4. TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 01200

PROTECTION OF ENDANGERED AND THREATENED SPECIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the required conservation measures for the protection of Hawaii's federally listed species and their native habitat. The listed species are the following: Hawaiian Goose, Hawaiian Horary Bat, Hawaiian Petrel, Newell's Shearwater, and Band-Rumped Storm-Petrel (proposed).

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONSTRUCTION CONSERVATION MEASURES

A. To avoid impacts to Hawaiian Geese, a biologist familiar with the nesting behavior of the Hawaiian Goose will survey the project area prior to the initiation of any work, and after any subsequent delay in the work of three or more days (during which seabirds may attempt nesting). If a nest is discovered, work will cease immediately and the U.S. Fish and Wildlife Service (Service) will be contacted. All on-site project personnel will be apprised that Hawaiian Geese may be in the vicinity of the project at any time during the year. If a Hawaiian Goose (or Geese) appears within 100 feet of ongoing work, all activity will be temporarily suspended until the Hawaiian Goose (or Geese) leaves the area of its own accord.

B. To minimize impacts to the endangered Hawaiian Hoary Bat, woody plants greater than 15 feet tall will not be disturbed, removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Any site clearing will also be timed to avoid disturbance to Hawaiian Hoary Bats in the project area. In order to minimize potential entanglement with the new and existing barbed-wire fence that surrounds the well/tank site, two aluminum plant tags will be attached to the top strand of barbed-wire between each set of fence posts. These tags will be attached to they can dangle or swing freely in the wind; thereby providing a visual cue for the Hawaiian Hoary Bat.

C. To minimize potential impacts to seabirds, construction activities shall only occur during daylight hours. Lights that cannot be eliminated due to safety or security concerns will be positioned as low to the ground as practicable, will be motion-triggered, and shielded. Light shields will be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below.

D. The following Standard Best Management Practices will be implemented during construction and grading activities, where applicable, to avoid and minimize impacts to aquatic habitats: 1) Project construction-related materials (fill, revetment rock, pipe, etc.)

should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried in into waters by wind, rain or high surf. 2) All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

3.02 MEASUREMENT AND PAYMENT

Biological monitoring and nest surveys shall be paid for under the ALLOWANCE FOR BIOLOGICAL MONITORING. Other requirements in this section not part of biological monitoring and nest surveys, but related to protection of endangered and threatened species shall not be paid for separately, but shall be included in the items of work to which this section applies.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUBMITTALS

A. Shop drawings shall be required for:

1. Section 02607 – Backflow Prevention Assemblies
2. Section 02611 – Pipe and Fittings
3. Section 02614 – Valves and Appurtenances
4. Section 02675 – Testing and Chlorination
5. Section 02831 - Galvanized Chain Link Fences and Gates
6. Any others as called for in the plans, specifications or by the Engineer.

B. Product Data, Samples, Certificate of Compliance, Test data, and other specified submittals as required for the following as stated in the specification:

1. Section 01567 – Pollution Control
2. Section 02225 – Trenching, Backfilling, And Compacting
3. Section 02512 – Asphaltic Concrete Pavement
4. Section 02513 – Prime Coat
5. Section 02514 – Tack Coat
6. Section 02605 – Valve Boxes, Manholes & Markers
7. Section 02606 – Pressure Reducing Valves
8. Section 02608 – Meters
9. Section 02611 – Pipe and Fittings
10. Section 02650 – Connections, Relocations & Lowering of Water Mains and Laterals
11. Section 02675 – Testing and Chlorination

12. Section 03300 – Concrete

13. Section 03305 – Concrete Thrust and Reaction Blocks

C. Other required submittals shall include:

1. Comprehensive List of Required Submittals;

2. Project Schedule;

3. Site Specific Best Management Practice Plan;

4. Lead Hazard Control Plan, Lead-Containing Paint Removal Plan, Occupant Protection Plan, and Closure Report;

5. Manufacturer's Data and MSDS;

6. Certificates of Warranty;

7. As-Built Drawings;

8. Training Certificates;

9. Personnel and Testing Laboratory Qualifications;

9. Any others as called for in the plans, specifications, or by the Engineer.

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

A. The Contractor is responsible for the coordination of all contractual work and submittals.
B. The Contractor shall stamp each submittal in the following format:

