and systems of units so specified.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02050 – SITE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

The General Requirements preceding these specifications shall govern this Section of the work.

1.02 DESCRIPTION OF WORK:

- A. The extent of selective demolition work is indicated in drawings. Selective demolition work includes, but is not limited to, removal and subsequent disposal of all materials indicated or required to be removed.
- B. It shall be the Contractor's responsibility to examine the project site and determine the existing conditions.
- C. Execute all work orderly and carefully with due consideration for all work items to remain.
- D. Obvious conditions at the site shall be accepted as part of the work, even though they may not be indicated on the Drawings and/or described herein or may vary from that place.
- E. Any debris accumulated from this Section's work shall be disposed of at the site.
- F. Burning of any debris on-site will not be permitted.
- G. Permits, Notice, Etc.:
 - 1. The Contractor shall procure and pay for all necessary permits, certificates, or approvals that may be required in connection with this work.
 - 2. The Contractor shall serve proper notice and consult with the Engineer regarding any temporary barricades and disconnections of electrical or other utility lines in the area which may interfere with the removal work. All such lines, where necessary, shall be adequately disconnected or relocated before commencing with the result.
- H. Carefully remove and store materials indicated for relocation or reinstallation. Record all deficiencies before removal and record them with the Engineer. All damage caused by the Contractor's operations shall be repaired as accepted by the Engineer at no additional cost to the State of Hawai'i.

1.03 SUBMITTALS:

- A. Schedule: Submit two copies of the schedule indicating proposed methods and sequence of operations for selective demolition work to the Engineer for

review before the commencement of work. Include coordination for temporary shut-off and continuation of utility services as required, together with details for weather protection and dust and noise control protection.

1.04 JOB CONDITIONS:

- A. Conditions existing at the time of commencement of contract will be maintained by the State of Hawai'i insofar as practicable.
- B. Do not interfere with the use of adjacent occupied spaces. Maintain free and safe passage to and from occupied spaces.
- C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed as work progresses. Transport salvaged items from the site as they are removed. Storage or sale of removed items on site will not be permitted.
- D. Protections: Provide temporary barricades and other forms of protection as required to protect the general public and staff from injury due to selective demolition work.
 - 1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or elements to be demolished and adjacent facilities or work to remain.
 - 2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
 - 3. Life safety procedures and provisions shall conform with all applicable Federal, State, and County regulations, including HIOSH.
 - 4. Provide accessibility around temporary structures conforming to Americans with Disabilities Act Accessibility Section 201.3 and Section 206.1.
 - 5. Remove protections, obstructions, and barricades after work.
 - 6. Where barriers are erected or placed to facilitate the work, barriers shall not affect or impact the facility's fire exiting route or alarm systems.
- E. Damages: Promptly repair damages caused to adjacent facilities by demolition work at no cost to the State of Hawai'i.
- F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close, block or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from the Engineer. Provide alternate routes around closed or obstructed traffic if required by governing regulations, as directed by the Engineer.
- G. Utility Services: The existence of utility lines other than those shown on the

drawings is not known and is based on available data but is not guaranteed accuracy, nor are there implied guarantees that other obstacles will not be encountered during the work. Should any other utility lines that affect the work be located, the Contractor shall immediately notify the Engineer and follow his direction as to procedure. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations. Do not interrupt existing utilities serving occupied buildings or facilities, except when authorized in writing by the Engineer. Outages and interruptions must be accepted in advance by the Engineer. Submit written notice of outages and interruptions not less than 14 days before the intended outage. Report damage, however slight, immediately. Do not repair or reconstruct any pipe, conduit, or installation without authorization, except perform emergency repairs immediately.

H. Dust Control:

1. Keep dust within acceptable levels at all times, including non-working hours, weekends, and holidays, in conformance with State Department of Health, Title 11, Administrative Rules, Chapter 60. 1 - Air Pollution Control, latest edition.
2. Only wet grinding or concrete cutting will be allowed on exterior surfaces.
3. Mechanical dry sweeping is not permitted. Vacuuming, wet mopping, approved limited dry hand, and wet sweeping is acceptable.
4. Water down debris and waste materials to allay dust during loading operations.
5. The method of dust control and all costs incurred thereof shall be the Contractor's responsibility.
6. All carpets to be removed shall be vacuumed with a commercial vacuum before removal to remove dust particles.

I. Noise Control:

1. Noise shall be kept within acceptable levels at all times in conformance with State Department of Health, Title 11, Administrative Rules, Chapter 46 - Community Noise Control, latest edition. The Contractor shall obtain and pay for a community noise permit from the State Department of Health when the construction equipment or other devices emit noise exceeding the allowable limits.
2. All internal combustion engine-powered equipment shall have mufflers to minimize noise and be adequately maintained to reduce noise to acceptable levels.
3. Starting up of on-site vehicular equipment meeting allowable noise limits shall not be done before 6:45 AM without prior acceptance of the Engineer. Equipment exceeding acceptable noise limits shall not be

started up before 7:00 AM.

- J. Fire Safety: Fire safety during demolition shall comply with NFPA 241, "Standard for Safeguarding Construction, Alteration, and Demolition Operations," and 2012 NFPA 1, "Fire Code," as amended.
- K. Demolition Work: Conform to the State of Hawai'i, Occupational Safety and Health Standards; Subtitle 8, Division of Occupational Safety and Health; Part 3, Construction Standards; Chapter 131.1, Demolition.
- L. Other Control:
 - 1. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being spilled onto the pavement. Wastewater shall not be discharged into existing streams, waterways, or drainage systems such as gutter and catch basins unless treated to comply with Department of Health pollution regulations.
 - 2. Trucks hauling materials shall be covered as required by PUC regulation. Trucks hauling fine materials shall be covered.

PART 2 - PRODUCTS
(Not Applicable)

PART 3 - EXECUTION

3.01 INSPECTION:

- A. Before commencement of selective demolition work, inspect areas where work will be performed. Inventory existing conditions of structure surfaces, equipment, or surrounding properties that could be misconstrued as damage resulting from selective demolition work; photograph, video, or otherwise document and file with the Engineer before starting work.
- B. Test all equipment that is to be relocated or reinstalled before disconnection. File a list of discrepancies with the Engineer before disconnection and relocation. Allow the Engineer 5 working days to verify differences before removal.

3.02 PREPARATION:

Provide temporary security-type weatherproof enclosures for exterior openings resulting from demolition work.

3.03 BARRICADES AND ENCLOSURES:

- A. Erect temporary barricades to prevent people from entering the project area to the extent accepted by the Engineer. The extent of the barricade may be

adjusted as necessary with the Engineer's acceptance. This work shall be accomplished at no extra cost to the State of Hawai'i.

- B. The Contractor shall provide, erect, and maintain lights, barriers, etc., as required by traffic and safety regulations, with particular attention to protecting life.

3.04 SELECTIVE DEMOLITION:

- A. Perform selective demolition work systematically, including all exterior improvements indicated on the drawings. Use such methods to complete work indicated on drawings per demolition schedule and governing regulations.
 - 1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to use power-driven masonry saw or hand tools; do not use power-driven impact tools.
 - 2. Provide services for adequate air and water pollution controls as required by local authorities having jurisdiction. All dust shall be suppressed by a fog spray or other approved method.
 - 3. Water and sewer facilities shall be available for the remainder of the building and in operating condition.
 - 4. The extent of demolition and removal, as shown, are minimum requirements. The Contractor shall be responsible for the extent of work required to adequately accommodate the methods of construction required for the new job. Additional work needed to accommodate construction shall be considered incidental to the new work and shall be done at no additional cost to the State of Hawai'i.
- B. Trenches, holes, depressions, and pits left by the removal of miscellaneous improvements shall be backfilled to the Engineer's satisfaction. Backfill with suitable material and compact to 95 percent maximum dry density as determined by ASTM D 1557, "Laboratory Compaction Characteristics of Soil Using Modified Effort."
- C. If unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the conflict's nature and extent. Submit the report to the Engineer in written, accurate detail. Pending receipt of the Engineer's directive, rearrange the selective demolition schedule to continue overall job progress without delay.

3.05 DISPOSAL OF DEMOLISHED MATERIALS:

- A. Remove debris, rubbish, and other materials resulting from daily demolition operations from the building site. Transport and legally dispose of materials off-site.
 - 1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning

removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on the project site.

B. Locksets on Swing Doors: The Contractor shall remove all locksets from all swinging doors indicated to be removed and disposed of. The Contractor shall give the locksets to the State of Hawai'i after their removal.

3.06 CLEAN-UP AND REPAIR:

A. Upon completion of demolition work, remove tools, equipment, and demolished materials from the site. Remove protections and leave areas broom clean.

B. Repair demolition performed more than that required. Return structures and surfaces to remain in the condition existing before the commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 02100 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.

1.02 DESCRIPTION OF WORK:

- A. Furnish all labor, materials, equipment, and tools necessary to accomplish all clearing and grubbing work as indicated on the plans and specified herein.
- B. It shall be the Contractor's responsibility to examine the project site and determine for himself the existing conditions.
- C. Obvious site conditions existing on the bid opening date shall be accepted as part of the work, even though they may not be indicated on the plans and/or described herein or may vary from that place.
- D. All debris accumulated from clearing or grubbing shall be disposed of off-site weekly and the whole area left clean. The Contractor shall be required to make all necessary arrangements related to the proposed place of disposal.
- E. Burning onsite will not be permitted.
- F. Related Work Specified Elsewhere:
 - Trench Excavation and Backfill Section 02221
 - Temporary Soil Erosion Control Section 02270

1.03 SUBSURFACE SOIL DATA:

- A. Subsurface soil investigations have been made at the DHHL Site and Infrastructure Improvements for Hanapēpē Residential Lots, Phase 2 project site by Geolabs, Inc. entitled "Geotechnical Engineering Exploration, Department of Hawaiian Home Lands, Hanapēpē Residential Subdivision, Phase 2, Hanapēpē, Kaua'i, Hawai'i", dated November 10, 2022. Test pit logs are shown in the soils report. A copy of the complete soils report is available.
- B. The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and when investigations were made.
- C. The soils report and its recommendations are included in these specifications except expressly modified herein.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROTECTION:

- A. Adequate precautions shall be taken before commencing and during the work to protect life, limb, and property.
- B. The Contractor shall protect from damage to all surrounding structures, trees, plants, grass, walks, pavements, utility boxes, etc. The Contractor will repair or replace any damages to the Engineer's satisfaction.

3.02 PERMITS:

The Contractor shall apply for and obtain the necessary permits before the commencement of work. The Contractor shall pay for all fees.

3.03 BARRICADE:

Erect a temporary barricade to prevent people and animals from entering the project area, as approved by the Engineer. Such barricades shall not be less than 5'-0" in height. The extent of barricades may be adjusted with the Engineer's approval. This work shall be accomplished to the satisfaction of DHHL and at no extra cost to DHHL. Barricades shall be removed upon completion of work and job site premises left clean.

3.04 MAINTAINING TRAFFIC:

- A. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, etc.
- B. When necessary, the Contractor shall provide, erect and maintain lights, barriers, etc., as required by traffic and safety regulations, with special attention to protecting life.

3.05 CONSTRUCTION LINES, LEVELS AND GRADES:

- A. The Contractor shall verify all lines, levels, and elevations indicated on the plans before clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the Engineer's attention, and any change shall be made per his instruction. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work within the area affected.
- B. All lines and grades shall be established by a Surveyor licensed in the State of Hawai'i.
- C. Starting clearing and grubbing operations will be construed to mean that the Contractor agrees that the existing grades, inverts, and improvements are correct.

3.06 DEMOLITION, REMOVAL, AND RELOCATION:

- A. Execute all work in an orderly manner, with proper safety precautions observed. Provide warning signs, lights, barricades, etc., as the Engineer requires or directs.
- B. As determined by the Engineer, removed material having no salvage value shall become the Contractor's property and be removed from the premises at no cost to the County.

3.07 CLEARING AND GRUBBING:

- A. The Contractor shall clear off and remove all rubbish, grass and weeds, stumps, large roots, buried logs, garbage, boulders, and other unsuitable material from the area to be graded. Where soft wet soils are encountered, light equipment should be used.
- B. No excavation or filling shall be undertaken until the area has been cleared and grubbed.
- C. Recycling green waste: Where a commercial composting or recycling facility is available on the island on which the project is situated and where economically practical, deliver the green waste material (e.g., yard debris and tree trimming, logs, and stumps, untreated wood, etc.) to a composting or recycling facility for recycling. Confirm the acceptable green waste material types and conditions with the composting facility and pay all applicable charges. Submit a copy of the receipt for disposal (e.g., tipping fees) to the Engineer.

3.08 DISPOSAL:

- A. All removed materials with no salvage value shall be removed from the premises. All removed material with salvage value as determined by DHHL shall be neatly stored on the premise as directed by DHHL.
- B. Excessive accumulation of debris, rubbish, and dirt will not be permitted. All material or debris shall be removed regularly from the site. A fog spray or other dust settling method shall dampen areas with excessive dust and dirt.
- C. All items to be later reused shall be carefully removed, inspected by DHHL, and neatly stored away. Items damaged during removal shall be replaced with a new matching type, size, and shape at no cost to DHHL.
- D. Comply with Federal, State, and local hauling and disposal regulations.

3.09 CONTRACT ZONE LIMITS:

The Contract Zone Limits shown on the plans indicate only the limits of the work involved in general. However, the Contractor must perform any necessary and incidental work that may fall outside of these demarcation lines. The Contractor is also expected to confine

All of his construction activities within the Contract Zone Limits, except as provided hereinbefore, and not to spread his equipment indiscriminately about the area.

3.10 CLEAN-UP:

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

3.11 UNSUITABLE EXCAVATED MATERIAL:

The Contractor shall remove all unsuitable excavated material from the site unless specified otherwise by the Engineer. The wrong material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly but shall be considered incidental to the project.

END OF SECTION

SECTION 02210 – SITE EARTHWORK

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, services, equipment, and related items necessary to excavate, fill, remove, transport, stockpile and dispose of all materials within the limits of the project required to construct the site work improvements per these specifications, dimensions, sections and details shown on the plans, and the approval of KLM.

1.03 RELATED WORK IN OTHER SECTIONS:

- | | |
|--------------------------------|---------------|
| Trench Excavation and Backfill | Section 02302 |
| Temporary Soil Erosion Control | Section 02270 |

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made at the Site and Infrastructure Improvements for Hanapēpē Residential Lots, Phase 2 project site by Geolabs, Inc. entitled “Geotechnical Engineering Exploration, Department of Hawaiian Home Lands, Hanapēpē Residential Subdivision, Phase 2, Hanapēpē, Kaua’i, Hawai’i”, dated November 10, 2022.” Test pit logs are shown in the soils report. A copy of the complete soils report is included in the bid documents.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are included in these specifications except expressly modified herein.

1.04 PROTECTION:

- A. Erosion Control: The Contractor shall incorporate into his work schedule the Temporary Erosion Control Measures and the Permanent Erosion Control procedures indicated on the plans and as specified in the contract.
- B. Dust Control: The Contractor shall make every effort to keep dust minimum. Spraying the ground with water or other control means shall be used wherever possible. The Contractor shall have an adequate water supply for moisture conditioning of fill material.

Without limiting the generality or applicability of other indemnity provisions of the contract, the Contractor agrees that he shall indemnify and hold harmless the Department from and against all suits, actions, claims, demands, damages, costs, and expenses (including but not limited to attorney’s fees) arising out of

any damage to any property whatsoever or injury to any person whomsoever, in any way caused or contributed to by dust from the Contractor's operations.

- C. Existing Utilities and Work Areas: The Contractor shall be responsible for protecting existing surface and subsurface utilities and poles within and abutting the project site, trench excavations, and other work areas. The Contractor will repair or replace any damages to the Engineer's satisfaction.
- D. Finished Grades and Subgrades: All subgrades shall be kept moist until covered by subbase, base course, or concrete. All finished grades shall be kept moist until landscaping or other permanent groundcovers are covered. Where shrinkage cracks are noted after compaction of the subgrade or finished grade, the subgrade or finished grade shall be re-scarified, moisture-conditioned to above the optimum moisture content, and recompacted to the specified requirement at no additional cost to the Department. The Contractor shall properly grade and adequately excavate surfaces during construction to provide positive drainage and prevent water ponding. If ponding of water caused softening of the subgrades, the Contractor shall remove the soft soils and backfill the excavation with compacted fill at no additional cost to the Department.

PART 2 – PRODUCTS

2.01 MATERIALS:

For the DHHL Site and Infrastructure Improvements for Hanapēpē Residential Lots, Phase 2 project, fills, backfills, select borrow, large over-sized rocks, boulders, and rock fill shall conform to the soils report entitled "Geotechnical Engineering Exploration, Department of Hawaiian Home Lands, Hanapēpē Residential Subdivision, Phase 2, Hanapēpē, Kaua'i, Hawai'i", dated November 10, 2022.

PART 3 – EXECUTION

3.01 GRADING:

- A. General: All cuts, fills, and trenching to be constructed shall be monitored by a licensed geotechnical consultant (soils engineer) retained by DHHL, who shall approve all foundation preparation, fill material, and placing methods compaction and perform field density tests during the grading. The Geotechnical Engineer shall notify DHHL that the work appears to be in general conformance with the project documents based on observations and testing. No deviation from these specifications shall be made except upon the written approval of the Engineer and/or other public agencies having jurisdiction.
- B. Excavations: All excavations shall be made to the lines and grades shown on the project plans. All excavation shall be inspected and approved by the Geotechnical Engineer. Where conditions are encountered or required, he shall direct the necessary modifications to be made.

Suitable material from excavation shall be used in the fill, and unsuitable material free of organic material from excavation shall be disposed of in the designated borrow site to replace the material borrowed.

- C. Drainage: Care shall be exercised during grading so that areas involved will drain adequately. Water shall be prevented from running over the slopes by the temporary berms, drainage swales, ditch diversion, silting basins, and the detention basin.
 - D. DD D. Field Testing: The Engineer shall be notified at least two days before grading. A pre-grading conference shall be held between the parties involved to discuss methods of operations, site problems, and scheduling. The Geotechnical Engineer retained by DHHL shall take field density tests.
 - E. Supervision: At all times, the Contractor shall have a responsible field superintendent on the project in full charge of the work with authority to make decisions. He shall cooperate with the Engineer in carrying out the work. Any instructions given to him by the Engineer shall be considered assigned to the Contractor personally.
 - F. Rainy Weather: No fill shall be placed, spread, or rolled during unfavorable weather. When the work is interrupted by rain, operations shall not be resumed until field tests by the Engineer indicate that conditions will permit satisfactory results.
 - G. Unforeseen Conditions: If unforeseen or undetected soil conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc. are encountered, unless otherwise indicated or provided for in the proposal, the Contractor at his sole expense shall make all necessary corrective measures in the field as such conditions are detected.
- 3.02 UNSUITABLE EXCAVATED MATERIAL: The Contractor shall remove all unsuitable excavated material from the site unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly but shall be considered incidental to the project.

END OF SECTION

SECTION 02215 – BLASTING

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Furnish all materials, labor, and equipment required to accomplish all excavation, filling, and grading as indicated on the drawings.
- B. The work specified in this section shall also consist of any blasting used in any excavation process.
 - 1. Definition: The term “controlled blasting” is defined as the excavation of rock in which the various elements of the blast, including hole size, depth, spacing, burden, charge, size, distribution, and delay sequence, are carefully balanced and controlled to provide a distribution of charge that will excavate the rock to the required limits with smooth surfaces. Controlled blasting minimizes overbreak, stressing, and fracturing the rock beyond the design lines. Smooth wall blasting, pre-splitting, cushion blasting, and line drilling are examples of operations included in the term controlled blasting.