CONTRACTOR NAME

PROJECT: _____

_____

JOB NO: _____

_____

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

DATE RECEIVED _____
SPECIFICATION SECTION_____
SPECIFICATION PARAGRAPH _____
DRAWING NUMBER_____
SUBCONTRACTOR NAME_____
SUPPLIER NAME _____
MANUFACTURER NAME _____

CERTIFIED BY: _____

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

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

E. Unless otherwise noted or agreed upon, the Contractor shall submit to the Engineer for his review six copies of all submittals. Drawings shall be submitted in sufficient time to allow the Engineer not less than twenty regular working days for examining the drawings.

F. The drawing shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.

G. Unless otherwise approved by the Engineer, shop drawings shall be submitted only by the Contractor, who shall indicate by a signed stamp on the drawings or other approved means that the Contractor has checked the shop drawings and that the work or equipment shown is in accordance with contract requirements and has been checked for dimensions and relationship with work of all other trades involved. All deviations from the plans and specifications shall be listed. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the contract documents and will be returned to the Contractor for resubmission in the proper form.

H. When the shop drawings have been reviewed by the Engineer, two sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the drawing may be rejected and one set will be returned to the Contractor

with such changes or corrections indicated, and the Contractor shall correct and resubmit eight copies of the drawings, unless otherwise directed by the Engineer. No changes shall be made by the Contractor to the resubmitted shop drawings other than those changes indicated by the Engineer. The resubmittal shall be so indicated on the shop drawing.

I. The review of such drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for correctness of the dimensions, fabrication details, and space requirements or for deviations from the contract drawings and specifications, unless the Contractor has called attention to such deviations, in writing, by a letter accompanying the drawings and the Engineer approved the change or deviations, in writing, at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the shop drawings. When the Contractor does call such deviations to the attention of the Engineer, he shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

J. The approval of the above drawings, lists, prints, specifications, or other data shall in no way release the Contractor from his responsibility for the proper fulfillment of the requirements of this contract nor for fulfilling the purpose of the installation nor from his liability to replace the same should it prove defective or fail to meet the specified requirements.

PART 2 - PRODUCTS (NOT USED)
PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01567

POLLUTION CONTROL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Rubbish Disposal

1. No burning of debris and/or waste materials shall be permitted on the project site.

2. No burying of debris and/or waste material except for materials which are specifically indicated elsewhere in these specifications as suitable for backfill shall be permitted on the project site.

3. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. During loading operations, debris and waste materials shall be watered down to allay dust.

4. No dry sweeping shall be permitted in cleaning rubbish and fines which can become airborne from floors or other paved areas. Vacuuming, wet mopping or wet or damp sweeping is permissible.

5. Enclosed chutes and/or containers shall be used for conveying debris from above to ground floor level.

6. Clean-up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean-up shall coincide with rubbish producing events.

B. Dust

1. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 60 - Air Pollution Control.

2. The method of dust control and costs shall be the responsibility of the Contractor. Methods of dust control shall include the use of water, chemicals or asphalt over surfaces which may create airborne dust.

3. The Contractor shall be responsible for all damage claims in accordance with Section 7.19 - "Responsibility for Damage Claims" of the CONSTRUCTION GENERAL CONDITIONS.

C. Noise

1. Noise shall be kept within acceptable levels at all times in conformance with the State Department of Health, Administrative Rules, Title 11, Chapter 46 - Community Noise Control for Oahu. The Contractor shall obtain and pay for the Community Noise Permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits.

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

3. Pile driving operations shall be confined to the period between 9:00 a.m. and 5:30 p.m., Monday through Friday. Pile driving will not be permitted on weekends and legal State and Federal holidays.

4. Starting-up of construction equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Engineer. Equipment exceeding allowable noise levels shall not be started-up prior to 7:00 a.m.

D. Erosion

1. During interim grading and trenching operations, the grade shall be maintained so as to preclude any damage to adjoining property from water and eroding soil.

2. Temporary berms, cut-off ditches and other provisions which may be required because of the Contractor's method of operations shall be installed at no cost to the State.

3. Drainage outlets and silting basing shall be constructed and maintained as shown on the plans to minimize erosion and pollution of waterways during construction.

E. Others

1. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Waste water shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.

2. Trucks hauling debris shall be covered as required by PUC Regulation. Trucks hauling fine materials shall be covered.

3. No dumping of waste concrete will be permitted at the job-site.

4. Except for rinsing of the hopper and delivery chute, and for wheel washing where required, concrete trucks shall not be cleaned on the job-site.

5. Except in an emergency, such as a mechanical breakdown, all vehicle fueling and maintenance shall be done in a designated area. A temporary berm shall be constructed around the area when runoff can cause a problem.

6. When spray painting is allowed such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

F. Suspension of Work

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein shall be cause for suspension of the work creating such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.

2. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.

3. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall follow Subsection 4.2 -"Changes" of the CONSTRUCTION GENERAL CONDITIONS be done by force account as described in Subsection 8.3.4 – “Force Account Method”, and paid for in accordance with Subsection 8.3 - "Payment for Additional Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.21 - "Contract Time" of the GENERAL CONDITIONS.

1.02 SUBMITTALS

Prior to construction starting a written site-specific BMP describing activities to minimize water pollution and soil erosion into State waters, drainage or sewer systems shall be submitted. BMP shall include the following:

1. An identification of potential pollutants and their sources.
2. A list of all materials and heavy equipment to be used during construction.
3. Descriptions of the methods and devices used to minimize the discharge of pollutants into State waters, drainage or sewer systems.
4. Details of the procedures used for the maintenance and subsequent removal of any erosion or siltation control devices.
5. Methods of removing and disposing hazardous wastes encountered or generated during construction.
6. Methods of removing and disposing concrete and asphalt pavement cutting slurry, concrete curing water, and hydro-demolition water.

7. Spill control.
8. Fugitive dust control, including dust from grinding, sweeping, or brooming off operations or combination thereof.
9. Methods of storing and handling of oils, paints and other products used for the project.
10. Material storage and handling areas, and other staging areas.
11. Concrete truck washouts.
12. Concrete waste control.
13. Fueling and maintenance of vehicles and other equipment.
14. Tracking of sediment offsite from project entries and exits.
15. Litter management.
16. Toilet facilities.
17. Other factors that may cause water pollution, dust and erosion control.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Fiber Rolls. Fiber Rolls shall consist of straw, flax, coconut, coir or other similar material bound into a tight tubular roll. Fiber Rolls shall be either prefabricated rolls or rolled tubes or erosion control blanket. If rolled erosion control blanket is used, bind roll at each end and every 4 feet along the length of the roll with jute type twine. Fiber Roll shall have a minimum diameter or 9 inches. Sandbags, or 2”x 2” wood stakes or metal stakes, a minimum of 24” long, shall be used to stake and secure fiber rolls.

1. Fiber rolls at the toe of slopes greater than 5:1 (H:V) shall be a minimum of 20 inches in diameter.
2. Fiber rolls should be either prefabricated rolls or rolled rubes of erosion control blanket.
3. Roll length of erosion control blanket into a tube of a minimum of 9 inches in diameter.
4. Bind roll at each end and every four (4) feet along the length of the roll with jute-type twine.

PART 3 – EXECUTION

3.01 INSTALLATION AND CONSTRUCTION METHODS

A. Locate fiber rolls on level contours spaced as follows:

1. Slope inclination of 4:1 (H:V) or flatter; fiber rolls should be placed at a maximum interval of 20 feet.
2. Slope inclination between 4:1 and 2:1 (H:V): fiber rolls should be placed at a maximum interval of 15 feet. (A closer spacing is more effective.)
3. Slope inclination 2:1 (H:V) or steeper: fiber rolls should be placed at a maximum interval of 10 feet. (A closer spacing is more effective.)

B. Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.

C. If more than one fiber roll is placed in a row, the rolls should be overlapped not abutted.

D. Fiber rolls located on ground with less than 4:1 slope shall not require anchoring. Fiber rolls shall be installed as detailed in the plans with a minimum 6 inch overlap.

E. As work progresses, fiber rolls shall be relocated around the work area in a configuration that will best capture runoff pollutants.