1.02 QUALITY ASSURANCE:

- A. Workforce Experience-Blasting:
 - 1. The Contractor shall retain the services of a recognized blasting consultant experienced on similar projects to develop all controlled blasting designs and details.
 - 2. Blasting supervisors shall have five years of experience supervising the loading and firing of charges for excavation of tunnels and shall have all necessary licenses and permits required by Federal, State, and local agencies or others having jurisdiction. The Contractor shall certify that blasting supervisors meet this experience and license requirement.
- B. Requirements of Regulatory Agencies:
 - 1. Permits: The Contractor shall obtain the required permits for all blasting and other operations.
 - 2. Reference Codes: Applicable ordinances, codes, statutes, rules, and regulations of the City & County of Kaua’i, the State of Hawai’i, and the Federal government shall be complied with during the work performance.

1.03 RELATED WORK IN OTHER SECTIONS:

- A. The Contractor must submit a letter of indemnification to the Department of Hawaiian Home Lands (DHHL) for damages and injuries caused by blasting as

determined by the Engineer. This letter must meet the written acceptance of DHHL before the award of the contract.

B. Blast Design: Specifics of proposed blast design shall be submitted before the start of blasting operations and before each change in blast design and shall include the following:

1. Drilling pattern, hole diameters, spacing, depth, and inclination.
2. Type, strength, the amount in weight, and the number of cartridges of explosives proposed for use in each hole, on each delay, and the total for the blast.
3. Distribution of the charge in the holes, priming of each hole and stemming of holes.
4. Type, sequence, and a number of delays, delay pattern, wiring diagram for a blast, size and type of hookup lines and lead lines, type and capacity of firing source, and condenser discharge blasting machine.
5. Written evidence of the qualifications of the person or persons who will be directly responsible for supervising, loading, and firing the shot.
6. Proposed schedule of dates/times of each shot. The Contractor shall notify the surrounding subdivisions and commercial properties of the blasting schedule a minimum of two (2) weeks before commencing blasting activities.
7. Blast design shall be subject to review and acceptance by the Engineer. The inappropriate design will be rejected. Review by the Engineer of the blast design and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy, and safety of the blasting operations or for exercising proper fired supervision and judgment and producing the results required by these specifications.

C. Daily Records: Daily records of all blasting operations shall be maintained. The Engineer shall be provided with one copy of each day's work history on the following workday. The following data shall be included in the daily record:

1. Unusual occurrences include rock falls, unstable ground, groundwater problems, work delays, equipment malfunction, and the time of each occurrence.
2. A complete description of each blast round used, including:
 - a. Date, time, and limits of the blast.
 - b. A diagram of the appropriate blast pattern indicates holes not drilled, drilled but not loaded, changes in spacing or pattern of delays or loading of holes, and burden of the round.

- c. The number of explosives used by weight and number of cartridges.
- d. The Total number of delays used and the number of holes for each delay period.
- e. An evaluation of the blast indicated areas of significant overbreak and planned adjustments for the next blast.
- f. Location and elevation of significant rock strata boundaries and a brief description of the rock.

PART 2 – MATERIALS

2.01 BLAST MONITORING EQUIPMENT: The Contractor shall provide a minimum of two, 10 to 200 Hertz three-component recording blast seismographs with three-component seismic wave paper trace self-calibration capability variable trigger level setting, an digital peak particle velocity memory operation (in inches per second). One seismograph shall have an airwave detector for monitoring air blast overpressures. The Contractor shall maintain these devices for use in monitoring blasting vibrations.

PART 3 – EXECUTION

3.01 PROTECTIVE MEASURES:

- A. All excavation shall be protected and guarded against danger to life, limb, and adjacent properties.
- B. Shoring shall be provided and installed by the Contractor as required to safely preserve the excavations and earth banks free from damages resulting from the work.
- C. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove the water to the extent required in carrying on the work. Grading shall be controlled to slate the ground surface properly to prevent water runoff from entering open trench excavations.
- D. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, traffic, adjacent properties, etc.

The Contractor shall schedule all work that involves excessive noise, dust, dirt, or any other detrimental aspect of this work to have minimum disruptions.

3.02 LAYING OUT:

- A. The laying out of baselines, the establishment of grades, and staking out the

entire work shall be done by a Licensed Professional land Surveyor, licensed in the State of Hawai'i, at the Contractor's expense, and he shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batter boards showing construction lines and levels.

- B. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Engineer before proceeding further with the work; otherwise, he will be held responsible for any costs involved in the correction of construction due to such discrepancies.

3.03 JOB CONDITIONS FOR BLASTING:

A. General Safety Requirements:

1. Work shall be performed to minimize hazards and exposure of the public, construction personnel, and equipment to hazardous and potentially hazardous conditions.
2. The Contractor shall coordinate all blasting operations with other contractors. The Contractor shall make all reasonable efforts to perform his work with minimal disruptions to work by other contractors.
3. Contractor shall physically sweep and survey the area to be shot immediately before a blast and document who did it and that it was done since kids are known to loiter in the Village 4 area.
4. The Contractor shall place personnel at commonly known approaches to the blasting zones or known footpaths during blasting operations to divert pedestrians from the site during blasting operations.
5. The Contractor shall place warning signs at apparent approaches to blasting areas and known footpaths.
6. The Contractor shall notify the Department of Hawaiian Home Lands of planned dates of blasting 72 hours in advance.

B. Blasting:

1. Blasting patterns shall be maintained not to exceed 2 inches per second peak radial particle velocity at the ground line of the nearest structure for distances greater than 35 feet.
2. Special procedures shall be implemented for utilities and improvements closer than 35 feet, and 2 inches/second velocities will be permitted if no damage is sustained. The Contractor shall adopt trial blast procedures with monitoring or vibrations and inspection for damage. Charge weights per delay shall be adjusted as experience indicates.
3. Blasting operations shall be controlled so that air blast overpressures shall not exceed 0.02 pounds per square inch at any structure.

4. The Contractor shall take measurements to determine if the Contractor's operations exceed the specified particle velocity and overpressure limitations. The data will be available to the Engineer.
5. Suppose the data indicates that the particle velocity or overpressure limitations are not met. In that case, measures shall be taken to reduce particle velocity or overpressure to the specified levels, including reducing the size of the charge and changing blasting delays by shortening the length of the blast round.

C. Damages:

Reference is made to DHHL Interim General Conditions 2.5, 7.17, and 7.19, which shall apply to any blasting conducted by the Contractor intended for the work under this contract.

END OF SECTION

SECTION 02270 – TEMPORARY SOIL EROSION CONTROL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. Hawai'i Standard Specifications for Road and Bridge Construction, 2005, as applicable to the County of Kaua'i, except for subsections regarding "Measurements" and "Payment"; referred to as "Standard Specifications."

Section 209 – Temporary Water Pollution, Dust, and Erosion Control

Amend **Section 209.01" Description"** to replace lines 5 to 22 with the following:
"209.01 Description.

(A) Including detailed plans, diagrams, and written Site-Specific Best Management Practices (BMP); constructing, maintaining, and repairing temporary water pollution, dust, and erosion control measures at the project site, including local material sources, work areas, and haul roads; removing and disposing of hazardous wastes; control of fugitive dust (defined as uncontrolled emission of solid airborne particulate matter from any source other than combustion); and complying with applicable State and Federal permit conditions.

(B) Work associated with construction stormwater, dewatering, and hydro testing activities and complying with conditions of the National Pollutant Discharge Elimination System (NPDES) permit(s) authorizing discharges associated with construction stormwater, dewatering, and hydro testing activities.

(C) Potential pollutant identification and mitigation measures are listed in Appendix A for use in developing the Contractor's Site-Specific BMP.

This section also applies to construction support activities, including concrete or asphalt batch plants, rock crushing plants, equipment staging yards/areas, material storage areas, excavated material disposal areas, and borrow areas located outside the State Right-of-Way. For areas serving multiple construction projects or operating beyond the completion of the construction project it supports, the Contractor shall be responsible for securing the necessary permits, clearances, and documents, and following the conditions of the permits and clearances, at no cost to the State."

- C. Construction Best Management Practices (BMPs) for the County of Kaua'i, May 2001.
- D. Conform to the requirements of the State of Hawai'i Department of Health for the National Pollution Discharge Elimination System (NPDES) Permit.
- E. Conform to the applicable requirements of the water quality and water pollution control standards contained within Hawai'i Administrative Rules, Title 11, Chapter 54, "Water Quality Standards," and Title 11, Chapter 55, "Water Pollution Control.
- F. Do not commence site clearing or disturbing earth operations until temporary erosion and sedimentation controls are in place.

- G. American Society for Testing and Materials (ASTM):
 ASTM D 4439 (2004) Geosynthetics
 ASTM D 4491 (1999a; R 2009) Water Permeability of Geotextiles by Permittivity
 ASTM D 4533 (2004; R 2009) Trapezoid Tearing Strength of Geotextiles
 ASTM D 4632 (2008) Grab Breaking Load and Elongation of Geotextiles
 ASTM D 4751 (2004) Determining Apparent Opening Size of a Geotextile
 ASTM D 4873 (2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

1.02 DESCRIPTION OF WORK:

- A. Submit three (3) sets of erosion control materials for approval by the Engineer. Furnish all labor, materials, services, equipment, and related items necessary to implement the temporary erosion control measures, submitted separately, as required by these specifications and as ordered by the Engineer during the life of the contract to control water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.
- B. Temporary erosion and siltation control measures as described herein shall be applied to any erodible material within this project, including local material sources and work areas.
- C. The Contractor shall be responsible for providing the necessary erosion control measures shown on the plans or which may be ordered by the Engineer. All grading operations shall be performed in conformance with the applicable provisions of the "Water Pollution Control and Water Quality Standards" in the "Public Health Regulations," State Department of Health.
- D. The Contractor shall be responsible for promptly (next day after storms) removing all silt and debris resulting from his work and deposited in drainage facilities, roadways, neighboring lands, and other areas.
- E. Related Work Specified Elsewhere:
 Site Earthwork Section 02210

PART 2 – PRODUCTS

2.01 MATERIALS:

- A. Mulches: To be bagasse, hay, straw, fiber mats, netting, wood cellulose, bark, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds deleterious materials.
- B. Slope Drains: To be constructed of fiber mats, plastic sheets, or other materials acceptable to the Engineer.

PART 3 – EXECUTION

3.01 TEMPORARY EROSION CONTROL:

- A. The Engineer has the authority to limit the surface area exposed by clearing and grubbing and limit the surface area exposed by excavation, borrow and fill operations. The Engineer may also direct the Contractor to provide immediate, permanent, or temporary pollution control measures to prevent contamination of streams, lakes, ponds, drainage channels and pipes, roads, neighboring lands, and other areas.

Except for specified measures shown on the plans, the Contractor shall determine the appropriate erosion control measures to use. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, temporary mulches, mats, and grass or the construction and use of other control devices or methods as necessary to control erosion.

- B. The Contractor shall incorporate all erosion control measures shown in the plans. The erosion controls may be modified as necessary to adjust to conditions during construction. All modifications are subject to approval by the Engineer.
- C. The Contractor shall limit the surface area exposed by grubbing, stripping of topsoil, and grading to that which is necessary for him to perform the following operation and which is within his capability and progress in keeping the finish grading, mulching, grassing, and other such pollution control measures current.

The grubbing of the vegetative root mat and stumps and the stripping of topsoil shall be confined within the grading limits, which can be actively and continuously prosecuted within 15 calendar days. The area to be graded shall be limited to the minimum extent necessary to accommodate the Contractor's equipment and workforce and shall not exceed 15 acres, unless otherwise stated on plans, without prior approval of the Engineer.

Any area remaining bared or cleared for more than ten calendar days and which is not within the limits of active construction shall be immediately hydro-mulch seeded or remedied as directed by the Engineer at the Contractor's expense without cost to the Department. All areas where finish grading has been completed shall be grassed within three calendar days after the completion of grading for that area.

- D. The Contractor shall, at the end of each work operation on any one day, shape the earthwork in such a manner as to control and direct the runoff to minimize the erosion of soils. He shall construct earth berms along the top edges of embankments or the property line with adjacent properties, streams, and water channels to intercept any runoff. Temporary slope drains shall be provided to carry runoff from the top of cuts and fills. Temporary facilities for controlled discharges shall be provided for runoff impounded, directed, controlled by project activities, or any erosion control measure employed.
- E. Cut slopes shall be shaped, topsoil added if necessary, and planted as the work progresses. In no case shall the exposed surface be greater than 15 feet in

height. Whenever major excavation is suspended or halted, and the slope is bared for more than 15 consecutive days, the exposed surfaces shall be hydro-mulch seeded or protected as directed by the Engineer at the Contractor's expense without cost to the Department of Hawaiian Home Lands.

Fill slopes shall be finished as specified and per the requirements outlined for cut slopes above.

- F. Construction of berms, cofferdams, or other construction in or near the vicinity of streams, ponds, waterways, or other bodies of water shall be with approved materials.
- G. The temporary erosion and siltation control measures outlined in these specifications are minimum requirements. They shall not preclude the provision of any additional measures which the Contractor may deem necessary. Damages caused by the erosion of soils and the pollution of downstream areas shall be the Contractor's responsibility. All costs for repairing, correcting, replacing, and cleaning damaged or polluted facilities shall be borne by the Contractor.

END OF SECTION

SECTION 02282 – SOIL TREATMENT FOR VEGETATION CONTROL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. This work shall consist of furnishing all labor, materials, and incidentals necessary to apply weed killer on prepared subgrade below gravel layer within the pump station.

1.02 DESCRIPTION OF WORK

This work shall spray weed killer on the subgrade of all existing unpaved areas where new pavement or building structures are constructed.

1.03 SUBMITTALS

- A. Before installation, submit to the Engineer affidavits from the manufacturers or suppliers of the weed killer to be furnished and applied under this section certifying that such materials delivered to the project conform to the requirements of these specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

Weed Killer shall be "Casoron 4G", "Norosac 4G", or an approved equal for under asphalt application on new or rebuilt pavement, and shall be "Hyvar X," "Roundup," or approved equal for application to existing weeds for resurfacing jobs.

PART 3 - EXECUTION

3.01 APPLICATION

- A. The Weed killer shall be mixed and uniformly spread using calibrated application equipment at the maximum rates permitted under asphalt use and according to the manufacturer's label.

Base course material shall be installed as soon as possible after applying the weed killer to preclude loss of germination inhibiting action.

- B. In the treatment of existing growth on resurfacing pavement areas, the weed killer shall be mixed and uniformly sprayed according to the manufacturer's label.

- C. Nut grass shall be retreated two days after initial application and if growth still exists.
- D. The Contractor shall notify the Engineer 24 hours before applying weed killer.

END OF SECTION

SECTION 02302 – TRENCH EXCAVATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.

1.02 DESCRIPTION OF WORK:

This item shall consist of trenching, excavating, and backfilling for utilities and their appurtenances complete.

PART 2 - PRODUCTS

2.01 BACKFILL MATERIALS:

- A. Backfill the trench with excavated on-site materials or imported materials as described herein below:
 1. Place 6-inch thick granular free-draining materials such as bedding sand or open-graded gravel per ASTM C33, No. 67 gradation.
 2. The backfill should be moisture conditioned to at least 2 percent above the optimum moisture content, placed in maximum 8-inch level loose lifts, and mechanically compacted to not less than 90 percent relative compaction.
 3. Where trenches are located in the pavement areas, the upper 3 feet of the trench backfill below the pavement grade should be compacted to at least 95 percent relative compaction. Compaction efforts by water tamping, jetting, or ponding should not be allowed.

PART 3 - EXECUTION

3.01 EXCAVATION:

- A. Trenching shall be carried to the lines and depths indicated and required to install structures properly. The bottom of the trenches shall be excavated to a sufficient depth to install bedding material. Trenches shall be excavated to a minimum of 6 inches on either side of the piping or structures and such additional widths as required for proper installation and inspection. The bedding material supporting the piping shall be compacted and shaped to fit the bottom quadrant of the piping with allowance for bells and joining. Trenches shall be kept dry and clean and adequately protected from the entry of surface water.

- B. When unsuitable material is encountered at the trench excavation, the Contractor shall be responsible for hauling and disposing of the material.
- C. When the subgrade material below the established trench grade is unstable, such as muck, buried debris, or lava cavities, excavate below grade to such depth and width as directed by the Soils Engineer. Fill the excavated area below grade with structural fill or crushed rock cushion fill within 6 inches of the invert grade or to the bottom of the concrete jacket or cradle.
- D. Over-Excavation: Refill and compact any part of the trench bottom excavated below the established grade with structural fill material to within 6 inches of the pipe invert or to the bottom of the concrete jacket or cradle of trench over-excavation.

The Contractor shall backfill and compact all over-excavated areas at his own expense.

- E. Surplus Material: Material resulting from trench and structure excavation shall be used by the Contractor for backfilling, filling, and grading to the extent required as specified in these specifications. The Soils Engineer shall determine whether or not excavation material is suitable for use as fill. All unsuitable material shall be disposed of off-site by the Contractor.

3.02 BACKFILLING AND COMPACTING:

- A. The first lift shall be backfilled by hand shoveling and tamping so that the backfill materials are in contact with the entire periphery of the pipe. Power equipment shall be of the front loader type where unloading of backfill material into the trench can be controlled so that the pipe is not damaged nor moved from its installed position. The backfill shall be compacted to a minimum of 90 percent relative compaction.
- B. The work shall be performed without damage to the pipe and trench so that water will not be impounded.
- C. All trench backfill placed above 12 inches of the top of the pipes shall be compacted in a maximum loose lift thickness of 12 inches unless specifically authorized in writing by the Soils Engineer.
- D. Compaction of trench backfill shall not be less than 95 percent relative compaction. The compaction requirement of the trench backfill within 3 feet of the finished grade and footing foundations shall be a minimum of 95 percent relative compaction.
- E. Mechanical tamper or vibratory compactor may be used in compacting each layer, provided that the backfill lift thickness considers the size of the compaction equipment used. The Contractor shall be responsible for protecting the pipe or structure while placing and compacting the backfill material.

- F. Jetting shall not be permitted. All backfilling shall be under the observation of the Soils Engineer. The Contractor shall notify the Soils Engineer before any backfilling.
- G. To avoid undermining the footings, G. Contractor should not encroach into a 45-degree imaginary plane that extends downward from the bottom of the existing spread footings.

3.03 EXISTING UTILITY LINES:

All underground lines, which are to remain, shown on the drawings or made known to the Contractor, and are in the path of new sanitary sewer, water, or storm drain lines shall be uncovered at points where they are in the way of such new piping. The sizes and invert elevations of the existing pipe and maintenance holes shall be ascertained. Any discrepancies, which would prevent the Contractor from laying lines to the established grades, shall be brought to the Engineer's attention immediately and before commencing work.

3.04 RESTORATION OF EXISTING PAVEMENT AND OTHER IMPROVEMENTS:

All restoration work shall conform to the requirements of the jurisdictional government agencies and under these specifications. Unless specified otherwise in the proposal, restoration work shall be considered incidental to the various related work items.

END OF SECTION

SECTION 02510 – WATER SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this Section of the work.
- B. "Standard Specifications for Public Works Construction," Department of Public Works, dated September 1986, as amended and from now on referred to as the "Standard Specifications" (FOR ALL CONSTRUCTION OUTSIDE OF THE RIGHT-OF-WAY).
- C. "Standard Details for Public Works Construction," Department of Public Works, dated September 1984 as amended as "Standard Details."
- D. Water System Standards, Department of Water Supply, County of Kaua'i, State of Hawai'i, 2002; hereinafter referred to as "Water System Standards." All references to measurement and payment do not apply to this project.
- E. Department of Health, State of Hawai'i:
 - 1. Chapter 20 of Title II, Administrative Rules "Potable Water Systems," 1981.
 - 2. Chapter 21 of Title II, Administrative Rules "Cross Connection and Backflow Control," 1981.
- F. American Society for Testing and Materials (ASTM) Publications:
 - ASTM B 32-89 Specifications for Solder Metal
 - ASTM B 88-89 Specifications for Seamless Copper Water Tube
- G. Permits: The Contractor shall make necessary deposits and/or pay for required permits for work under this Section as required by the County or State rules and regulations.