3.02 MAINTENANCE

A. Fiber rolls shall be inspected for damage after each rainfall event. Repairs shall be performed immediately.

B. Sediments shall be removed after each rainfall event or when sediment deposits reach one-third the height of the barrier.

3.03 MEASUREMENT AND PAYMENT

Payment for Pollution Control and appurtenant work shall be paid for in the Lump Sum Bid Price under bid item Temporary Best Management Practices (BMPs). Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete pollution control and appurtenant work at the project site, in place complete.

END OF SECTION

SECTION 01569

TEMPORARY TRAFFIC CONTROL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing, installing, maintaining and subsequently removing traffic control devices to control traffic during construction, as indicated in the construction drawings, the Contractor's traffic control plans and street usage permit, and as specified herein. The work shall also include services from flagmen and special duty police officers, if required. The work shall conform to applicable provisions of the "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD), as amended, published by the Federal Highway Administration, and the Contractor's final traffic control plans.

No work on any right-of-way will be allowed until traffic control plans and applicable permits covering the Project work have been approved by the appropriate government agencies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall meet all applicable Contract and regulatory agencies' requirements.

PART 3 - EXECUTION

3.01 DETAILS

A. All barricades, signs, cones, barriers, lights, flashing signals, and other traffic control devices shall be furnished, installed and maintained as shown on the contractor's traffic control plans and in accordance with the requirements of the contract. In event of a conflict between provisions cited therein, the more restrictive laws, rules, regulations or requirements shall apply. The traffic control plan in the construction plans specifies the minimum requirements for traffic control work for the Project.

B. Construction within and on public and private streets shall be limited to the hours designated in the contract documents, unless otherwise approved by appropriate City and State agencies.

C. During non-working hours or during any suspension of work, open trenches and other excavations shall be covered with anchored non-skid steel plates.

D. No materials or equipment shall be stored where they will interfere with the free and safe passage of public traffic.

E. All barricades, construction and warning signs, and other traffic control devices shall be kept in good condition throughout their usage. The Contractor shall repair, repaint, clean, or replace the barricades, signs or other devices as necessary to maintain their effectiveness and appearance or as directed by the Officer-in-Charge. The Officer-in-Charge shall be the sole judge in determining the suitable condition of each barricade, sign, or other traffic control device.

F. During any suspension of work, the Contractor shall provide for public traffic to pass through the work over a reasonably smooth and even surface and with as little inconvenience and delay as possible.

G. Detours not specifically provided for on the Contractor's approved traffic control plans (for passage of public traffic) to facilitate the Contractor's operations or detours used exclusively by the Contractor for hauling materials and equipment shall be constructed, maintained and removed by the Contractor at his expense. The Officer-in-Charge will have the authority to regulate the Contractor's hauling over such detour if such hauling, in the judgment of the Officer-in-Charge, interferes with the free and safe passage of public traffic.

H. All detours shall be approved in writing by the appropriate City or State agency and submitted to the Officer-in-Charge.

I. The Contractor shall give two (2) weeks advance notice to the Police Department, Fire Department, ambulance services (i.e., City, State, private), and any public transit or public utility company of any work that may affect their operations, including any road closures.

3.02 MEASUREMENT AND PAYMENT

TRAFFIC CONTROL shall not be measured for payment. Payment for TRAFFIC CONTROL will be made by Lump Sum. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals required to complete the work.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

The work to be performed under this section shall include clearing the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of the other work included in this contract.

1.02 COORDINATION WITH OTHER SECTIONS

Coordinate site preparation with SECTION 02225- TRENCHING, BACKFILLING, AND COMPACTING.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

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

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

B. Protection: Throughout the progress of the work protection shall be provided for all property and equipment, and temporary barricades shall be provided as necessary. Work shall be done in accordance with the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, and the State of Hawaii's Occupational Safety and Health Standards, Rules and Regulations.

C. Fires: No burning of fires of any kind will be allowed.

D. Reference Points: Bench marks, etc., shall be carefully maintained, but if disturbed or destroyed, shall be replaced as directed, at the Contractor's expense.

E. Disposal: All materials resultant from operations under this Section shall become the property of the Contractor and shall be removed from the site. Loads of materials shall be trimmed to prevent droppings.