1.02 DESCRIPTION OF WORK:

- A. This Section includes furnishing all labor, materials, equipment, and incidentals necessary to install a new water lateral, as shown on the drawing.
- B. Related Work Specified Elsewhere: SECTION 02302 – TRENCH EXCAVATION.

1.03 SUBMITTALS:

- A. Product Data: Manufacturer's product data and installation instructions. All materials shall be provided with identification marks and data required by the Water System Standards.

- B. Test Results: Test results as required in the Water System Standards for the water distribution system.
- C. Certificates:
 - 1. Before installation, furnish affidavits from the Manufacturers or suppliers of pipe, fittings, etc., certifying that such materials delivered to the project conform to the requirements of these specifications.
 - 2. Certificate of Water System Chlorination.
 - 3. All other certificates as required by the Water System Standards.
- D. As-Built Drawings: Record drawings of the water system.

PART 2 – PRODUCTS

2.01 LOCATION AND ADJUSTMENT OF EXISTING UTILITY LINES:

- A. Before commencement of work, the Contractor shall study and analyze the vertical and horizontal alignment of all new subsurface utilities to be installed for conflicts in the routing of these lines, especially in the vertical direction. The Contractor shall identify any such conflicts before construction to allow the Engineer to make revisions to avoid such conflicts.
- B. The Contractor shall be responsible for laying out the various utility lines shown on the contract drawings and provided elsewhere in these specifications. The locations of the various existing utility lines shown on the contract drawing, which the new lines are to cross over or under or connect to, were determined based on the best information available; however, no assurance can be provided that the actual locations will be precise as shown on the contract drawing. Expose all existing utility lines at the crossing before installation, and any interference encountered should be reported to the Engineer, and his instructions followed.
- C. In performing all work, the Contractor shall exercise the due care and caution necessary to avoid any damage to and impairment in using any existing utility line. 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.

2.02 MATERIALS:

- A. Materials shall be per the following sections of the "Water System Standards":

Materials - Volume 1, Part 2:

- 1. Valves and appurtenances – Section 6
- 2. Cast iron manhole covers, frames, rungs, eyebolts, valve box covers,

and frames – Section 8

3. Pre-molded filler, crushed rock, pipe cushion, backfill material – Section 10
4. Reduced pressure principle backflow prevention assembly – Section 4

B. Pipes and Fittings:

1. Pipe and fittings shall be copper tubing, Type "K" conforming to ASTM B 88.
2. Solder shall conform to ASTM B 32, solder containing only 0.2 percent lead.

- C. Buried Warning and Identification Tape: Tape shall be polyethylene plastic or 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 on rolls, 3-inch minimum width, color-coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Notice and identification to read, "CAUTION, BURIED POTABLE WATER LINE BELOW" or similar wording. Color and printing are to be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Blue Water System

- D. All other materials not specified herein shall be as specified in the References.
- E. Connection to existing water line shall be by the Contractor. The Contractor shall schedule the connection work and arrange for an inspection of the work with the Engineer.

2.03 EXCAVATION AND BACKFILL:

- A. Trench excavation and backfill for the laying and installing the water lateral to the required line and grade and structure excavation for the construction of the appurtenant structures shall be governed by SECTION 02302 – TRENCH EXCAVATION.
- B. The Contractor shall use surplus material resulting from trench and structure excavation or backfilling, filling, and grading to the extent required in these specifications. In performing any work within the project area, the Contractor shall exercise due care to keep any damages to existing improvements to an absolute minimum. The Contractor shall be responsible for repairing, replacing, and/or restoring all damages to existing improvements to the Engineer's satisfaction.

2.04 FINAL INSPECTION:

At the final inspection of the work performed under the contract, the utilities covered by this Section shall be complete and operating as designed. All surplus materials in every character resulting from the work of this Section shall have been removed. Water systems shall be free from sand, silt, or other obstructions. After this inspection, all defects discovered in the utilities shall be corrected before final acceptance.

PART 3 – EXECUTION

3.01 WATER LATERAL INSTALLATION:

- A. All work shall be done per the "Water System Standards."
- B. The Surveyor shall precisely lay out the various exterior utility lines shown on the Contract Drawings. The locations are shown on the Contract Drawings of the various existing utility lines to which the new lines are to cross over or under or connect determined based on the best information available; however, no assurance can be provided that the actual locations will be precise as shown on the Contract Drawings.
- C. In performing all work, the Contractor shall exercise the due care and caution necessary to avoid any damage to and impairment in using 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 minimum excavated width for any utility trench is such that at least 14 inches of clearance exist between the edge of the utility pipe and the excavated trench sidewall before utility pipe placement. Insufficient space between the utility pipe and trench wall could lead to inadequate backfill compaction and potential pipe failure.
- E. All utility backfills shall be placed in horizontal lifts for the full width of the utility trench before compaction. In over-widened trenches, such as trenches excavated in hard rock, arching or shaping the initial bedding lifts shall not be allowed.
- F. Shallow temporary utility trench excavations will install the required utility lines. All vertical, steeply-sided trench excavations deeper than 5 feet should be braced and shored according to good construction practices and applicable safety ordinances and codes.

END OF SECTION

SECTION 02520 – CONCRETE HEADERS, SIDEWALKS, AND CURB RAMPS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. "Hawai'i Standard Specifications for Road and Bridge Construction," Department of Transportation, Highways Division, 2005 and from now on referred to as "Standard Specifications." Measurement and payment provisions on these specifications do not apply to this project.
 - 1. Section 203 – Excavation and Embankment
 - 2. Section 204 – Excavation and Backfill for Miscellaneous Facilities
 - 3. Section 304 – Aggregate Base Course
 - 4. Section 634 – Portland Cement Concrete Sidewalks
 - 5. Section 638 – Portland Cement Concrete Curb and Gutter
 - 6. Section 650 – Curb Ramps
 - 7. Section 701 – Hydraulic Cement
 - 8. Section 703 - Aggregates
- C. Standard Details for Public Works Construction, September 1984 and as amended as applicable to County of Kaua'i; referred to as "DPW Standard Details."

- 1.02 DESCRIPTION OF WORK: Furnish all labor, materials, tools, equipment, and related items necessary to complete, in place, concrete curbs, gutters, sidewalks, and wheelchair ramps in conformity with the dimensions, profiles, sections, and details shown on the plans.

PART 2 – PRODUCTS

- 2.01 MATERIALS: Materials shall conform to the DPW Standard Specifications sections noted herein.

PART 3 – EXECUTION

- 3.01 INSTALLATION: The Contractor shall be responsible for precisely laying out the curbs, gutters, sidewalks, driveway aprons, and curb ramps shown on the contract plans per the sections of the DPW Standard Specifications noted hereinbefore. The Contractor shall note that the plan and profile curb grades are based on the standard 6-inch high

curbs and shall make necessary adjustments for the difference in the roll curb's height as shown in the DPW Standard Details.

3.02 QUALITY CONTROL FOR CURB RAMPS: The Contractor shall install curb ramps to the dimensions and grades shown in the plans. Installation of the curb ramps shall be within the tolerance range shown in the table below.

CONSTRUCTION TOLERANCE		
Surface Slope per Plans	Allowable Slope Tolerance	Allowable Flatness Tolerance
Less than 5%	+0.9% max.	1/4" max. gap
5% - 8.3%	+1.2% max.	3/8" max. gap
Greater than 8.3%	+1.5% max.	1/2" max. gap
For Horizontal Plan Measurements, Length of Intended Dimension		Horizontal Tolerance Allowed
Less than 12."		+1/4" or -1/4"
12" - 36"		+3/8" or -3/8"
Greater than 36."		+1/2" or -1/2" in each 10.'

The method of measuring the surface requires a 24-inch long digital level to be placed so that when set on the measured sloped surface, it reads the steepest slope of any part of the measured surface.

The measuring of flatness requires a 24-inch long level to be placed, so it is centered over any trough or balanced on a ridge with an equal gap at both ends of the level. Measure the gap under the level at troughs and the end of the level at ridges.

Horizontal measurements are to be made with steel tape.

END OF SECTION

SECTION 02530 – SANITARY SEWER SYSTEM

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this Section of the work.
- B. Specific sections of the "Standard Specifications for Public Works Construction," Department of Public Works, dated September 1986, as amended and from now on referred to as the "Standard Specifications" (FOR ALL CONSTRUCTION OUTSIDE OF THE RIGHT-OF-WAY).
- C. "Standard Details for Public Works Construction," Department of Public Works, dated September 1984 as amended and referred to as the "Standard Details."
- D. Current applicable Uniform Plumbing Code.
- E. Permits: The Contractor shall make necessary deposits and/or pay for required permits for work under this Section as required by the County or State rules and regulations.

1.02 DESCRIPTION OF WORK:

- A. This Section includes furnishing all labor, materials, equipment, and incidentals necessary to install a new sewer lateral, as shown on the drawing.
- B. Related Work Specified Elsewhere:
SECTION 02302 – TRENCH EXCAVATION.

1.03 SUBMITTALS:

- A. Submit in accordance to SECTION 01300 – SUBMITTALS.
- B. Product Data: The manufacturer's product data references industry standards and installation instructions for each item to be incorporated into the system. Products shall be provided with identification marks and data as required by the "Standard Specifications." Submit manufacturer's catalog data for pipes and fittings.
- C. Shop Drawings: Submit shop drawings for the pipes, fittings and sewer pump replacements.
- D. Test Reports: Test results for product tests performed per the "Standard Specifications."
- E. Certificates: Before installation, submit affidavits from the manufacturers or suppliers of pipe and fittings certifying that such materials delivered to the project conform to the requirements of these specifications.

- F. As-Built Drawings: Record drawings of the sewerage system.

PART 2 – PRODUCTS

2.01 LOCATION AND ADJUSTMENT OF EXISTING UTILITY LINES:

- A. Before commencement of work, the Contractor shall study and analyze the vertical and horizontal alignment of all new subsurface utilities to be installed for conflicts in the routing of these lines, especially in the vertical direction. The Contractor shall identify any such conflicts before construction to allow the Engineer to make revisions to avoid such conflicts.
- B. The Contractor shall be responsible for laying out the various utility lines shown on the contract drawings and provided elsewhere in these specifications. The locations of the various existing utility lines shown on the contract drawing, which the new lines are to cross over or under or connect to, were determined based on the best information available; however, no assurance can be provided that the actual locations will be precise as shown on the contract drawing. Expose all existing utility lines at the crossing before installation, and any interference encountered should be reported to the Engineer, and his instructions followed.
- C. In performing all work, the Contractor shall exercise the due care and caution necessary to avoid any damage or impairment in using any existing utility line. 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.

2.02 MATERIALS:

- A. Piping shall be C-900 polyvinyl chloride (PVC).
- B. Materials for the gravity sewer lateral line and fittings shall be PVC pipe unless otherwise indicated.
- C. Materials for the sewer cleanouts shall be PVC and conform to the current Uniform Plumbing Code requirement.
- D. Connection to existing sewer line shall be by the Contractor. The Contractor shall schedule the connection work and arrange for an inspection of the work with the Engineer.
- E. Replacement sewer pumps shall be equal or better than the existing Godwin CD103M 4-inch pump at the Riverside Sewer Pump Station (SPS) No. 1 and equal or better than the existing Godwin CD160M 6-inch pump at the Fire Station SPS No. 2.
- F. Pump performance for the 4-inch pump
 - a. Suction connection: 4"

2.03 EXCAVATION AND BACKFILL:

- A. Trench excavation and backfill for the laying and installation of the sewer lateral to the required line and grade and structure excavation for the construction of the appurtenant structures shall be governed by SECTION 02302 – TRENCH EXCAVATION.
- B. The Contractor shall use surplus material from trench and structure excavation for backfilling, filling, and grading to the extent required as specified in these specifications. In performing any work within the project area, the Contractor shall exercise due care to keep any damages to existing improvements to an absolute minimum. The Contractor shall be responsible for repairing, replacing, and/or restoring all damages to existing improvements to the Engineer's satisfaction.

2.04 FINAL INSPECTION:

At the final inspection of the work performed under the contract, the utilities covered by this Section shall be complete and operating as designed. All surplus materials in every character resulting from the work of this Section shall have been removed. Sanitary sewer systems shall be free from sand, silt, or other obstructions. After this inspection, all defects discovered in the utilities shall be corrected before final acceptance.

PART 3 – EXECUTION

3.01 SANITARY SEWER LATERAL SYSTEM INSTALLATION:

- A. All work shall be done per the "Standard Details" and the applicable Uniform Plumbing Code.
 - 1. The Surveyor shall precisely lay out the various exterior utility lines shown on the Contract Drawings. The locations are shown on the Contract Drawings of the various existing utility lines to which the new lines are to cross over or under or connect determined based on the best information available; however, no assurance can be provided that the actual locations will be precise as shown on the Contract Drawings.
 - 2. In performing all work, the Contractor shall exercise the due care and caution necessary to avoid any damage or impairment in using 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.
 - 3. Provide cleanouts where shown on the drawings and as required by the Plumbing Code.
 - 4. Installation of Joints: Joints for a pipe using flexible, watertight, rubber-type gaskets. Installation of joints shall be per the manufacturer's recommendations of the joint material.

5. The minimum excavated width for any utility trench is that at least 14 inches of clearance exist between the edge of the utility pipe and the excavated trench sidewall before utility pipe placement. Insufficient space between the utility pipe and trench wall could lead to inadequate backfill compaction and potential pipe failure.
6. All utility backfills shall be placed in horizontal lifts for the entire width of the utility trench before compaction. In over-widened trenches, such as trenches excavated in hard rock, arching or shaping the initial bedding lifts shall not be allowed.
7. Shallow temporary utility trench excavations are anticipated to install the required utility lines. All vertical, steeply-sided trench excavations deeper than 5 feet should be braced and shored according to good construction practices and applicable safety ordinances and codes.
8. The Contractor shall provide the replacement pumps in coordination with the County of Kaua'i Wastewater Division. Refer to the contract drawings.

END OF SECTION

SECTION 02577 - PAVEMENT MARKERS, STRIPING, AND MARKINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work

1.02 DESCRIPTION OF WORK:

- A. Furnish all labor, materials, and equipment required to install all pavement markers, reflectorized white and yellow traffic pavement striping, and other markings in conformance to the DPW Standard Specifications and these plans and specifications. This work shall also include removing existing pavement markers and removing or eradicating existing pavement striping and markings when called for in the plans and/or directed by the Engineer.

- 1.03 SUBMITTALS: Submit material certifications, test results, and brochures for all pavement markers and traffic paint materials.

PART 2 - PRODUCTS

- 2.01 MATERIALS: Materials shall conform to the requirements of Pavement Markers, Adhesives for Pavement Markers, and Thermoplastic Pavement Markings, as specified in the State of Hawai'i Standard Specifications for Road and Bridge Construction, 2005 and these specifications.

PART 3 - EXECUTION

- 3.01 GENERAL: Pavement markers and markings shall be applied to surfaces that have been thoroughly cleaned and are free of dirt, dust, curing compound, grease, oil, moisture, loose aggregates, unsound layers, and any other material which would adversely affect the bond of the adhesive or paint.

In installing pavement markers, the cleaning of Portland cement concrete and asphalt concrete surfaces shall be done by blast cleaning. Clean, newly placed asphalt concrete need not be blast cleaned unless the surface contains an abnormal amount of asphalt or the surface is contaminated with dirt, grease, oil, or any other material which would adversely affect bonding.

Unless otherwise specified, the Contractor shall establish control points spaced at intervals to ensure the accurate location of pavement markers and striping. Markers and tape shall not be applied when moisture or foreign matter is present on the pavement surface or when wind conditions are such as to cause dust to be deposited on the prepared areas or to prevent the satisfactory application of the marker adhesive or paint.

The Contractor shall paint temporary guidelines and outline of arrows, legends, and crosswalks with a 2-inch wide brushed line on the day the roadway is opened to traffic. The County of Kaua'i shall approve before permanent lines are placed.

The Contractor shall furnish and place all warning and directional signs necessary to direct and control the traffic during marker installation or the striping operations. Warning signs shall be set up before the beginning of each operation, and extra signs shall be kept well ahead of the marking equipment.

The Contractor shall install all markers and apply all pavement striping before opening roadways to public traffic, except that when connections to existing pavements are made, or temporary detours carry public traffic, the Contractor shall mark or stripe the connecting pavements on the day that the roadway is open to traffic.

If it is necessary to run public traffic over roadways soon after paving, the Contractor shall paint, on the day of each day's paving, temporary guide dashes at the traffic stripe or marker location on the pavement as guidance for drivers, until the permanent markings can be placed. The Contractor shall maintain and repaint, if necessary, all temporary markings until the permanent striping and/or markers are installed. This work shall be considered incidental to the items of paving, pavement markers, and/or pavement striping, and no separate payment will be made.

Permanent pavement markers, striping, and markings shall be applied no sooner than 7 calendar days nor later than 14 calendar days after completion of the pavement.

- 3.02 PAVEMENT MARKERS: Unless otherwise ordered in writing by the Engineer, markers shall be cemented to the pavement with Standard Set Type adhesive. If the Engineer orders, the Contractor shall use Rapid Set Type adhesive for the Standard Set Type adhesive at no extra cost to DHHL.

If the Contractor uses Rapid Set Type adhesive, he shall submit samples of the markers and Rapid Set Type adhesive proposed for use to the Engineer for testing and approval at least 10 days before the date of its intended use.

The Standard Set Type adhesive shall not be used when the pavement or the air temperature is less than 50°F. The Rapid Set Type adhesive shall not be used when the pavement or the air temperature is less than 30°F. No markers shall be installed if the relative humidity of the air is greater than 80 percent or if the pavement is not surface dry. DHHL shall be the judge as to when the adhesive has set sufficiently to bear traffic. The following table may be used as a guide; however, the times shown may vary, depending upon field conditions:

TIME TO BEAR TRAFFIC		
Temperature* (°F)	Standard Set Type (Hours)	Rapid Set Type (Minutes)
100	1-1/2	15
90	2	20
80	3	25
70	4	30
60	5	35
50	7	45
40	No Application Below 50°F	65
30		85
		No Application Below °F

*The temperature indicated is either pavement surface or air temperature, whichever is lower. The hardness of the rim of epoxy around the marker shall not be used as an indication of the degree of cure of the epoxy under the marker.

No pavement markers shall be installed over longitudinal or transverse joints of the pavement surface.

3.03 **PAVEMENT STRIPING AND MARKINGS:** Pavement striping and markings shall be of the length, width and placement specified and shall conform to the County of Kaua'i Traffic Division Standards.

Pavement arrows, legends, and crosswalks shall be applied with appropriate templates (refer to "Manual on Uniform Traffic Control Devices for Streets and Highways," dated 2009).

No stripe shall be less than the specified width. No stripe shall exceed the specified width by more than 1/2 inch. The length of the 10-foot painted segment for skip stripe may vary ±1 foot, and the 30-foot gap between segments may vary ±1 foot. The alignment of the stripe shall not deviate from the intended alignment by more than 1 inch on tangents and curves up to and including one degree. On curves exceeding one degree, the alignment of the stripe shall not deviate from the intended alignment by more than 2 inches.