3.02 EXISTING UTILITY LINES

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

3.03 CLEARING AND GRUBBING

A. The Contractor shall clear the premises of all obstacles and obstructions, the removal of which will be necessary for the proper reception, construction, execution and completion of other work included in this contract.

B. After clearing has been completed, the entire site shall be stripped of the organically contaminated near-surface soils to a minimum depth of 6 inches. Remove trees and roots to a minimum of 3 feet below existing ground level. Remove all large roots in excess of 2 inches in diameter, and backfill and compact the resulting depression. All debris accumulated from this operation shall be completely removed from the premises by the Contractor.

C. The Contractor shall protect from injury and damage all surrounding trees, plants, etc., and shall leave all in as good as condition as at present. Any damage to existing improvement shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

3.04 CLEAN UP OF PREMISES

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

END OF SECTION

SECTION 02110

ASBESTOS CEMENT PIPE REPAIRS, DEMOLITION, AND DISPOSAL

PART 1 – GENERAL

1.01 WORK INCLUDED IN THIS SECTION

A. The WORK of this Section includes the repair, demolition, and disposal of asbestos cement pipe (ACP).

1.02 REFERENCED SPECIFICATIONS

A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section.
   1. AWWA C213 Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

   2. AWWA C400 Asbestos-Cement Transmission Pipe 4 inch through 16 inch for Water and Other Liquids.

   3. AWWA C401 the Selection of Asbestos Cement Distribution Pipe, 4 inch through 16 inch for Water and Other Liquids.

   4. AWWA C402 Asbestos-Cement Transmission Pipe 18 inch through 42 inch for Potable Water and Other Liquids.

   5. AWWA C403 the Selection of Asbestos-Cement Transmission and Feeder Main Pipe, 18 inch through 42 inch.

   6. AWWA C800 Underground Service Line Valves and Fittings.

PART 2 – PRODUCTS

2.01 GENERAL

A. All connections shall be made at existing joints. Field cutting of ACP shall not be permitted.

B. ACP installations, other than for repairs and connections shall not be allowed.

C. The pipe and couplings shall be carefully inspected for defects. Any length of pipe, couplings or gaskets found to be defective in workmanship or materials, or so damaged as to make repair and use impossible, shall be rejected and removed from the job site the day defect is discovered.

2.02 ASBESTOS CEMENT PIPE

A. The pipe and couplings shall comply with the latest edition of the AWWA Standards.

B. Pipe ends shall be step machined to provide automatic end separation without the use of mechanical spacers. When assembled, the pipe will have only two rubber rings per coupling.

C. Cast iron fittings shall be used for all bends where deflections exceed maximum allowable deflection.

PART 3 - EXECUTION

3.01 GENERAL

A. The CONTRACTOR shall install all repair and connection pipe, closure sections, fittings, valves and appurtenances shown on the plans including bolts, nuts, gaskets, and jointing materials.

B. The CONTRACTOR shall maintain the inside of the pipe clean, sanitary, and free from foreign materials. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trenches shall be kept tightly closed to prevent the entrance of animals and foreign materials.

C. Where closure sections are required by the CONTRACTOR's laying operations, the sections shall be installed in accordance with the manufacturer's installation guide and shall only be used with the approval of the Engineer.

D. Combined deflections at rubber gasket or flexible coupling joints shall not exceed 2 1/2 degrees.

E. Any ACP water line(s) being abandoned shall be abandoned in place unless otherwise noted.

3.02 ABANDONMENT AND DISPOSAL

A. If it is necessary to remove any abandoned ACP line(s) and/or appurtenances to accommodate improvements, the ACP line(s) and/or appurtenances shall be removed and disposed of in accordance with all applicable laws.

B. All work involved in the removal, salvage or disposal of ACP shall be the responsibility and at the expense of the CONTRACTOR.

C. All scrap ACP shall be properly manifested and prepared for transport following the criteria of the Kauai County Department of Public Works, Solid Waste Division. The scrap material shall be delivered to a landfill permitted for disposal of non-friable asbestos

containing materials.

D. Kauai County landfills do not accept friable asbestos-containing materials for disposal. Friable asbestos-containing materials are regulated as hazardous waste (22 CCR 66261.24). A friable material is defined as material that can be crumbled, pulverized, or reduced to powder in the hand.

3.03 INSTALLATION

A. Proper care shall be used to prevent damage in handling, moving, and placing the pipe. Tools and equipment satisfactory to the Engineer shall be provided and used by the CONTRACTOR.

B. The pipe shall not be dropped, dragged, or handled in a manner that will cause bruises, cracks, or other damage.

C. All pipe, fittings, valves, and other pipeline materials shall be lowered into the trench in a manner that prevents damage.

D. Rubber rings for pipe joints shall be stored and protected in a proper manner to prevent deterioration.

E. All material damaged in the course of installation shall be identified and removed from the job site.

E. Pipe sections shall be laid by mechanical means in the trench to true alignment and grade in accordance with the drawings. The pipe grade shall be approved by the Engineer.

F. Bell holes shall be excavated at each joint to permit proper assembly and inspection of the entire joint.

G. Field cutting of ACP will not be permitted. All connections shall be made at existing joints.

I. The CONTRACTOR shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source. The CONTRACTOR shall assume full responsibility for any damage due to this cause; and shall, at their own expense, restore and replace the pipe to its specified condition and grade before any displacement occurred due to floating.

J. Fittings shall be temporarily supported by placing concrete blocks under the bells until thrust blocks and supports are poured so that the pipe is not subjected to the weight of the fitting.

K. Concrete thrust blocks of the size shown on the Standard Drawings or as instructed by the Engineer, shall be provided at the locations of all fittings and valves, at no additional cost to the Engineer.

3.04 MEASUREMENT AND PAYMENT

Removal and proper disposal of asbestos cement pipe shall be measured for payment by the Linear Foot.

Payment for REMOVAL AND PROPER DISPOSAL OF EXISTING 6-INCH FIRE HYDRANT AC LATERAL will be made by Linear Foot of asbestos cement pipe removed.

Payment for REMOVAL AND PROPER DISPOSAL OF EXISTING 8-INCH AC PIPE will be made by Linear Foot of asbestos cement pipe removed.

Payment shall represent full compensation for all labor, tools, equipment, removal, hauling and proper disposal, including excavation, backfill, grading, compacting, permits, permit fees, and other incidentals required to complete the work.

END OF SECTION

SECTION 02225

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

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

A. Work included: Trench, backfill, and compact as specified herein and as needed for installation of underground utilities associated with the Work.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

C. In addition to complying with requirements of governmental agencies having jurisdiction, comply with the directions of the Engineer.

D. Compaction requirements are defined by American Society for Testing and Materials (ASTM) publication D-1557 "Moisture-Density Relations of Soils and Soil-Aggregate Mixtures using 10-lb Rammer and 18-inch Drop."

1.03 SUBMITTALS

A. Shoring and sheeting plan: Describe materials of shoring system to be used. Indicate whether or not components will remain after filling or backfilling. Provide plans, sketches, or details along with calculations by a professional engineer registered in Hawaii. Indicate sequence and method of installation and removal.

B. Dewatering plan: Describe methods for removing collected water from open trenches and diverting surface water or piped flow away from work area. Describe equipment and procedures for installing and operating the dewatering system indicate.

C. Approval of on-site material for backfill: Submit approval letter and any testing data from Geotechnical Engineer if on-site material is found to be suitable for use as trenching backfill material by the Geotechnical Engineer.

1.04 PERMITS

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

PART 2 - PRODUCTS

2.01 BACKFILL MATERIALS

A. Pipe Cushion Material: Backfill from the bottom of the trench to six inches above the top of the pipe shall be pipe cushion material. The various materials used for pipe cushion are natural sand, manufactured sand, coral, and crusher screenings on Table 2.1 below. Cinders are not allowed.
   1. Natural sand shall be free from hard lumps, debris, salt, and other foreign matter.
   2. Manufactured sand shall be approximately equal to that specified under concrete Work.
   3. Coral shall be dredged coral, free from salt, silt, clay, and other deleterious substances.
   4. Crusher screenings "S4C" shall have a minimum amount of fines and shall conform to Table 2.1, or shall be subjected to tests conducted by the Manager for approval.