When necessary to correct a deviation that exceeds the permissible tolerance in alignment, that portion of the affected stripe shall be removed plus an additional 30 feet in each direction, and a new stripe is provided per these specifications.

All stripes, segments of stripes, and markings shall present a clean-cut, uniform appearance. All striping and markings that fail to meet the requirements specified herein, or

are marred or damaged by traffic or other causes, shall be corrected before acceptance by the County at the Contractor's expense.

The Contractor shall submit DHHL test specimens as requested. Test films shall be applied to a suitable plane rigid surface. The area shall be sufficient to permit film thickness measurement to be made at least 1 inch from any edge.

- 3.04 REMOVING EXISTING PAVEMENT MARKERS, STRIPING, AND MARKINGS: Existing pavement markers shall be removed by methods that cause the least possible damage to the pavement or surfacing.

Where specified on the plans and/or directed by the Engineer, existing pavement striping and markings shall be removed to the fullest extent possible by methods that will not materially damage the surface or texture of the pavement or leave impressions on the roadway that could be confused with permanent striping during inclement weather or night driving conditions. The Contractor shall repair any damage to the pavement or surfacing caused by the removal operations at his expense by methods acceptable to the County of Kaua'i. Painting over the existing striping and markings will not be permitted. Burning off existing striping and markings will be permitted using an approved method using excess oxygen.

Sand or other material deposited on the pavement as a result of removing pavement markers, traffic striping, and markings shall be removed as the work progresses. Accumulating sand or other material that may constitute a traffic hazard will not be permitted.

Extraneous traffic striping and markings shall be removed before any change is made in the traffic pattern.

- 3.05 PREFORMED PAVEMENT MARKING TAPE: Preformed pavement marking tape may be applied manually or with the tape applicators approved by the tape manufacturer. All markings shall be applied in accordance with the tape manufacturer's recommendations and as specified herein.

The Contractor shall install permanent preformed pavement marking tape only at the locations shown on the plans and as specified herein.

Preformed pavement marking tape shall not be applied over other markings or old paint. The Contractor shall remove all old markings and otherwise prepare the surface for tape application as specified.

The minimum temperatures for the application of preformed pavement marking tape shall be 60°F (15°C) for air and 70°F (21°C) for roadway surfaces, with both temperatures rising. The maximum temperature shall be 150°F (66°C) for roadway surfaces.

The Contractor shall prime existing roadway surfaces with an approved primer immediately before applying permanent preformed pavement marking tape. The Contractor shall apply the primer as the tape manufacturer recommends and as directed by the Engineer.

The Contractor may use tapes of different widths to form a specified stripe width (i. e., two 4-inch wide tapes may be used to form an 8-inch wide stripe); however, a 12-inch wide stripe shall be of a single width, and payment shall be made for the specified stripe width as shown on the plans and called for in the proposal.

The Contractor shall use butt splices only and shall not overlap the tape material.

All markings shall be thoroughly tamped with approved mechanical tampers. Additionally, the Contractor shall slowly drive on the newly applied markings several times with a truck.

All areas marked with preformed pavement marking tape shall be ready for traffic immediately after application.

- 3.06 REMOVAL OF TEMPORARY TAPE TRAFFIC MARKINGS: The Contractor shall remove all temporary tape striping placed to delineate traffic lanes, crosswalks, stop bars, etc., before the laydown of the finished asphalt concrete mix #4 layer.

END OF SECTION

SECTION 02610 – PIPE AND FITTINGS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. “Water System Standards, Department of Water Supply, County of Kaua‘i, State of Hawai‘i, 2002”, including any amendments.
- C. Related Work Elsewhere:
 - Valves and Cocks Section 02640
 - Water System Section 02510

1.02 DESCRIPTION OF WORK:

- A. Furnish all labor, materials, tools, equipment, and related items necessary to complete, in place, and ready for use, pipes, and fittings in conformity with the dimensions, profiles, sections, and details shown on the plans.
- B. Whenever the Contractor is required by State or local laws or regulations to make a deposit and/or to pay for a permit before proceeding with any work called for under this part of the specification, the Contractor shall make the necessary deposit and/or pay for obtaining the required permit for the work.

1.03 SUBMITTALS:

- A. Submit manufacturers’ information bulletins, catalog cuts, drawings, and other data to show that the proposed items conform to the requirements of the specifications. The Engineer must approve the manufacturer and details of the flanged pipe and fittings before the piping layout drawings are submitted.
- B. Submit six sets of piping layout drawings. Drawings shall show all valves, piping, fittings, and appurtenances dimensions. The Engineer must approve manifold piping layout drawings before ordering the piping, valves, fittings, and appurtenances.

PART 2 - PRODUCTS

2.01 PIPE:

- A. Pipe: Pipe materials shall meet County Standards.
- B. Flanges: Flange materials shall meet County Standards. Bolt holes shall straddle the vertical center line.

2.02 FITTINGS: Fittings shall meet County Standards.

2.03 CEMENT MORTAR LINING: All flanged pipe and fittings shall be cement mortar lining per ANSI A21.4. Interior linings shall have ends tapered and sealed with a bituminous coat.

2.04 GASKET:

- A. Gaskets shall be 1/16 inch thick duck inserted rubber packing, Garlock No.19 or approved equal.
- B. A 1/8-inch thick gasket may be substituted for the 1/16-inch gasket specified above. If the thicker gasket is to be used, it must be noted on the piping layout drawings with the appropriate changes made in piping lengths. The Engineer must approve the design and materials of the substitute gasket before construction.

2.05 STEEL BOLTS AND NUTS:

- A. All bolts shall be hot dip galvanized steel machine bolts with cut threads and American Standard heavy hexagon heads.
- B. All nuts shall be hot dip galvanized American Standard cold punched heavy hexagon nuts.
- C. One coat of Inertol #49, manufactured by Koppers Co., Inc., or approved equal, shall be applied to all buried bolts and nuts.

PART 3 - EXECUTION

3.01 INSTALLATION: Install pipe, fittings, and appurtenances strictly following the manufacturer's installation instructions.

END OF SECTION

SECTION 02640 – VALVES AND COCKS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. 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 Department of Water Supply (DWS), County of Kaua'i, and all subsequent amendments, hereinafter referred to as the DWS Standards and the Uniform Plumbing Code.

C. Related Work Specified Elsewhere:

Pipe and Fittings.....	Section 02610
Water System.....	Section 02510

1.02 DESCRIPTION OF WORK: This Section includes the furnishing and installation of a pressure-reducing valve station, which consists of a combination of pressure-reducing and pressure sustaining valves, pressure-reducing valve, pressure relief valve, gate valves, ball valves, necessary piping, fittings, and appurtenances as shown on the plans.

The equipment package shall include, but is not limited to the following:

A. Combination Pressure Reducing and Pressure Sustaining Valve:

- 1. Number and size required: 1 – 6 inches
- 2. Main valve trim: Bronze
- 3. End detail: F.E., 150 lb.
- 4. Pressure rating: 250 psi
- 5. Temperature range: 180° F
- 6. Rubber material: Buna-N
- 7. Coating: Fusion bonded epoxy
- 8. Desired Options: B: Pilot System Isolation cocks
P: X141 Pressure Gauge
S: Opening Speed Control
Y: "Y" Pattern Strainer

B. Pilot Control System for Combination Pressure Reducing and Pressure Sustaining Valve:

- 1. Pressure rating: 300 psi
- 2. Trim: Monel, Stainless Steel
- 3. Rubber material: Buna-N

- 4. Tubing and Fittings: Brass, Bronze, Copper
- 5. Operating Fluids: Water
- 6. Pressure reducing adjustment range: CRD: 15-75 psi
- 7. Pressure sustaining adjustment range: CRL: 20-200 psi

C. Pressure Reducing Valve:

- 1. Number and size required: 1 – 2 inches
- 2. Main valve trim: Bronze
- 3. End detail: S.E.
- 4. Pressure rating: 400 psi
- 5. Temperature range: 180° F
- 6. Rubber material: Buna-N
- 7. Coating: Fusion bonded epoxy
- 8. Desired Options: A: Flow Clean Strainer
B: Pilot System Isolation cocks
S: Opening Speed Control

D. Pilot Control System for Pressure Reducing Valve:

- 1. Pressure rating: 300 psi
- 2. Trim: Monel, Stainless Steel
- 3. Rubber material: Buna-N
- 4. Tubing and Fittings: Brass, Bronze, Copper
- 5. Operating Fluids: Water
- 6. Pressure reducing adjustment range: CRD: 15-75 psi

E. Pressure Relief Valve:

- 1. Number and size required: 1 – 2 inches
- 2. Main valve trim: Bronze
- 3. End detail: S.E.
- 4. Pressure rating: 400 psi
- 5. Temperature range: 180° F
- 6. Rubber material: Buna-N
- 7. Coating: Fusion bonded epoxy
- 8. Desired Options: B: Pilot System Isolation cocks
P: X141 Pressure Gauge

F. Pilot Control System for Pressure Relief Valve:

- 1. Pressure rating: 300 psi
- 2. Trim: Monel, Stainless Steel
- 3. Rubber material: Buna-N
- 4. Tubing and Fittings: Brass, Bronze, Copper
- 5. Operating Fluids: Water
- 6. Pressure reducing adjustment range: CRD: 15-75 psi

1.03 SUBMITTALS:

- A. Shop Drawings and Catalog Cuts: 6 copies of dimensioned shop drawings of the valves and piping layout of the pressure-reducing station.
- B. Manufacturer's Installation, Operation, and Maintenance Manual, including spare parts list and ordering instructions.

PART 2 - PRODUCTS

2.01 COMBINATION PRESSURE REDUCING AND PRESSURE SUSTAINING VALVE:

- A. This valve shall maintain constant downstream pressure regardless of changing flow rate and/or inlet pressure. When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain constant inlet pressure.
- B. The valve shall be hydraulically operated, single diaphragm-actuated, and globe pattern. The valve shall consist of three major components: the body with the seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the main valve or pilot controls.
- C. No separate chambers shall be allowed between the main valve cover and body. The valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.
- D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted, and no V-type or slotted type disc guides shall be used.
- E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall have a solid, one-piece design and a minimum of five-degree taper on the seating surface for a positive, drip-tight shut-off. No center

guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

- F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to ensure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and covered by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.
- G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To ensure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. The cover bearing, disc retainer, and the seat shall be made of the same material. All necessary repairs and/or modifications other than replacing the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted, and components, including cast material, shall be of North American manufacture.
- H. The valve manufacturer shall be able to supply a complete line of equipment from 1 ¼-inch through 24-inch sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart that shows flow rate, differential pressure, valve opening percentage, Cv factor, system velocity, and if there will be cavitation damage.
- I. The valve shall be a Cla-Val Model No. 92-01 BYSP KCX X101 Combination Pressure Reducing and Pressure Sustaining Valve as manufactured by Cla-Val Co. or approved equal.

2.02 PILOT CONTROL SYSTEM:

- A. The pressure-reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm, and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted.
- B. The pilot control shall have a second downstream sensing port which can be

utilized to install a pressure gauge.

- C. The pressure sensing pilot control shall be a direct-acting adjustable spring-loaded control that opens when upstream pressure exceeds the spring setting on the pilot. The pilot control system shall include an X44A strainer and orifice assembly. A full range of spring settings shall be available from 0 to 450 psi.
- D. A direct factory representative shall be available for start-up service, inspection, and necessary adjustments.

2.03 PRESSURE REDUCING VALVE:

- A. This valve shall maintain constant downstream pressure regardless of changing flow rate and/or inlet pressure.
- B. The valve shall be hydraulically operated, single diaphragm-actuated, and globe pattern. The valve shall consist of three major components: the body with the seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the main valve or pilot controls.
- C. No separate chambers shall be allowed between the main valve cover and body. The valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.
- D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth flow transition and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted, and no V-type or slotted type disc guides shall be used.
- E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
- F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem

must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to ensure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and covered by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

- G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To ensure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and the seat shall be made of the same material. All necessary repairs and/or modifications other than replacing the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted, and components, including cast material, shall be of North American manufacture.
- H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4" through 24" sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, valve opening percentage, Cv factor, system velocity, and if there will be cavitation damage.
- I. The valve shall be a Cla-Val Model No. 90-01 ABS KCX X101 Pressure Reducing Valve manufactured by Cla-Val Co. or approved equal.

2.04 PILOT CONTROL SYSTEM:

- A. The pressure-reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm, and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include an opening speed control.
- B. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.
- C. A full range of spring settings shall be available from 0 to 450 psi.
- D. A direct factory representative shall be available for start-up service, inspection, and necessary adjustments.

2.05 PRESSURE RELIEF VALVE:

- A. This valve shall maintain a constant downstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.
- B. The valve shall be hydraulically operated, single diaphragm-actuated, and globe pattern. The valve shall consist of three major components: the body with the seat installed, the cover with bearings installed, and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted, and there shall be no pistons operating the main valve or pilot controls.
- C. No separate chambers shall be allowed between the main valve cover and body. The valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.
- D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square, or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth flow transition and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted, and no V-type or slotted type disc guides shall be used.
- E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall have a solid, one-piece design and a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut-off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.
- F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to ensure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and covered by machined surfaces which support no less than one-

half of the total surface area of the diaphragm in either the fully open or fully closed position.

- G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To ensure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No "pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and the seat shall be made of the same material. All necessary repairs and/or modifications other than the replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted, and components, including cast material, shall be of North American manufacture.
- H. The valve manufacturer shall be able to supply a complete line of equipment from 1 ¼-inch through 24-inch sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart that shows flow rate, differential pressure, valve opening percentage, Cv factor, system velocity, and if there will be cavitation damage.
- I. The valve shall be a Cla-Val Model No. 50-01 BP KCX X101 Pressure Reducing Valve manufactured by Cla-Val Co. or approved equal.

2.06 PILOT CONTROL SYSTEM:

- A. The pressure relief pilot control shall be a direct-acting, adjustable, spring-loaded, normally open diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer, so accurate control may be maintained if the strainer is partially blocked.
- B. A full range of spring settings shall be available from 0 to 450 psi.
- C. A direct factory representative shall be available for start-up service, inspection, and necessary adjustments.

PART 3 - EXECUTION

- 3.01 Construction and installations shall conform to the applicable sections of the Water System Standards, Department of Water Supply, County of Kaua'i, State of Hawai'i, 2002.

END OF SECTION

SECTION 02720 – CRUSHED AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. "Hawai'i Standard Specifications for Road and Bridge Construction," Department of Transportation, Highways Division, 2005 and hereinafter referred to as "Standard Specifications." Measurement and payment provisions on these specifications do not apply to this project.
- C. Water System Standards, Department of Water Supply, County of Kaua'i, State of Hawai'i, 2002; hereinafter referred to as "Water System Standards." All references to measurement and payment do not apply to this project.
- D. ASTM International (ASTM):
 - 1. ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 2. ASTM D6938 Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods Shallow Depth).

1.02 DESCRIPTION OF WORK:

This item consists of a base course composed of crushed aggregates constructed on a prepared course per these specifications and conforming to the dimensions and typical cross sections shown on the plans.

PART 2 – MATERIALS

2.01 AGGREGATE:

Aggregates shall consist of clean, sound, durable particles of crushed stone, and crushed gravel shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 sieve shall consist of fines from the operation of crushing the coarse aggregate. The fine aggregate may be added if necessary to produce the correct gradation. The fine aggregate shall be produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate.

The coarse aggregate portion, defined as the material retained on the No. 4 sieve and larger, shall contain not more than 15 percent, by weight, of flat or elongated pieces as defined in ASTM D 693 and shall have at least 90 percent by weight of particles

with at least two fractured faces and 100 percent with at least one fractured face. Each face's area shall equal at least 75 percent of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 to count as 2 fractured faces. The percentage of wear shall not be greater than 45 percent when tested per ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent after 5 cycles when tested per ASTM C 88.

The fraction passing the No. 40 sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested per ASTM D 2419.

1. Sampling and Testing: Aggregates for preliminary testing shall be furnished by the Contractor before the start of production. All tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor. The Contractor shall furnish aggregates samples at the start of production and intervals during production. The Engineer will designate the sampling points and intervals. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section. Instead of testing, the Engineer may accept certified state test results indicating that the aggregate meets specification requirements. Certified test results shall be less than 6 months old. The Engineer will take samples of aggregates to check gradation at least two times per lot. The lot will be consistent with adequate sampling for density. The samples shall be taken from the in-place, compacted material. Sampling shall be per ASTM D 75, and testing shall be per ASTM C 136 and ASTM C 117.
2. Gradation Requirements: The final mixture's gradation (job mix) shall fall within the design range indicated in Table 1 when tested per ASTM C 117 and ASTM C 136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Size	Design Range Percentage by Weight	Job Mix Tolerances Percent
2 inch	100	0
1-1/2 inch	95-100	+/- 5
1 inch	70-95	+/- 8
3/4 inch	55-85	+/- 8
No.4	30-60	+/- 8
No. 30	12-30	+/- 5
No. 200	0-8	+/- 3

Where environmental conditions (temperature and availability of free moisture) indicate the potential to damage the maximum percent of the material, by weight, of particles smaller than shall be 3 percent when tested per ASTM D 422. It also may be necessary to have a lower percentage of material passing the No. 200 sieve to help control the percentage of particles smaller than 0.02 mm maximum limit of 5 percent is recommended).

The job mix tolerances in Table 1 shall be applied to the job mix gradation to establish a job control grading band. The full tolerance will still apply if the tolerances result in a job control grading band outside the design range.

The fraction of the final mixture that passes the No. 200 sieve shall not exceed 60 percent of the fraction passing the No. 30 sieve.

PART 3 – EXECUTION

3.01 PREPARING UNDERLYING COURSE:

The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon.

3.02 MIXING:

The aggregate shall be uniformly blended or mixed in a plant during crushing operations. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction.

3.03 PLACING:

The crushed aggregate base material shall be placed on the moistened subgrade in layers of uniform thickness with a mechanical spreader

The maximum depth of a compacted layer shall be 6 inches. If the total depth of the compacted material is more than 6 inches, it shall be constructed in 2 or more layers. In multi-layer construction, the base course shall be placed in approximately equal-depth layers.

The previously constructed layer should be cleaned of loose and foreign material before placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

3.04 COMPACTION:

Immediately upon completion of the spreading operations, the crushed aggregate shall be thoroughly compacted. The number, type, and weight of rollers shall be sufficient

to compact the material to the required density. The moisture content of the material during placing operations shall be determined by ASTM D 2216.

3.05 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY:

Aggregate base course shall be accepted for density on a lot basis. A lot will consist of one day's production, where it is not expected to exceed 2,400 square yards. A lot will consist of one-half day's production; a day's production is expected to consist of between 2,400 and 4,800 square yards.

Each lot shall be divided into 2 equal sublots. One test shall be made for each subplot. The Engineer will randomly determine sampling locations according to the statistical procedures contained in ASTM D 3665.

Each lot will be accepted for density when the field density is at least 100 percent of the maximum density of laboratory specimens prepared from samples of the base course material delivered to the job site. The specimens shall be compacted and tested per ASTM D 1557. The in-place field density shall be determined per ASTM D 1556 or ASTM D 2167. If the specified density is not attained, the entire lot shall be reworked and/or compacted and 2 additional random tests made. This procedure shall be followed until the specified density is reached.

Instead of the core method of field density determination, acceptance testing may be accomplished using a nuclear gage per ASTM D 2922 and ASTM D 3017. The gauge should be field calibrated per paragraph 8 of ASTM D 6938. Calibration tests shall be conducted on the first lot of material placed that meets the density requirements.

ASTM D 6938 shall be used to determine the wet unit weight and to determine the moisture content of the material. Calibration and Standardization shall be conducted per ASTM standards.

If a nuclear gage is used for density determination, two random readings shall be done for each subplot.

3.06 FINISHING:

The surface of the aggregate base course shall be finished by blading or with automated equipment specially designed for this purpose.

In no case will the addition of thin layers of material be added to the top layer of the base course to meet the grade. If the elevation of the top layer is 1/2 inch or more below grade, the top layer of the base shall be scarified to a depth of at least 3 inches. New material is added, and the layer shall be blended and recompact to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and recoiled.

3.07 SURFACE TOLERANCES:

The finished surface shall not vary more than 3/8 inch when tested with a 16-foot straightedge applied parallel with or at right angles to the centerline. The Contractor shall correct any deviation above this amount at the Contractor's expense.

3.08 THICKNESS CONTROL:

The completed thickness of the base course shall be within 1/2 inch of the design thickness. Four determinations of thickness shall be made for each lot of material placed. The lot size shall be consistent with that specified in the item entitled "ACCEPTANCE SAMPLING AND TESTING FOR DENSITY" hereinabove. Each lot shall be divided into four equal sublots. One test shall be made for each subplot. The Engineer will randomly determine sampling locations according to procedures contained in ASTM D 3665. Where the thickness is deficient by more than 1/2 inch, the Contractor shall correct such areas at no additional cost by excavating to the required depth and replacing them with new material. Additional test holes may be required to identify the limits of deficient areas.

3.09 MAINTENANCE:

The base course shall be maintained to meet all specification requirements until the work is accepted. Equipment used in the construction of an adjoining section may be routed over completed portions of the base course, provided no damage results, and the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

The Contractor shall remove all survey and grade hubs from the base courses before placing any bituminous surface course.

TESTING REQUIREMENTS:

- ASTM C 29 Unit Weight of Aggregate
- ASTM C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 117 Materials Finer than 75 μ m (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C 131 Resistance to Degradation of Small-Size Coarse Aggregate by abrasion and impact in the Los Angeles Machine
- ASTM C 136 Sieve Analysis of Fine and Coarse Aggregates
- ASTM D 75 Sampling Aggregate
- ASTM D 422 Particle Size Analysis of Soils
- ASTM D 698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-inch Drop
- ASTM D 1556 Density of Soil in Place by the Sand-Cone Method
- ASTM D 1557 Test for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2419 Sand Equivalent Value of Soils and Fine Aggregate

ASTM D 6938 In-Place Density and Water Content of Soil and Soil-Aggregate in Place
by Nuclear Methods

ASTM D 3665 Random Sampling of Construction Materials

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

END OF SECTION

SECTION 02721 – STORM DRAINAGE SYSTEM

PART 1 – GENERAL

- 1.01 GENERAL REQUIREMENTS: The General Requirements preceding these specifications shall govern this work section.
- 1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment, and related items necessary to complete, in place, the storm drainage system piping, catch basins, storm drain manholes, drain inlets, drainage ditches, and drywells in conformity with the dimensions, sections, and details shown on the plans. Work relating to drainpipes and drainage structures shall be governed by the following sections of the DPW Standard Specifications:
- | | |
|-------------------------------------|------------|
| Trench Excavation and Backfill | Section 11 |
| Drainpipes | Section 24 |
| Drain Manholes | Section 25 |
| Catch Basins and Storm Water Inlets | Section 26 |
| Concrete Structures | Section 40 |
- 1.03 CONTRACTOR SUBMITTALS: Shop drawings shall be submitted for drain inlet grating.

PART 2 – PRODUCTS

- 2.01 MATERIALS:
- A. Materials for the storm drainage system shall be per the DPW Standard Specifications noted hereinbefore.

PART 3 – EXECUTION

- 3.01 INSTALLATION: Install the storm drainage system per the sections of the DPW Standard Specifications noted hereinbefore.
- 3.02 RESPONSIBILITY: The Contractor shall be responsible for precisely laying out the catch basins and drywells locations shown on the contract plans. The location shown on the contract plans of the various existing utility lines to which the new lines are to cross over or under or connect is determined based on the best information available; however, no assurance can be provided that the actual locations will be precise as shown on the contract plans.
- 3.03 PERFORMANCE: In performing all work, the Contractor shall exercise the due care and caution necessary to avoid any damage to and impairment in using 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.

3.04 TESTING: The installation of drain pipes and testing and acceptance shall be governed by the DPW Standard Specifications.

END OF SECTION

SECTION 02741 – HOT MIX ASPHALT (HMA) PAVEMENT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. "Hawai'i Standard Specifications for Road and Bridge Construction," Department of Transportation, Highways Division, 2005 and hereinafter referred to as "Standard Specifications." Measurement and payment provisions on these specifications do not apply to this project.
- C. Standard Details for Public Works Construction, September 1984 and as amended as applicable to County of Kaua'i; referred to as "DPW Standard Details."

1.02 DESCRIPTION OF WORK:

This section describes furnishing and placing HMA pavement on a prepared surface.

PART 2 - PRODUCTS

2.01 MATERIALS:

- A. Asphalt Cement (PG 64-16) – ASTM D 977 702.01
- B. Cationic Emulsified Asphalt – ASTM D 2397 702.04
- C. Emulsified Asphalt 703.09
- D. Aggregate for Hot Mix Asphalt (HMA) Pavement 703.15
- E. Filler 712.03
- F. Hydrated Lime 401
- G. Hot Mix Asphalt (HMA) Pavement:
 - 1. HMA pavement shall be plant mixed, include a mixture of aggregate and asphalt cement, and may include reclaimed pavement (RAP), filler, or both.
 - 2. HMA pavement shall include surface course and may include one or more binder courses, depending on HMA pavement thickness indicated in the contract documents.

3. RAP is defined as removed or reprocessed pavement materials containing asphalt and aggregates. Process RAP by crushing until 100 percent of RAP passes a 3/4-inch sieve. Size, grade uniformly, and combine materials such that the blend of RAP and aggregate material conforms to grading requirements of the "Standard Specifications," Subsection 703.09 – Aggregate for Hot Mix Asphalt Pavement.
4. In surface and binder courses, aggregate for HMA may include RAP quantities up to 15 percent of total mix weight.
5. Quantity of filler material to correct deficiencies in aggregate gradation passing the No. 200 sieve shall not exceed 3 percent by weight of fine aggregates.

H. Job-Mix Formula and Tests: "Standard Specification," Subsection 401.02 Materials.

Design job-mix formula per procedures contained in the current edition of Asphalt Institute's Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, Manual Series No. 2 (MS-2) for either Marshall Method or Hveem Method of Mix Design.

Limit compacted lift thickness and asphalt content of job-mix formula as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

TABLE 401.02-1 - LIMITS OF COMPACTED LIFT THICKNESS AND ASPHALT CONTENT

MIX NO.	II	III	IV	V
Minimum to Maximum Compacted Thickness for Individual Lifts (Inches)	2-1/4 to 3	2 to 3	1-1/2 to 3	1-1/4 to 3
Asphalt Content Limits (Percent of Total Weight of Mix)	3.8 to 6.1	4.3 to 6.1	4.3 to 6.5	4.8 to 7.0

Asphalt content limits for porous aggregate may be exceeded only if accepted in writing by the Engineer.

Meet the job-mix formula design criteria specified in Table 401.02-2 - Job-Mix Formula Design Criteria.

TABLE 401.02-2 - JOB-MIX FORMULA DESIGN CRITERIA

Hveem Method Mix Criteria (AASHTO T 246 and AASHTO T 247)	
Stability, minimum	37
Air Voids (percent) ¹	3 - 5
Marshall Method Mix Criteria (AASHTO T 245)	
Compaction (number of blows at each end of the specimen)	75
Stability, minimum (pounds)	1,800
Flow (x 0.01 inch)	8 - 16
Air Voids (percent) ¹	3 - 5
<u>Notes:</u> Air Voids: AASHTO T 166 or AASHTO T 275; AASHTO T 209, AASHTO T 269.	

Minimum percent voids in job-mix formula mineral aggregates (VMA) shall be as specified in Table 401.02-3 - Minimum Percent Voids in Mineral Aggregates (VMA).

TABLE 401.02-3 - MINIMUM PERCENT VOIDS IN MINERAL AGGREGATES (VMA)

Nominal Maximum Particle Size, (Inches)	1-1/2	1	3/4	1/2	3/8
VMA, (percent) ¹	11	12	13	14	15
<u>Notes:</u> VMA: See Asphalt Institute Manual MS-2, Chapter 4.					

- I. Submittals: Establish and submit the job-mix formula for each type of HMA pavement mix indicated in the contract documents as follows:
 1. Design percent of aggregate passing each required sieve size.
 2. Design asphalt content added to aggregate based on the total weight of the mix.
 3. Design proportion of processed RAP.
 4. Design temperature of the mixture at point of discharge at paver.

5. Source of aggregate.
6. Grade of asphalt cement.
7. Test data used to develop the job-mix formula.

Except for item 4. in this subsection, if design requirements are modified after the Engineer accepts the job-mix formula, submit new job-mix formula before using HMA produced from the modified mix design.

Submit a certificate of compliance for asphalt cement, accompanied by substantiating test data.

- J. Range of Tolerances for HMA: Provide HMA within allowable tolerances of accepted job-mix formula as specified in Table 401.02-4 - Range of Tolerances for HMA.

TABLE 401.02-4 - RANGE OF TOLERANCES FOR HMA

Passing No. 4 and larger sieves (percent)	± 7
Passing No. 8 to No. 100 sieves (inclusive) (percent)	± 4
Passing No. 200 sieve (percent)	± 3
Asphalt Content (percent)	± 0.4
Mixture Temperature (degrees F)	± 20

PART 3 - EXECUTION

3.01 CONSTRUCTION:

- A. Weather Limitations: Placement of HMA will not be allowed under the following conditions:
1. On wet surfaces as determined by the Engineer.
 2. When the air temperature is below 50 degrees Fahrenheit and falling. HMA may be applied when the air temperature rises above 40 degrees Fahrenheit. Air temperature will be measured in the shade and away from artificial heat.
 3. When weather conditions prevent the proper method of construction.

B. Equipment:

1. Mixing Plant. Use mixing plants that conform to AASHTO M 156, supplemented as follows:

a. All Plants.

(1) Automated Controls: Control proportioning, mixing, and mix discharging automatically. When RAP is incorporated into the mixture, provide positive controls for proportioning processed RAP.

(2) Dust Collector. AASHTO M 156, Requirements for All Plants, Emission Controls, is amended as follows:

Equip the plant with a dust collector. Dispose of collected material. In the case of baghouse dust collectors, dispose of collected material or return collected material uniformly.

(3) Modifications for Processing RAP. When RAP is incorporated into the mixture, modify the mixing plant per the plant manufacturer's recommendations to process RAP.

b. Drum Dryer-Mixer Plants.

(1) Bins. Provide a separate bin in the cold aggregate feeder for each aggregate stockpile in the mix. Use bins of sufficient size to keep the plant in continuous operation and of proper design to prevent overflow of material from one bin to another.

(2) Stockpiling Procedures. Separate aggregate into at least 3 stockpiles with different gradations: coarse, intermediate, and fine. Separate aggregates for Mix V into at least 2 stockpiles. Stockpile RAP separately from virgin aggregates.

c. Batch and Continuous Mix Plants.

(1) Hot Aggregate Bin. Provide bin with three or more separate compartments for storage of screened aggregate fractions to be combined for the mix. Make partitions between compartments tight and of sufficient height to prevent spillage of aggregate from one compartment into another.

(2) Load Cells. Calibrated load cells may be used in batch plants instead of scales.

2. Hauling Equipment. Use trucks with tight, clean, smooth metal beds to haul HMA.

Thinly coat truck beds with a minimum quantity of non-stripping release agents to prevent the mixture from adhering to beds. The use of diesel or petroleum-based liquid release agents, except for paraffin oil, will not be allowed.

Equip each truck with tarpaulin conforming to the following:

- a. In good condition, without tears and holes.
- b. Large enough to be stretched tightly over the truck bed, completely covering the mix.

3. Asphalt Pavers. Use asphalt pavers that are:

- a. Self-contained, power-propelled units.
- b. It is equipped with an activated screed or strike-off assembly, heated if necessary.
- c. Capable of spreading and finishing courses of HMA mixtures in lane widths applicable to typical sections and thicknesses indicated in the contract documents.
- d. It is equipped with receiving hopper having sufficient capacity for uniform spreading operation.
- e. It is equipped with automatic feed controls to maintain the uniform depth of material ahead of the screed.
- f. Equipped with automatic screed controls with sensors capable of sensing grade from the outside reference line, sensing transverse slope of screed, and providing automatic signals to control screed grade and transverse slope.
- g. Capable of operating at constant forward speeds consistent with the satisfactory laying of the mixture.

4. Rollers. Rollers shall be self-propelled, steel-tired, pneumatic-tired, or vibratory-type rollers capable of reversing without shoving or tearing the HMA mixture. Unless otherwise indicated in the contract documents, provide sufficient number, sequencing, type, and weight of rollers to the compact mixture to the required density while the mixture is still in workable condition. Do not use equipment that will excessively crush aggregate. Operate rollers per the manufacturer's recommendations.

- a. Steel-Tired Tandem Rollers. Steel-tired tandem rollers used for the initial breakdown of intermediate roller passes shall have a minimum gross weight of 12 tons and shall provide a minimum

250-pound weight per linear inch of width on the drive wheel.

- (1) Steel-tired tandem rollers used for finish roller passes shall have a minimum gross weight of 3 tons.
 - (2) Do not use a roller with the grooved or pitted rolling drum. Replace excessively worn scrapers and wetting pads.
- b. Pneumatic-Tired Rollers. Pneumatic-tired rollers shall be oscillating-type, equipped with smooth-tread pneumatic tires of equal size and diameter. Maintain tire pressure within 5 pounds per square inch of designated operational pressure when hot. Space tires, so the following tires cover gaps between adjacent tires.
- (1) Equip pneumatic-tired rollers used for the breakdown of intermediate roller passes with ballast capable of establishing an operating weight per tire of not less than 3,000 pounds. Equip rollers with tires having a minimum 20-inch wheel diameter. Inflate tires to 70 to 75 pounds per square inch pressure when cold and 90 pounds per square inch when hot. Equip rollers with skirt-type devices to maintain the temperature of tires during rolling operations.
 - (2) Equip pneumatic-tired rollers used for kneading finished asphalt surfaces with ballast capable of establishing an operating weight per tire of not less than 1,500 pounds. Equip rollers with tires having a minimum 15-inch wheel diameter. Inflate tires to 50 to 60 pounds per square inch pressure.
- c. Vibratory Rollers. Vibratory rollers shall be steel-tired tandem with a minimum weight of 3 tons. Equip vibratory rollers with amplitude and frequency controls and a speedometer. Operate vibratory roller per manufacturer's recommendations.
5. Hand Tools. Keep hand tools used in production, hauling, and placement of HMA clean and free of contaminants. Liquids such as diesel or mineral spirits may be used to clean hand tools. Do not contaminate HMA with cleaning liquids. Clean hand tools over the catch pan with the capacity to hold all the cleaning liquid. Dry hand tools before using with HMA.
6. Material Transfer Vehicle (MTV).
- a. Usage. Unless indicated in the contract documents, MTV usage applies to surface courses of paving projects on all Islands except Lanai. When placing the HMA surface course, use MTV to deliver mixtures independently from hauling

equipment to paving equipment. MTV usage will not be required for the following:

- (1) Projects with less than 1,000 tons of HMA.
 - (2) Temporary pavements.
 - (3) Bridge deck approaches.
 - (4) Shoulders.
 - (5) Tapers.
 - (6) Turning lanes.
 - (7) Driveways.
 - (8) Areas with low overhead clearances.
- b. Equipment. When using MTV, install a minimum 10-ton capacity hopper insert in a conventional paver hopper. Provide the following equipment:
- (1) High-capacity truck unloading system in MTV capable of receiving HMA from hauling equipment.
 - (2) MTV storage bin with a minimum 15-ton capacity.
 - (3) Auger mixing system in MTV storage bin, paver hopper insert, or paver hopper to continuously mix HMA before discharging to the conveyor system.
- Coordinate plant production rate, number of haul units, and MTV and paver speed to avoid stop-and-go operations and provide continuous, uniform, segregation-free material flow.
- c. Performance Evaluation. The Engineer will evaluate the performance of MTV and mixing equipment by measuring the mat temperature profile immediately behind the paver screed on the first day of paving.
- (1) Six temperature profile measurements of the mat surface will be taken using non-contact thermometers at 50-foot intervals behind the paver. Each temperature profile will consist of three surface temperature measurements taken transversely across the mat in approximately a straight line from the screed while the paver is operating. For each profile, temperatures will be measured approximately one foot from each edge and in the middle of the mat; and the difference between

the maximum and minimum temperature measurements within each temperature profile shall not exceed 10 degrees Fahrenheit. If any 2 or more temperature profiles exceed the allowable 10-degree Fahrenheit temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that material placed by paver meets specified temperature requirements.

- (2) Once adjustments are made, the Engineer will repeat the measurement procedure to verify that the material placed by the paver meets specified temperature requirements. Terminate paving if temperature profile requirements are not met during the repeated measurement procedure. If equipment fails to meet requirements after repeated measurement procedure, equipment replacement will be required before the Engineer conducts any further temperature profile measurements.
- (3) The Engineer may perform additional surface temperature profile measurements at any time during the project. If two consecutive temperature profiles fail to comply with specified allowable temperature differential, halt paving operation and adjust MTV or mixing equipment to ensure that HMA placed by paver complies with temperature requirements.

d. Transport.

- (1) Trailered MTV. Transport MTV by truck- tractor/trailer combination per Chapter 104 of Title 19, Department of Transportation, entitled "The Movement by Permit of Oversize and Overweight Vehicles on State Highways."
- (2) Crossing Bridges for Self-Powered MTV. When self-powered MTV exceeds legal axle or total weight limits for vehicles under the HRS, Chapter 291, conform to the following when crossing bridges within project limits unless otherwise indicated in the contract documents:
 - (a) Completely remove the mix from MTV.
 - (b) Move MTV at a relatively constant speed not exceeding 5 miles per hour. MTV will not be allowed to stop on the bridge.
 - (c) No other vehicle or equipment will be allowed on the bridge.

BROOMING OFF. Apply tack coat per SECTION 02744 – BITUMINOUS TACK COAT.

1. As indicated in the contract documents, bring irregular surfaces to uniform grade and cross section by furnishing and placing one or more leveling courses of HMA Mix V. Spread leveling course in variable thicknesses to eliminate irregularities in existing surface. Place leveling course such that the maximum depth of each course, when thoroughly compacted, does not exceed 3 inches.
2. In multiple-lift leveling course construction, spread subsequent lifts beyond edges of previously spread lifts per procedures contained in the current edition of the Asphalt Institute's *Construction of Hot Mix Asphalt Pavements*, Manual Series No. 22 (MS-22) for leveling wedges.

D. Plant Operation:

1. Preparation of Asphalt Cement. Uniformly heat asphalt cement and provide a continuous supply of heated asphalt cement from storage to mixer. Do not heat asphalt cement above 350 degrees Fahrenheit.
2. Preparation of Aggregate. Dry and heat aggregate material at a sufficient temperature to produce the job-mix formula's design temperature. Do not exceed 350 degrees Fahrenheit. Adjust heat source used for drying and heating to avoid damage to and contamination of aggregate. When dry, aggregate shall not contain more than one percent moisture by weight.

For batch plants, screen aggregates immediately after heating and drying into 3 or more fractions. Convey aggregates into separate compartments ready for batching and mixing with asphalt cement.

3. Mixing. Measure aggregate and asphalt; or aggregate, RAP, and asphalt into the mixer per the job-mix formula. Mix until components are thoroughly mixed and adequately coated with asphalt per AASHTO M 156. Percent of coated particles shall be 95 percent when tested per AASHTO T 195.
4. Plant Inspection. For control and acceptance testing during production periods, provide a testing laboratory next to the plant. Provide space, utilities, and equipment required by the Engineer for performing specified tests.

- E. Spreading and Finishing: Before each day's paving operation, check the screed or strike-off assembly surface with a straight edge to ensure straight alignment. Provide screed or strike-off assembly that produces a finished surface without tearing, shoving, and gouging HMA. Discontinue using spreading equipment that leaves ridges, indentations, or other marks on surfaces that cannot be eliminated by rolling or be prevented by adjustment in operation.

1. Maintain HMA at a minimum of 250 degrees Fahrenheit temperature at discharge to the paver. Measure the temperature of the mix in the hauling vehicle just before depositing it into the spreader.
2. Deposit HMA in a manner that minimizes segregation. Raise truck beds with tailgates closed before discharging HMA.
3. Lay, spread, and strike off HMA upon the prepared surface. Use asphalt pavers to distribute the mixture.
4. Control horizontal alignment using automatic grade and slope controls from the reference line, ski and slope control device, or dual skis.
5. Obtain a sensor-grade reference from 30-foot skis for the first pass. For subsequent passes, substituting one ski with a joint-matching shoe riding on finished adjacent pavement is acceptable. A comparable non-contact mobile reference system and the joint matching shoe are acceptable.
6. Avoid stop-and-go operations. Minimize changing forward speed of paver during the paving operation.
7. Offset longitudinal joint in successive lifts by approximately 6 inches. Position joint in the surface course at the centerline of pavement when the roadway comprises 2 lanes of width or at lane lines when the roadway is more than 2 lanes in width.
8. In areas where irregularities or unavoidable obstacles make mechanical spreading and finishing equipment impracticable, spread, rake, and lute mixture by hand tools. Deposit, spread, and screed mixture to the required compacted thickness for such areas.
9. Demonstrate personnel operating grade and crown control device competence before placing surface courses. If the automatic control system becomes inoperative during the day's work, the Engineer will permit the Contractor to finish the day's work using manual controls. Do not resume work until the automatic control system is made operative. The Engineer may waive the requirement for an electronic screed control device when paving gores, shoulders, transitions, and various reconstruction areas.
10. When production of HMA can be maintained and practicable, use pavers in the echelon to place surface course in adjacent lanes.
11. At the end of each workday, HMA pavement open to traffic shall not extend beyond an adjacent panel of new lane pavement by more than the distance typically covered in one workday. At the end of each workweek, complete the entire pavement width, including shoulders, to the same elevation with no drop-offs. Construct transition taper along lane line at longitudinal pavement drop-off. The maximum drop-off height shall be 3 inches. Remove and dispose of transition taper

before placing adjoining panel.

- F. Compaction: Immediately after spreading and striking off HMA and adjusting surface irregularities, uniformly compact mixture by rolling.
1. Maintain HMA at a minimum of 250 degrees Fahrenheit temperature at discharge to the paver. Measure the temperature of the mix in the hauling vehicle just before depositing it into the spreader—initiate compaction at the highest mix temperature allowing compaction without excessive horizontal movement. Temperature shall not be less than 220 degrees Fahrenheit.
 2. Finish rolling using a tandem roller while HMA temperature is at or above 175 degrees Fahrenheit.
 3. On super elevated curves, begin rolling at the lower edge and progress to the higher edge by overlapping longitudinal trips parallel to the centerline.
 4. If necessary, repair damage immediately using rakes and fresh mix. Do not displace the line and grade of HMA edges during rolling.
 5. Keep roller wheels moistened adequately with water or water mixed with small quantities of detergent. Use of excess liquid, diesel, and petroleum-based liquids will not be allowed on rollers.
 6. Along with forms, curbs, headers, walls, and other places not accessible to rollers, compact mixture with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, trench roller or cleated compression strips under roller may be used to transmit compression.
 7. Remove pavement that is loose, broken, contaminated, or a combination thereof; pavement that shows an excess or deficiency in asphalt cement content; and pavement that is defective. Replace with fresh HMA pavement of the same type and compact. Remove and replace defective pavement and compact at no contract price or contract time increase.
 8. Operate rollers at slow but uniform speed with drive wheels nearest paver. Continue rolling to attain specified density until roller marks are eliminated.
 9. HMA Pavement Courses One and a Half Inches Thick Or Greater. Where HMA pavement compacted thickness indicated in the contract documents is 1-1/2 inches or greater, compact to not less than 92 percent nor greater than 97 percent of the maximum specific gravity determined per AASHTO T 209, modified by deletion of Supplemental Procedure for Mixtures Containing Porous Aggregate.

Place HMA pavement in individual lifts within minimum and maximum

allowable compacted thickness for various types of the mixture as specified in Table 401.02-1 - Limits of Compacted Lift Thickness and Asphalt Content.

10. HMA Pavement Courses Less Than One and a Half Inches Thick. Where HMA pavement compacted thickness indicated in the contract documents is less than 1-1/2-inches, compaction to a specified density will not be required.
 - a. Initiate rolling using a non-vibratory, steel-tired tandem roller. Roll the entire surface with a minimum of two roller passes. A roller pass is defined as one roller trip in one direction over any spot.
 - b. For intermediate rolling, roll the entire surface with a minimum of four roller passes.
 - c. Finish rolling using a steel-tired tandem roller. Continue rolling until the entire surface has been compacted with a minimum of three passes of the roller and roller marks have been eliminated.
 - d. Do not use rollers that will excessively crush aggregate.

G. Joints, Trimming Edges, and Utility Marking: At HMA pavement connections to existing pavements, joints are vertical to the new pavement's depth.

1. At HMA, connections to previously placed lifts form joints by cutting back on the previous run to expose the full depth of the course. Dispose of material trimmed from edges. Protect the end of the freshly laid mixture from rollers.
2. Apply tack coat per SECTION 02744 – BITUMINOUS TACK COAT to contact surfaces of joints before placing additional HMA.

H. HMA Pavement Samples: Obtain test samples from compacted HMA pavement within 72 hours of lay down. Provide minimum 4-inch diameter cores consisting of undisturbed, full-depth portion of compacted mixture taken at locations designated by the Engineer per the "Sampling and Testing Guide for Acceptance and Verification" in Hawai'i DOT Highways Division, *Quality Assurance Manual for Materials*, Appendix 3.

Restore HMA pavement immediately after obtaining samples. Apply tack coat per SECTION 02744 – BITUMINOUS TACK COAT to the vertical faces of sample holes. Fill the sampled area with new HMA pavement of the same type as that removed and compact. Only sample and test leveling course if 1-1/2 inches or greater. No compaction requirements for less than 1-1/2 inches.

I. HMA Pavement Surface and Thickness Tolerances: The Engineer will test the surface of completed HMA pavement using a 10-foot straightedge placed

parallel and at right angles to the roadway centerline at selected locations.

Pavement surface that varies more than 3/16 inches from the testing edge of straightedge between two contacts exceeds surface tolerance.

The thickness of the finished HMA pavement shall be within 1/4 inch of the thickness indicated in the contract documents. Correct pavement exceeding specified tolerances by methods accepted by the Engineer, including removal and replacement, at no increase in the contract price or contract time.

J. Protection of HMA Pavement: Except for construction equipment directly connected with paving operations, keep traffic off HMA pavement.

1. Protect HMA pavement from damage until it has cooled and set.
2. Do not refuel equipment or clean equipment or hand tools over paved surfaces unless a catch pan or device that will contain spilled fuel is provided. After completion of refueling or cleaning, remove the catch pan or device.

END OF SECTION

SECTION 02744 - BITUMINOUS TACK COAT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.

1.02 DESCRIPTION OF WORK:

- A. This item shall consist of preparing and treating a bituminous or concrete surface with bituminous material per these specifications and reasonably conforming to the lines shown on the plans.

PART 2 - PRODUCTS

2.01 BITUMINOUS MATERIALS:

The bituminous material shall be emulsified asphalt and shall conform to the requirements of Table 1. The Engineer shall specify the type, grade, controlling specification, and application temperature of bituminous material to be used.

TABLE 1. BITUMINOUS MATERIAL

<u>Type and Grade</u>	<u>Specification</u>	<u>Application Temperature</u>	
		<u>Deg. Fahrenheit</u>	<u>Deg. Celsius</u>
Emulsified Asphalt			
55-1, SS-1h	ASTM D 977	75-130	25-55
CSS-1, CSS-1h	ASTM D 2397	75-130	25-55

PART 3 – EXECUTION

3.01 WEATHER LIMITATIONS:

The tack coat shall be applied only when the existing surface is dry, and the atmospheric temperature is above 60 degrees Fahrenheit. The temperature requirements may be waived, but only when directed by the Engineer.

3.02 EQUIPMENT:

The Contractor shall provide equipment for heating and applying the bituminous material.

The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable surface widths at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer,

pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump, and full circulation spray bars adjustable laterally and vertically.

If the distributor is not equipped with an operable quick shut-off valve, the tack operations shall be started and stopped on building paper. The Contractor shall remove blotting sand before asphalt concrete laydown operations at no additional expense to the State of Hawai'i.

A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

3.03 APPLICATION OF BITUMINOUS MATERIAL:

Immediately before applying the tack coat, the full width of the surface to be treated shall be swept with a power broom and/or airblast to remove all loose dirt and other objectionable material.

The emulsified asphalt shall be diluted by the addition of water when directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixtures is placed on the tacked surface.

The bituminous material, including vehicle or solvent, shall be uniformly applied with a bituminous distributor at the rate of 0.05 to 0.15 gallons per square yard, depending on the condition of the existing surface. The Engineer shall approve the type of bituminous material and application rate before application.

Following the application, the surface shall be allowed to cure without being disturbed for as long as possible to permit drying out and setting of the tack coat. The Engineer shall determine this period. The Contractor shall maintain the surface until the next course has been placed. The Contractor shall take suitable precautions to protect the surface against damage during this interval.

3.04 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY:

Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before the use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other requirements of the contract. Only satisfactory materials so demonstrated by service tests shall be acceptable.

The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The test reports shall contain all the data required by the applicable specification. If the Contractor applies the material before receipt of the test reports, payment for the material shall be withheld until they are received. If the material does not pass the specifications, it shall be replaced at the Contractor's expense. The report shall be delivered to the Engineer before permission is granted to use the material. The

furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

MATERIAL REQUIREMENT

ASTM D 977 Emulsified Asphalt

ASTM D 2397 Cationic Emulsified Asphalt

END OF SECTION

SECTION 02840 – TRAFFIC SIGNS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.
- B. Hawai'i Standard Specification for Road and Bridge Construction, 2005, as applicable to the County of Kaua'i, except for subsections regarding "Measurement" and "Payment"; referred to as "Standard Specifications"
Section 631– Traffic Control Regulatory, Warning, and Miscellaneous Signs
Section 750 – Traffic Control Sign and Marker Material
- C. American Disabilities Act
- D. Federal Highways Administration, "Manual on Uniform Traffic Control Devices for Streets and Highways." (MUTCD), the latest edition
- E. American Society for Testing and Materials (ASTM) Publications
ASTM B209 – Aluminum and Aluminum-Alloy Sheet and Plate

1.02 DESCRIPTION OF WORK:

- A. Furnish all labor, materials, tools, equipment, and related items necessary to install all traffic signs as indicated on the plans and specified herein.

1.03 SUBMITTALS: A list of parts indicating the description of each part, the materials from which it has been fabricated (including ASTM numbers where applicable and a statement certifying compliance to the material specification.

PART 2 – PRODUCTS

2.01 MATERIALS:

- A. 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.
- B. Materials shall be per Section 621 – Traffic Control Signs of the State of Hawai'i Standard Specifications for Road and Bridge Construction, except as shown on the plans or amended in the specifications herewith.

PART 3 – EXECUTION

3.01 INSTALLATION: Installation of signs shall be per Section 631 – Traffic Control Regulatory, Warning, and Miscellaneous Signs of the State of Hawai'i Standard

Specifications for Road and Bridge Construction except as shown on the plans or amended in the specifications herewith.

END OF SECTION

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. The General Requirements preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Cast-in-place concrete and reinforcing steel for concrete slabs and footings. Work shall conform to Section 39 - Portland Cement Concrete and Section 48 - Reinforcing Steel of the DPW Standard Specifications.

1.03 QUALITY ASSURANCE:

- A. Codes: Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified.

1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice"
2. ACI 318 "Building Code Requirements for Structural Concrete"
3. ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete"
4. ACI 311, "Recommended Practice for Concrete Inspection"

- B. Concrete Testing Service:

1. At his own expense, the Contractor will employ a testing laboratory experienced in testing concrete materials and mixes to perform material evaluation tests. This laboratory shall be the official testing agency for this project.
2. Materials and installed work may require testing and retesting, as directed by the Engineer at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Test, if not the retesting of rejected materials and installed work, shall be done at the Contractor's expense.
3. Tests shall comply with ASTM Standards whenever applicable.

1.04 SUBMITTALS:

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mixing water to be withheld for later addition at the project site.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bend bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports concrete reinforcement.
- D. Field quality-control test and inspection reports.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C150, Type I
- B. Aggregates: ASTM C33:
 - 1. Fine Aggregates: Clean, Sharp, Natural sand or rocks and manufactured locally free from loam, clay, lumps, or other deleterious substances.
 - 2. Course Aggregates: Clean, uncoated, processed aggregate containing no clay, mud loam, or foreign matter.
- C. Reinforcing:
 - 1. ASTM A615-51, Grade 60
 - 2. ASTM A185 galvanized welded wire fabric

2.02 CONCRETE ADMIXTURES:

- A. Air-Entraining Admixtures: ASTM C260
- B. Water-Reducing Admixtures: ASTM C494, Type D
- C. Set Control Admixtures: ASTM C494, as follows
 - 1. Type B, retarding
 - 2. Type D, water-reducing and retarding

2.03 PROPORTIONING AND DESIGN OF MIXES:

- A. Prepare design mixes for each type of concrete; 28-day compressive strengths shall be 3,000 psi (Class A); 2,500 psi (Class B); 2,000 psi (Class C), and in the DPW Standard Specifications.
- B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each concrete class required.

- C. Unless otherwise noted, Class A concrete shall be used for all electrical ducts, reaction blocks, slabs, and walls; Class B concrete for the curb, gutter, and sidewalk applications.

2.04 JOINT MATERIALS:

- A. Pre-molded Joint Fillers: Pre-molded material of specified thickness is fiberboard impregnated with asphalt.
- B. Joint Sealing Compound: Tremco Butyl Sealant or approved equal.
- C. Epoxy-Resin Bonding Agent: Two component, mineral-filled epoxy polysulfide polymer complying with FS MMM-G-650, Type I or Type II, Grade A.

2.05 MOISTURE BARRIER: Provide moisture barrier over prepared base material shown on plans. Use only materials resistant to decay when tested per ASTM E154, as follows: Polyethylene sheet, not less than 6 mils thick.

2.06 CURING MATERIALS:

- A. Curing compounds for membrane curing shall conform to ASTM C309.
- B. Liquid Curing - Hardening Compound: Aqueous solution of sodium silicate with a non-acid penetrating agent, reacting chemically with free lime in concrete to form a hard, non-dusting surface that will not inhibit bonding with future finishes. Products offered by manufacturers to comply with the requirements for liquid curing hardening compounds include the following:
 - 1. Demicon: Castle Chemical Corp.
 - 2. Eucosil: Euclid Chemical Co.
 - 3. Chem Hard: L&M Construction Chemicals

2.07 EPOXY GROUT: Manufactured grout with built-in bonding material subject to the Engineer's approval.

PART 3 - EXECUTION

3.01 PREPARATION: Pre-Placement Inspection -- Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in place. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

3.02 CONCRETE PLACEMENT:

- A. General: Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.
 - 1. Deposit concrete continuously or in layers of such thickness that no

concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete being integrated with fresh concrete is still plastic. Deposit concrete nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. Screen concrete is to receive other construction to the proper level to avoid excessive skimming or grouting.
3. Do not use concrete that becomes non-plastic and unworkable, does not meet the required quality control limits, or has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Concrete Conveying:

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and the locations of final deposit as rapidly as practicable by methods that will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure a continuous concrete flow at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris water, and other deleterious materials.

C. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation within the limits of construction joints until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Bring slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth the surface, freeing it from humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces before beginning finishing operations.
4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

D. Dowel installation where shown: Prepare for bonding dowels and anchors to existing concrete by using drilled holes and a two-component epoxy

manufactured for this specific purpose. Install per manufacturer's requirements to develop strength of dowels.

3.03 CONCRETE SLAB FINISHES:

- A. Slabs: Finish by tamping the concrete to force aggregate away from the surface and screen at the proper level. Float the surface and lightly trowel. When the concrete has set sufficiently to ring under the trowel, give a second troweling to produce a smooth, dense surface free from trowel marks and sweeps, air bubbles, or other imperfections of troweling.

3.04 CONCRETE CURING AND PROTECTION:

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and per ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods:

1. Perform concrete curing by moist curing, moisture-retaining cover curing, membrane curing, or combinations thereof, as herein specified for a continuous period of 14 days.
2. Liquid Curing-Hardening Compound: Apply to horizontal surfaces when concrete is dry to touch using power spray, hand spray, or hair broom per manufacturer's directions.

C. Curing Unformed Surfaces:

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by moist curing, whenever possible.
2. Moist cure surfaces to receive fluid applied waterproof membranes and composition flooring. Do not cure by membrane curing or curing compounds.
3. All slabs not receiving a finish floor material shall receive a liquid curing-hardening compound in accordance with the manufacturer's recommendations.

4. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.
- D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances, including load stresses, heavy shock, excessive vibration, and damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.05 MISCELLANEOUS CONCRETE ITEMS:

- A. Filling In: Fill in holes and openings left in concrete structures from the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.
- B. Epoxy Adhesive: For application on corrective work where the ordinary remedy methods are deemed inadequate by the Engineer. The type of adhesive shall be subject to the approval of the Engineer.

3.06 CONCRETE SURFACE REPAIRS:

- A. Repair of Unformed Surfaces:
1. Test unformed surfaces such as monolithic slabs for smoothness and to verify surface plane to the tolerance specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope and smoothness using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish unformed surfaces that contain defects that adversely affect the durability of the concrete. Surface defects, as such, include cracks over 0.03 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
 5. Correct low areas in unformed surfaces during or after completion of surface finishing operations by cutting out the low areas and replacing them with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Finishing of Formed Surfaces:

1. Joint marks and fins shall be removed, and surfaces left smooth and dense. Tie holes and honeycombing shall be repaired with cement and sand mortar.
2. Exposed concrete surfaces shall be vigorously and thoroughly rubbed with a sand cement mortar the consistency of a thick paint to fill all voids and provide a smooth surface. There shall be no discernible thickness of mortar on the surface.

3.07 FIELD QUALITY CONTROL:

A. Testing and Inspecting: The Contractor shall engage, at his own expense, independent qualified testing, and inspecting agency to perform tests and inspections and submit reports.

B. 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

C. Testing Services: 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 at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.
 - a. When testing frequency will provide fewer than five compressive strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at the point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for lightweight structural concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when the air temperature is 40 deg F/4 deg C and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 - a. Cast and field cure one set of four standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. Test two field-cured specimens at 7 days and two at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from two specimens obtained from the same composite sample and tested at the age indicated.
7. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, the Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. The strength of each concrete mix 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/3.4 MPa.
9. Test results shall be reported in writing to the Engineer, 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 the concrete batch in work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other non-destructive devices may be permitted by the Engineer but will not be used as the sole basis for acceptance or rejection of concrete.
11. Additional Tests: The testing and inspecting agency shall conduct additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been

met, as directed by the Engineer. Testing and inspecting agency may conduct tests to determine the adequacy of concrete by cored cylinders complying with ASTM C 42 or other methods as directed by the Engineer.

END OF SECTION

DIVISION 16 – ELECTRICAL

SECTION 16000 – GENERAL ELECTRICAL PROVISIONS

PART 1 – GENERAL

1.01 DESCRIPTION:

- A. Scope: This division includes the general provision for all material, labor, tools, equipment, testing and services necessary to provide a complete and operable electrical system.
- B. Compliance: The GENERAL REQUIREMENTS preceding this section of specifications shall govern all electrical work. All electrical work shall comply with the requirements of this and other applicable sections, whether referenced to or not, in accordance with good practice of the industry.
- C. Completeness: It shall be understood that the Contractor shall provide a complete and operative system that is fully coordinated to any other section of these specifications that are appropriate, whether or not reference is made to them.

1.02 QUALITY ASSURANCE:

A. Performance and Design Requirements:

- 1. Manufacturer's Qualifications: The Contractor shall cause the equipment to be furnished under this division to be the product of firms regularly engaged in the design and manufacture of the type of item specified, possessing the required technical competence, skill, resources and ability to complete the work specified herein with the requisite degree of quality in a timely and efficient manner. The Contractor shall be prepared to adequately document the qualification of the manufacturers nominated to provide equipment specified under this division. All documentation shall be submitted to the Engineer prior to design, fabrication and shipment of any component specified herein. Nothing contained within these provisions shall be construed as relieving the Contractor of his responsibility for any portion of the work covered by this division.
- 2. Arrangement: The plan drawings are generally diagrammatic and the location of equipment terminals are approximate unless detailed or dimensioned. Any device may be relocated within 10 feet of location shown on drawings, before installation is made, at the direction of the Engineer, without additional charge to the State. However, the Contractor may not implement any major relocation without the approval of the Engineer. The exact locations and routing of cables and conduits shall be governed by structural conditions, physical interferences and the location of electrical terminations on equipment. However, all changes shall be approved by the Engineer and shall be shown on the "As-built" drawings to be submitted by the Contractor.

3. The Contractor shall examine the architectural, structural, civil, and mechanical plans and shop drawings for the various equipment in order to determine exact routing and final terminations for all raceways and cables. Conduits shall be stubbed up as near as possible to equipment terminals and shall be within the concrete base for the equipment or a separate concrete curb. Before installing equipment or raceways, verify dimensions and physical condition at the job site.
4. Allowance has been made in the design for the number of raceways, cables and conductors which the Engineer considers adequate for feeding the various equipment. These circuits and diagrams are based on available data pertaining to a particular design of equipment and portray the systems which the Engineer has chosen to effect the required operation and level of control. Equipment provided by the Contractor (even though of the make and model specified) may differ in detail, arrangement, connections or form from that shown and therefore it shall be the Contractor's responsibility to ensure that the system can be properly installed within the space available and will operate according to the intent of the Engineer.
5. Departures From Drawings and Specifications: Departures resulting from substitution of materials or systems shall be accompanied by appropriate changes in all affected work of every trade. Such changes shall be at no additional cost to the State and shall be the responsibility of the subcontractor(s) and or supplier(s) responsible for the departures. Changes proposed by the Contractor shall be based on a system approach and shall be allowed if implemented without decrease in quality of performance or operations, increase in utility cost, structural modifications to the facility, or space to install the equipment. Such departures shall be submitted and noted in shop drawings for approval to the Engineer. Departures initiated by other trades, requiring changes in the electrical system as well as other systems, shall be accompanied by appropriate changes in all affected work of every trade, at no increase in contract amount, by the trade responsible for the departures.
 - a. The General Contractor shall be responsible to coordinate, approve, and select systems that do not impose unaccounted for impact on the electrical work. It shall be understood that after the award of contract, all departures having electrical impact, unless otherwise noted, will be coordinated so that all appropriate changes to the electrical system required to accommodate the departures shall be at no additional cost to the State.

B. Operating Requirements:

1. Permits: The Contractor shall pay for permits, inspections and other costs incidental to providing electrical installations and shall arrange for periodic inspection by local authorities as well as deliver certificates of final inspection to the State.

2. Contractor's Record Drawings: The Contractor shall maintain 2 sets of neatly marked record as-built drawings showing the installed location and routing of conduits, cables, junction boxes, pull boxes, outlets and interconnection circuits, etc., and the current status of control circuits as reflected on the control diagrams.
 3. Inspection: The Contractor shall cooperate with the State and shall provide assistance at all times for the inspection of the electrical work performed under this contract. He shall remove covers, operate machinery, or perform any reasonable work which, in the opinion of the State, will be necessary to determine the quality and adequacy of the work. The State shall be afforded every opportunity to determine skill and competency of completed work. Concealed work shall be reopened at random during formal inspection by the State and repaired by the Contractor at no additional cost to the State, to the satisfaction of the State, and finished without defects to indicate the repaired work and without negative impact to the structural integrity of the facility.
- C. Standards: Electrical work, including connection to electrical equipment integral with mechanical equipment described elsewhere in these special provisions, shall be performed in accordance with the latest published regulations of the following codes and standards:
- State and local codes and ordinances and inspecting authorities.
 - The National Board of Fire Underwriters.
 - National Fire Protection Association.
 - Underwriters Laboratories Inc. (UL).
 - National Electrical Manufacturers' Association (NEMA).
 - American Society for Testing and Materials (ASTM).
 - American National Standards Institute, Inc. (ANSI).
 - Institute of Electrical and Electronics Engineers (IEEE).
 - Insulated Power Cable Engineers Association (IPCEA).
 - State Department of Industrial Safety (OSHA).
 - State Public Utilities Commission.
 - United States Department of Commerce, National Bureau of Standards (National Electrical Safety Code).
 - National Electrical Code (NEC) for all items not specifically covered by state or local ordinances.
 - JIC standards.

Utility company standards.

1. Nothing in these special provisions or on the drawings shall be interpreted as permission or direction to violate any governing code or ordinance.
2. Materials and equipment used in the performance of the electrical construction shall be fully UL approved for the class of service for which they are intended prior to submittal of shop drawings.

1.03 SUBMITTALS:

- A. Submittals for the work shall be in accordance with applicable paragraphs of Section 01330, SUBMITTAL PROCEDURES.
- B. General: Submittals for all electrical equipment provided for this project shall be prepared and submitted to the Engineer.

The following, as a minimum, shall be submitted:

1. Manufacturer and manufacturer's type and designation.
2. Original manufacturer's catalog data indicating rated capacity, efficiency, rated output and other characteristics. Photographic copies will not be accepted.
3. Any exception to these specifications along with justification for each exception.
4. Shop drawings:
 - a. Coordinate requirements and shop drawings for equipment specified in other sections requiring electrical work. Submit list of shop drawings being coordinated.
 - b. Shop drawings for inter-wiring terminal designations:
 - 1) Interfacing wiring/terminations between equipment shall be recorded by shop drawings complete with all wiring terminals identified.
 - 2) Manufacturer shall complete the wiring termination identification sheets for all equipment under his responsibility.
 - 3) Manufacturer shall supply as many coordination copies of shop drawing and wiring termination identification sheets to the component contractors as may be required for coordination and completeness of equipment under his responsibility.

- 4) Each supplier shall coordinate with the responsible manufacturer and distribute to each, the appropriate associated equipment shop drawings and wiring termination identification sheets.
 - 5) It shall be the responsible manufacturer's and the Contractor's responsibility to coordinate, review, and certify the accuracy and completeness of the submittals before submitting for shop drawing approval. Partial, incomplete, and uncoordinated submittals shall be rejected without review and the resulting delay in approval shall not be justification for time extensions.
5. Installation requirements, showing all dimensions and various clearances required.
 6. Details of all appurtenances to be furnished with the specified item.
 7. Carefully coordinate all work with other Trades to minimize overlapping responsibilities and duplicating work.

1.04 ENVIRONMENTAL CONDITIONS:

It is the intent of these specifications that all materials, components, equipment, operations, and systems be rated for use and operations in the specified areas without having negative impact of deterioration, corrosion, hazard, or fouling.

- A. Electrical Equipment: Electrical apparatus will be subjected to environmental conditions where temperatures may vary from 50 degrees F to 100 degrees F; relative humidity 30 to 100 percent; trace quantities of chlorine, sulfur dioxide or hydrogen sulfide gas and dust may be present.
- B. Unclassified Field Locations: Field equipment located in interior areas which have not been classified as hazardous locations as defined by the National Electrical Code, Article 500, may be subjected to ambient temperatures varying from 50 to 100 degrees F and relative humidity ranging from 10 to 90 percent. Incidental quantities of hydrogen sulfide gas and dust also may be present.
 1. In exterior areas, ambient temperatures may vary from 50 to 100 degrees F with strong direct radiation from the sun and exposure to sea spray. Relative humidity in all exterior field areas will vary from 10 to 100 percent. All areas may have trace quantities of hydrogen sulfide gas with wind blown dust and rain occurring. Chlorination areas may have concentrations of chlorine gas or sulfur dioxide gas up to 2 parts per million.
- C. Corrosive Locations: Field equipment located in areas subject to sea spray, chlorine or sulfur dioxide gas, hydrogen sulfide gas, corrosive fumes or liquid chemical spills shall utilize materials and equipment specifically for corrosive areas. Corrosive areas shall consist of all areas of the plant, interior and exterior locations.

- D. Seismic Zone: Project is located in seismic zone No. 1 and therefore requires seismic bracing for equipment permanently attached to the building. Bracing shall have sufficient strength to withstand seismic activity normally anticipated for this area in accordance with County and 2003 IBC requirements.

1.05 INTENT OF SPECIFICATIONS AND DRAWINGS:

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

- A. Specifications and drawings complement each other and what is specified, scheduled, or mentioned by one shall be as binding as if called for by both. Specifications and drawings are intended to specify nature, quantity and quality of work.
- B. Before bidding, visit the project site, inspect existing facilities as may be required, and review carefully the specifications and drawings so that the intent of the documents is clear to the Contractor.
- C. Conflicts between drawings and specifications, within each of these documents, with existing conditions, as well as apparent omissions, shall be reported to the Engineer at least ten (10) days before submission of bids for interpretation and clarification. If no conflict or omissions are reported to the Engineer, it is understood that the Contractor intends to resolve conflicts or omissions which may exist during the course of the project at no additional cost to the State.
- D. Conflicts in size, quantity, or quality specified shall be interpreted to mean the larger or more stringent, as applicable requirement as determined by the Engineer shall govern unless otherwise authorized in writing by the Engineer.

1.06 DEFINITIONS:

- A. Provide: "furnish, install, test and deliver to the Engineer in operating and ready to use condition".
- B. Wiring: "provide all raceways, junction boxes, conductors, cables, devices, protection equipment, etc., including testing for a complete, operative, and ready to use electrical system".
- C. Equal: "material, equipment or system including all necessary labor, modifications, and accessories satisfying the requirements of the specifications and drawings to provide features or have operating characteristics equal to or better than that specified".
- D. Complete: "finished installation that is operative, tested, ready to use, and satisfies the intent of the documents, including all necessary accessories and modifications".

- E. Ground: "provide ground system according to code, including all necessary material and testing to certify compliance with code".
- F. Contractor: "General Contractor responsible for work who shall assign work to subcontractor. Except where noted, Division 16 work will be assigned by the General Contractor to the electrical subcontractor and his subcontractors".

1.07 SPECIAL CONDITIONS:

A. Safety and Protection:

1. The majority of the work is in or around energized electrical equipment and rotating machinery. A program for personnel safety and equipment protection shall be established, supervised, and closely inspected.
2. Personnel shall be instructed to use caution to ensure their safety and to protect equipment from damage.
3. Work in the vicinity of rotating and/or energized equipment shall be carried out with caution. Where necessary, safety barricades shall be provided.
4. Dust producing operations shall be carried out in such a manner as to minimize the spread of dust within the operational areas. Accumulated dust and debris shall be removed daily.
5. Damage to equipment and operations found to be a result of negligent workmanship by the Contractor to allow dust or debris into equipment shall be repaired by Contractor at no additional cost to the State and to the satisfaction of the State.

1.08 BIDDING AND CONSTRUCTION:

During bidding and construction, the Contractor shall coordinate his work with utilities and other trades to avoid omission and overlapping responsibilities. Electrical contractor shall notify other trades and suppliers of project voltages.

1.09 FIELD MEASUREMENTS:

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.

1.10 QUALITY ASSURANCE:

Equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory service for at least 5 years prior to bidding.

1.11 GUARANTEE:

Installation shall be complete in every detail and ready for use. Any item supplied by contractor developing defects within one (1) year from Date of Substantial Completion, shall be replaced by such materials, apparatus or parts including installation labor to make such defective portion of complete system to true intent and meaning of drawings and specifications, at no cost to the State.

PART 2 – PRODUCTS

2.01 MATERIALS:

All materials and equipment shall be new, free from defects, of current manufacture, and of the quality specified or shown, and shall be listed by the Underwriters Laboratories, Inc. (UL) for the purpose for which it is to be used where such listing has been applied by UL to similar products. Each type of material shall be of the same manufacture and quality throughout the work.

2.02 CORROSION PROTECTION:

Unless otherwise noted, all equipment and appurtenances provided under this section shall be treated with zinc phosphate, bonderized or otherwise given a rust-preventive treatment, then primed and painted with a durable enamel finish. Minimum dry film thickness shall be 3 mils.

- A. Galvanizing, where specified, shall conform to industry requirements. Galvanized equipment and appurtenances shall not be shop primed or painted but will be field painted as specified. Field application of cold galvanizing compound shall be in accordance with manufacturer's instructions.
- B. Dissimilar metals in contact anywhere in the system shall be avoided to eliminate the possibility of galvanic action. Where contact is unavoidable, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.
- C. For all locations enclosures shall be NEMA 4X, 316 stainless steel, unless otherwise indicated.
- D. Appropriate sized oxidation inhibitors shall be placed in all motor control center sections, electronics equipment cabinets, enclosures and cabinets. Inhibitor shall be time release type corrosion inhibiting vapors with estimated life of 2 years minimum for properly applied size inhibitor.
- E. Corrosion protection oxidation inhibitor shall emit an odorless, non-toxic vapor that saturates the atmosphere of the space in which it is installed and then coats all surfaces, including all metal parts, to protect it against corrosion. The vapor essentially protects the metal parts by displacement of corrosive atmospheres and

therefore all enclosed parts to be protected shall be sealed shut from the outside atmosphere.

1. The corrosion protection equipment shall be installed as recommended by the manufacturer to provide the maximum protection for the application.
2. Selection of inhibitor size and mounting location shall be coordinated with the manufacturer.
3. The Contractor shall provide, if not already provided by the standard enclosures, gaskets to seal shut all enclosures with electrical parts.
4. All raceways entering the protected enclosures shall be sealed with duct seal to limit the dissipation of the inhibiting vapors through the raceway system.
5. All knockouts and other holes in enclosures shall be sealed to prevent the dissipation of the corrosion inhibiting vapors to the outside atmosphere.
6. Corrosion protection film shall be applied immediately upon uncrating of any equipment on site. While the equipment is unmounted, the Contractor shall apply spray on film type corrosion protection to protect the equipment during the interim before they are mounted. Immediately upon mounting of the equipment, inhibitors shall be installed.
7. Upon final Substantial Completion, a second inhibitor shall be mounted adjacent to the initial unit mounted.
8. Appropriate labels shall be mounted to the protected enclosures to identify the date of installation and the maximum life of the unit. The label shall warn that unnecessary opening of the enclosure should be avoided.
9. Manufacturer: Cutler Hammer Oxidation Inhibitor, or equal.

2.03 MISCELLANEOUS:

Hardware, supports, backing, adapters, connectors, attachment devices, and other accessories necessary to install electrical systems shall be provided in accordance with good industry practice although not specifically included in these Specifications and Drawings.

- A. Wood material shall be "wolmanize" treated, or equal, for protection against termite damage.
- B. Stainless steel material for application throughout the station shall be marine grade, 316L or equivalent.
- C. Non-ferrous materials shall be brass, bronze, or special high strength corrosion free alloy. Ferrous materials shall be stainless steel.

D. Wood screws shall be stainless steel 316L.

2.04 PROTECTION:

- A. Protection During Storage: All materials and equipment shall be stored in a safe manner, secured against damage, and given weather and fire protection.
- B. Protection of Work in Progress: All materials and equipment shall be completely protected from physical or chemical damage. In areas exposed to weather, provide weather protection. All electrical contact parts shall be given factory applied protective coating to prevent corrosion to contacting parts that are stored in the field waiting installation or partially installed and waiting a mating part.

2.05 CONDUCTING PARTS:

- A. Electrical conducting parts such as wires and cables, bus bars of panels, and contacts of switches, circuit breakers, and contactors shall be made from copper with tin plating or other suitable protection recommended for corrosive atmospheres. Bus joints shall be tin plated. Wear and protective coating shall be provided when applicable.
- B. Aluminum conducting parts shall not be used.

2.06 NAMEPLATES:

- A. Nameplates shall be black-white-black laminated plastic engraved with 1/4-inch high commercial letters to expose white unless otherwise specified. Mount to enclosure with stainless steel (316L) screws.

PART 3 – EXECUTION

3.01 GENERAL:

- A. Conform to construction practices as recommended by the latest edition of American Electricians' Handbook by Croft, Edison Electric Institute, REA, and applicable instruction of manufacturers of equipment and material supplied for this project.
- B. The Contractor shall cause each item of equipment provided as a part of this project to be installed, aligned and tested by skilled workmen to the tolerances recommended by the equipment manufacturer.
- C. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Engineer reserves the right to require minor changes in location of outlets or equipment, within ten feet, prior to roughing in, without incurring any additional costs or charges to the State.

3.02 FIELD MEASUREMENTS:

- A. The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.

3.03 MANUFACTURER'S SERVICES:

- A. Training, as specified in Section 01660, Installation, Testing, Commissioning, and Training.

3.04 PERFORMANCE TESTING:

- A. In accordance with the requirements set forth in Section 01660, INSTALLATION, TESTING, COMMISSIONING, AND TRAINING, each equipment shall be field tested to ensure compliance with the performance requirements as specified.
- B. General: The Contractor shall furnish all labor, materials, instruments and tools to make all connections for testing. All electric power, fuel, water, supplies, and utilities required for all tests shall be provided by the Contractor.
1. All equipment shall be demonstrated as operating properly prior to the acceptance of the work.
 2. These tests shall be made in the presence of the Engineer and the results recorded by him. All deficiencies or unsatisfactory conditions as determined by the Engineer or inspecting authorities shall be corrected by the Contractor in a satisfactory manner at his own expense.
 3. In accordance with the requirements set forth in Section 01660, Installation, Testing, Commissioning, and Training, all equipment furnished in Division 16 shall be field tested to ensure compliance with the performance requirements as specified.
- C. Protective Devices: All protective devices shall be properly set and operative during the testing period. Before testing and energizing a system, all necessary precautions shall be taken to ensure the safety of personnel and equipment. All conductors and all electrical equipment shall be properly insulated and enclosed. All enclosures for conductors and equipment shall be properly grounded. Insulation resistance measurements must have been made and approved by the Engineer on all conductors and energized parts of electrical equipment.
- D. Inspection of Joints: Joints and connections in conductors No. 500 MCM AWG and larger shall be inspected by the Engineer after the joints have been made and prior to application of any tape.
- E. Preliminary Testing: After the visual inspection of joints and connections and the application of tape and other insulating materials, all sections of the complete system of wiring shall be thoroughly tested for shorts and grounds. The Contractor shall correct all defects.

- F. Insulation Resistance Tests: General insulation resistance measurements shall be made on conductors and energized parts of electrical equipment. Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA, or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.
1. Wire and Cable: All wire and cables to be used as feeders, branch circuit wiring, control circuits and other wiring shall be tested with an insulation resistance tester rated 500 volts DC and capable of measuring 100 megohms (Biddle Company Megger). Wires and cable shall have a resistance to ground not less than 10 megohms.
 2. Tests: The insulation resistance of each circuit phase-to-phase and phase-to-ground shall be measured and recorded, for the following:
 - a. Control circuits shall be measured with pushbuttons, interlocking relays, instruments, overcurrent devices, and the like connected.
 - b. Feeders to panelboards shall be measured with the branch circuit breakers open.
 - c. The test shall be made with the branch breakers closed, and with receptacles and fixtures mounted, but before lamping.
 - d. Power feeders shall be measured with switches and circuit breakers in place.
- G. Equipment Tests:
1. Control Panels: The following tests shall be performed:
 - a. Megger the main bus, and all power and control circuits.
 - b. Check the wire terminals, clean connections.
 - c. Check all control switches, alarm devices, indicating instruments for proper operation under normal and simulated abnormal conditions.
 2. Phase Rotation: The connections of all equipment shall be checked for correct phase rotation.
 3. Circuit Breakers: The following tests shall be performed:
 - a. Inspect each circuit breaker.
 - b. Check for loose connections.
 - c. Operate each circuit breaker manually.

- d. Set the adjustable trips to the values specified.
 - e. Perform factory approved testing, calibration, and modification, including coordination by the Contractor's Engineer.
- H. Thermal Overload Protective Devices: For each motor the Contractor shall compile the following data in neatly tabulated form. Data shall be obtained from the equipment as provided on the job.
- 1. Equipment driven
 - 2. Nameplate amperes and voltage
 - 3. Service factor
 - 4. Overload device catalog number
 - 5. Overload device current range and setting

3.05 CUT, DRILL AND PATCH:

- A. Repair surface damaged or marred by notching, drilling or any other process necessary for the installation of electrical work.
- B. Cutting repairs and refinishing subject to approval of the Engineer.

3.06 MISCELLANEOUS DETAILS:

- A. Provide necessary foundation, supports, backing, etc. for all raceways and equipment.
- B. Attachment to concrete by embedded or expansion inserts and bolts. Powder-charge driven studs and anchors by Engineer approval only.
- C. Attachment to steel shall be by machine screws, welded threaded studs, or spring-tension clamps.
- D. Clean all surfaces of enclosures and equipment.
- E. Weatherproof devices shall not be installed in a manner that defeats the design intent of the weatherproofing feature.
- F. Supports shall be provided complete with all necessary anchors, inserts, brackets, and hangers to support electrical equipment.
 - 1. Mount to structural walls or ceiling slabs. When required to be mounted to partition walls, coordinate with General Contractor for reinforcing the wall with adequate additional structural elements.

2. When mounted to hollow masonry blocks, cells shall be reinforced and filled when equipment weight exceeds strength of wall. For light weight equipment provide large area plate on opposite side wall from bracket and welded to mounting bolts.
 3. Supports shall have safety factor of 2 as a minimum.
- G. For rotating and vibrating equipment, provide vibration isolating pads or springs selected to match the frequency, amplitude, and period of the source of the vibration to insure proper deflection. Power and controls connections to the equipment shall be via flexible elements.
- H. Heat producing elements shall be mounted in a manner to provide maximum ventilation and be sufficiently isolated or separated from building elements so as not to cause heat damage to adjacent surfaces. When required to be mounted within 12 inches of walls and ceilings or other facilities, provide heat shield barrier between to eliminate heat damage to the adjacent equipment. When inadequate physical ventilation space results, provide appropriate ventilation system at no additional cost to the State to properly cool the equipment in accordance with the manufacturer's requirements.

3.07 FINISHING:

- A. Structural and architectural elements shall be cut or drilled for installation of electrical system, then patched, repaired and restored. Drilling, cutting, patching, repairing and restoring are subject to approval of the Engineer.

END OF SECTION

SECTION 16010 – EXTERIOR ELECTRICAL WORK

PART 1 – GENERAL

1.01 SCOPE:

The work within the Hanapēpē residential subdivision phase 2 shall include, but is not necessarily limited to:

- A. Complete underground ductline system.
- B. Complete exterior lighting system.
- C. Coordinating work with the applicable utility companies. Obtain their requirements and approval.

1.02 RELATED WORK DESCRIBED ELSEWHERE:

<u>Section</u>	<u>Title</u>
02302	TRENCH EXCAVATION
02520	CONCRETE HEADERS, SIDEWALKS, AND CURB RAMPS
16000	GENERAL ELECTRICAL PROVISIONS
16020	INTERIOR ELECTRICAL WORK

1.03 SUBMITTALS:

- A. Submittals for the work shall be in accordance with applicable paragraphs of Section 01330, SUBMITTAL PROCEDURES.
- B. Shop drawings and catalog cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Review of shop drawings and catalog cuts shall not release Contractor from complying with intent of specification and drawings. Submit complete shop drawings and manufacturer's literature, of the following, for Engineer's review before any work is fabricated.
 - 1. Junction Boxes
 - 2. Conduits
 - 3. Handholes
 - 4. Equipment Mounting Hardware
 - 5. Light Poles and Base

1.04 WORK BY OTHERS:

During bidding and construction, Contractor shall coordinate his work with applicable utility companies and other trades to avoid omissions and overlapping responsibilities. Electrical Contractor shall notify other trades and suppliers of the project voltages.

1.05 MATERIALS AND WORKMANSHIP:

- A. For actual fabrication, installation, and testing of the work of this section, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation.
- B. Codes and Standards: Comply with all applicable codes and regulations and applicable utility companies' requirements.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. All equipment shall be delivered and stored in a safe manner, secured against damage, and given weather and fire protection.

1.07 PRODUCT HANDLING:

- A. Protection: Use all means necessary to protect the work and materials of this section before, during and after installation and to protect completed facilities.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the County.

1.08 ENVIRONMENTAL CONDITIONS:

- A. The system components covered by this specification section shall be suitable for continuous outdoor duty at a municipal wastewater facility. The ambient temperatures may range from 50 to 100 degrees F and ambient relative humidity will range between 30 and 100 percent. The equipment will be exposed to sunlight, rain, dust, washdown water, ocean salt spray, wastewater gases and chemical vapors.

1.09 FIELD MEASUREMENTS:

- A. The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy before performing the work.

1.10 GUARANTEE:

The Contractor shall furnish a written guarantee from the manufacturer of equipment and items to the Engineer at the time of completion and before acceptance of the installation. The guarantee does not apply to any item damaged from misuse, lack of maintenance, alteration, neglect, accident, or wear from normal use.

- A. All equipment items supplied under this section shall be free from defect in material or workmanship and the Contractor shall repair or replace at his own expense any such defective equipment for a period of one year from Date of Substantial Completion.

- B. The Contractor shall be responsible for repair or replacement of any equipment or item which fails to meet the design requirements as specified which are revealed during demonstration and acceptance testing. Repair or replacement of any such equipment shall be completed within 60 days of notice by Engineer at the expense of the Contractor.

PART 2 – PRODUCTS

2.01 GENERAL:

Ducts and related materials such as fittings, couplings, spacers, plugs, and bells, etc., and all materials required to complete the distribution system shall be furnished by the Contractor, unless otherwise indicated.

2.02 CONCRETE:

Plain concrete jackets for conduits and ducts shall be Class B concrete. Concrete shall conform to the requirements of Section 02520, CONCRETE HEADERS, SIDEWALKS, AND CURB RAMPS. The maximum size of coarse aggregate shall be 3/4 inch and the slump shall be 6-inch minimum and 7-inch maximum.

2.03 REINFORCING STEEL:

All reinforcing steel including welded wire mesh shall be as shown. All reinforcing shall be sufficiently tied to withstand any displacement during placement of concrete. All bars shall be hard grade billet steel conforming to ASTM A15. Bars 3/8-inch round and larger shall be deformed in accordance with ASTM A305.

Design loads shall consist of dead load, live load, impact and, in addition, loads due to water table and any other loads which may be imposed on the structure.

2.04 CONDUITS:

Conduits installed under this contract shall be new and furnished by the Contractor in accordance with the requirements indicated herein. The Contractor shall furnish rigid PVC conduits for all installations below grade and PVC coated galvanized steel conduits above grade, unless otherwise indicated on the plans or specifications. Electrical metallic tubing (EMT) shall not be used. The fittings shall be of the same material as the conduit and duct. The Contractor shall also inform applicable utility companies in writing of the type of conduit and duct and fittings that shall be used for this project and obtain the utility company approvals.

- A. PVC plastic conduits and fittings shall conform to the applicable requirements of Section 16020 INTERIOR ELECTRICAL WORK.
- B. Concrete Encasement: Concrete encasement shall be provided for conduits below grade.

2.05 PULL-CORD:

Provide nylon pull-cord of 200 pound minimum tensile strength in all empty ducts.

Leave a minimum of 24-inches of slack at each end of the pull-cord.

2.06 GROUND ROD:

Stainless steel 3/4-inch x 10 feet rod, or as indicated. Bond metal hardware and ground rod with No. 1/0 bare tinned copper grounding wire.

2.07 BURIED WARNING AND IDENTIFICATION TAPE:

Provide detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried conduits. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 2 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.08 CONDUCTORS:

Single Power Conductors: Conductor insulation shall be 600 volt, NEC type RHW. Conductors shall be copper.

2.09 LIGHT POLE:

- A. The standard shall be an assembly of a shaft and luminaire. The standard shall be capable of withstanding 100 mph sustained winds and 130 mph gusts as computed in accordance with the International Building Code, 2003 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. All welds shall be in conformance with AWS D1.1-94. The post height is 16'-0".
- B. Shaft: Ameron concrete pole, round tapered prestressed with steel strand reinforcement and centrifugally cast.
- C. Luminaire: Die-cast aluminum housing, high power factor ballast, Bronze powder coated paint over clear anodized coat, KIM Lighting Entablature series or approved equal.
- D. Lamps: High-pressure sodium, ANSI C78.
- E. Anchor bolts: One set of four 1" diameter by 40" (min.) long with 4" L (min.) galvanized steel anchor bolts, leveling nuts (8 total), and washers (8 total) shall be provided for each pole assembly.
- F. Photocell: Shall have adjustable shutter control. Contractor shall be responsible for orienting the photocell to ensure proper operation of the luminaire as determined by the Engineer.

PART 3 – EXECUTION

3.01 GENERAL:

- A. Equipment and appurtenances specified in this section shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating system shall be provided, including such items as conduit, wiring, concrete foundations, anchors, grouting, power supply, and controls.

3.02 CONSTRUCTION METHODS:

Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition), Edison Electric Institute, National Electric Code, National Electrical Safety Code and applicable instructions of manufacturers of equipment and material supplied for this project. Installation of electrical items shall be in accordance with plans, specification, Engineer approved shop drawings and approved manufacturer's recommendations.

- A. The Contractor shall coordinate all exterior work with other utilities, building structures, existing facilities, and landscaping elements to avoid conflicts. When necessary, obtain the approval of the Engineer for relocation and adjustments to electrical facilities to suit the conditions of installation and at no additional cost to the Owner.
- B. The Contractor shall remove and dispose of all demolished or excess material from the job site to a site as directed by the Engineer.
1. Excavation: Unless otherwise indicated, the width of trenches for concrete encased ducts shall not be less than the width of the encasement nor more than that required to properly and safely execute the work. Ducts encased in concrete jackets which are embedded in disturbed (fill) ground shall be installed in the following manner. Embankments shall be built-up and thoroughly compacted to the required elevation shown on the plans. This work shall conform to the requirements of Section 02302, TRENCH EXCAVATION, the trench to accommodate the jacket shall then be excavated through the constructed embankment.
 2. Trenches shall be excavated at least 50 feet ahead of duct placement so that any obstruction to the duct line can be avoided through gradual vertical and horizontal alignment. All cuts in excess of depth required shall be filled with concrete or rock.
 3. All excavation shall be approved by applicable utility companies' inspector before any ducts or conduits are placed or any structures and foundations are constructed.
 4. The trenches shall be widened at junction boxes to permit proper entry of the ducts and conduits.

5. Excavation for duct lines shall not commence until the locations for these structures are staked out by the Contractor and verified correct by applicable utility companies' inspector and Engineer.
 6. 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.
 7. Excavation work shall be based on encountering large hard boulders where excavation to remove such boulders may be required to accommodate trenches for ductlines.
- C. Backfill: No backfilling shall be done until the duct and conduit installations have been verified correct by the applicable utility companies' representative.
1. Compaction as indicated. Jetting or flooding of backfill will not be permitted.
 2. A 4" wide warning tape, orange in color with a black imprinted message "WARNING - - STOP DIGGING - - ELECTRICAL CABLE BURIED BELOW", shall be placed 12" below finish grade over the concrete jacket for the entire length of ductline installations.
 3. Material for use as trench backfill shall conform to the general fill provisions of Section 02302, TRENCH EXCAVATION.
- D. Installation of Ducts Encased in Concrete Jacket: All ducts shall be installed with concrete jacket unless otherwise indicated. All joints shall be watertight and all ducts shall be installed to drain towards pull points, unless otherwise required.
1. Plastic Conduit: Plastic conduits shall be PVC Schedule 40, except as required by applicable utility company regulations.
 2. Plastic Conduit Storage and Transportation: Conduits that are to be stored for more than two weeks shall be covered.

Support shall be provided for the full length of the conduit when transporting or storing long lengths. Unsupported overhang will not be permitted.
 3. Plastic Conduit Installation: Conduits shall be square cut with a fine tooth wood saw and all burrs shall be removed. When it is necessary to cut tapered end of piece of duct at site, cut shall be made with saw and tapered with lathe designed to match original taper.
 - a. Changes in direction of runs exceeding five degrees shall be accomplished by using special coupling or bends manufactured for this purpose.

- b. All foreign matter shall be wiped off the sockets of the fittings and the edges of the conduit with a clean cloth. Ducts shall be thoroughly cleaned before laying.
 - c. Unless indicated otherwise, after all ducts are installed, duct bank shall be securely bound with No. 12 steel tie wire and anchored to prevent movement during concrete pouring.
4. Plastic Conduit Solvent-Cement Joints: The Contractor shall exercise due care in selecting the cement. The cement should be obtained from the conduit manufacturer. A clean paper paint pot shall be used for containing the cement during use. Adding of thinners to the cement will not be permitted.
- a. A liberal and uniform coat of cement shall be applied to the conduit for a length equal to the depth of the socket. Also sufficient cement shall be applied to set the socket of the fitting. Excess cement on the fitting shall be avoided as it is wiped into the joint and tends to weaken the pipe. Plastic bristle brushes shall not be used. The brush size shall be approximately equal to joint depth, for example, a 2-inch brush for a 4-inch conduit.
 - b. The conduit shall be slipped into the socket of the fitting with a slight twist until it bottoms. The joint shall be held for 15 seconds so the conduit does not push out of the fitting. The pipe shall not be twisted or driven after the insertion is complete.
 - c. The joined members shall be cured for at least 5 minutes before disturbing or applying stress to a joint. After this initial cure, care must be exercised in handling to prevent twisting or pulling the joint. In damp weather, this interval shall be increased to allow for slower evaporation of the solvent. Where possible, all conduits shall be assembled above ground and allowed to lay undisturbed while curing before lowering it into the trench.
 - d. Excess cement left on the outer shoulder of the fitting shall be wiped off.
 - e. Another fitting or section of conduit may be added to the opposite end within 2 or 3 minutes if care is exercised in handling so that strain is not placed on the previous assembly.
 - f. The brush shall be returned to the cement pot after covering the joint surfaces. When stopping work, the brush shall be placed in a solvent; unused cement shall be poured back in the can and covered tightly. When reusing the brush, the excess solvent shall be shaken out before dipping it into the cement. The cement brush shall be cleaned with a wire brush.
 - g. Any trench joint included in a section of conduit to be bent in the trench shall be assembled above ground and allowed to lay undisturbed for at least 2 hours before installation. In cases

where a plastic connection is made with the union under stress due to misalignment or other factors, the union shall be staked out to relieve stress on the joint until the conduit is encased.

h. The conduit in an open trench shall not be exposed longer than is absolutely necessary to minimize accidental mechanical damage.

5. Plastic Conduit Temperature: All plastic conduit and fittings shall be exposed to the same temperature conditions for a reasonable length of time before assembly.

a. Due to expansion and contraction of the plastic conduit of 1-1/2 inches per 100 feet for every 20°F change in the temperature, the Contractor shall allow extra conduit footage at each tie-in for contraction when the conduit temperature is higher than that of the earth; or extra room for expansion if lower than that of the earth.

6. Plastic Conduit Spacers: Spacers for plastic conduit shall be placed along the length of the conduit as follows:

<u>Conduit Size</u>	<u>Maximum Spacing</u>
Up to 3 inches	8 feet
4 inches and larger	6 feet

a. Spacers shall be 15 inches or more away from any coupling or joint. When conduit is assembled above the ground, the spacer shall be supported in a vertical position by use of a No. 4 rebar and smooth black steel wire, No. 14 gage.

b. Spacers shall not be located at the centers of a long radius bend. On prefabricated bends, the spacer shall be located in the tangent, free of the coupling. On trench formed bend, the spacer shall be located midway between the tangent and center of the bend.

7. Plastic Conduit Termination: The ends of the conduit shall be sealed with a plastic cap, plug, or approved substitute at the end of each day's work, when work on duct installation has to be interrupted, where ducts may be submerged in water, and in stub-outs.

E. Routing and Cleaning of Completed Duct Bank: The Contractor shall clean and test completed ducts by passing a standard duct wire brush and a bullet shaped test mandrel not less than 14 inches long with a diameter 1/2-inch less than the inside diameter of the ducts through the length of each duct. Scars in the mandrel deeper than 1/32-inch, other than that caused by normal abrasion between the duct line and bottom of mandrel shall be considered an indication of the presence of burrs and/or obstructions in the duct run. The Contractor shall remove such burrs and/or obstructions, after which the test mandrel will be

passed through again. The process shall be repeated until a satisfactory result is obtained. A brush with stiff bristles shall then be pulled through to make certain that no particles of earth, sand or gravel have been left in the lines.

1. After completion of cleaning and testing of the duct line, the Contractor shall install in each duct run a plastic pull line and plug both ends of each duct with plastic plugs. Using the duct measuring/cable pulling tape, the Contractor shall measure at least one duct of a common duct run. The distance shall be marked on a copy of the record prints and submitted to the Hawaiian Telcom inspector for record keeping.
- F. Splicing: Shall comply with applicable requirements of Section 16020 INTERIOR ELECTRICAL WORK. In addition, splices shall be water-proof.
- G. Grounding: Shall comply with applicable requirements of Section 16020 INTERIOR ELECTRICAL WORK and the following:
1. Make grounding connections which are buried or otherwise normally inaccessible by exothermic weld or compression connector.
 2. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
 3. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. 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.

3.03 MANUFACTURER'S SERVICES:

- A. Training, as specified in Section 01660, INSTALLATION, TESTING, COMMISSIONING, AND TRAINING, section.

3.04 PERFORMANCE TESTING:

- A. In accordance with the requirements set forth in Section 01660, INSTALLATION, TESTING, COMMISSIONING, AND TRAINING, each equipment shall be field tested to ensure compliance with the performance requirements as specified.

END OF SECTION