Pipe Cushion Table 2.1	
Sieve Size	Total Percent Passing By Weight
½"	100
3/8"	90-100
No. 16	25-45
No. 100	5-15
No. 200	≤2.5
0.006 mm	≤1.5

The pipe cushion material shall have a resistivity of 5,000 ohm-cm or greater when saturated with distilled water and measured using the soil box method explained in ASTM G57. Pipe cushion material shall have a pH greater than 6.0. Pipe cushion material shall contain no hazardous substances above its corresponding regulatory action level. Hazardous substances include, but not limited to, lead, asbestos, mercury, chromium, cadmium, zinc, strontium and polychlorinated biphenyls (PCB). The Contractor shall submit a soil certification that high resistant cushion material has a resistivity greater than 5000 ohm-cm.

B. Ordinary Backfill Material: Material used in the upper portion of the backfill from six inches above the top of the pipe to the surface of the ground or base course of the road shall not contain stone, rock or other material larger than six inches in its longest dimensions. No wood, vegetable matter or other material which, in the opinion of the Engineer, is unsuitable, shall be included in the backfill. No "adobe" or other materials determined to be

deleterious by the Engineer shall be included in the backfill. Material shall contain no hazardous substances including but not limited to lead, asbestos, mercury, chromium, cadmium, zinc, strontium and polychlorinated biphenyls (PCB), above the regulatory action levels.

C. The Contractor shall obtain the approval of the Engineer of all backfill material.

2.02 OTHER MATERIALS

A. Warning Tape: Warning tapes shall be four mil thick, non-metallic, acid and alkali resistant polyethylene and 6-inches wide with minimum strength of 1750 psi lengthwise and 1500 psi crosswise.

Tape color shall be “safety precaution blue” and shall bear a continuous printed inscription “CAUTION WATER LINE BURIED BELOW”. Inscription shall be 2-inches high, black text.

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

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINISH ELEVATIONS AND LINES

A. All material excavated from trenches shall be considered unclassified, whether consisting of earth, lava, soft rock, decomposed rock, solid rock, boulders, or coral. The trench shall be so dug that the pipe can be properly installed or modified to the alignment and grade specified. Excavation shall commence at the point directed by the Engineer and shall be carried on in an orderly manner. No trench shall be opened more than 500 feet in advance of the installed pipe without the approval of the Engineer. No jumps or spaces will be permitted unless approved by the Engineer. Before proceeding with any excavation under asphaltic concrete and concrete pavements, the Contractor shall cut the edges of the excavation with a power saw to insure a neat cut along the pavement.

B. Trench Widths:

1. The widths of trenches for all pipes and appurtenances shall be as shown on the Drawings.

2. Increases in widths over those shown due to sheeting, bracing, or other necessities of construction, may be made by the Contractor with the approval of the Engineer but no

additional compensation will be allowed for such extra width.

C. Trench Depths:

1. In general, trench depths for all pipes and appurtenances shall be as shown on the Drawings.

2. Where necessary, the Engineer reserves the right to raise or lower the grades or to change alignments from those shown on the Drawings.

D. Excavation Below Grades:

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

3.03 PROCEDURES

A. Utilities:

1. All excavated areas shall be toned prior to excavation.

2. Unless shown to be removed, protect lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the State.

3. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

4. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the State.

5. Expose existing utilities to confirm clearances as initial trenching work. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.

6. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.

B. Protection of persons and property:

1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.

2. Operate warning lights during hours from dusk to dawn each day and as otherwise

required.

3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. Dewatering:

1. Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from soil.

2. Dispose water at an approved location by pumps, drains, and other approved methods.

D. During the period of construction, the Contractor shall protect the public against mud, dust and similar nuisances and shall take steps to abate such nuisances.

E. Convenient access to buildings along the line of work shall be maintained and temporary approaches shall be provided and kept in order. Temporary bridges for pedestrian traffic shall have handrails securely fastened to them. Handrails shall be free from any projecting nails, splinters, and rough edges.

F. Storing of excavated material alongside the trench shall be done in such a manner as not to obstruct traffic. Whenever, in the opinion of the Engineer, proper storage of excavated material cannot be made alongside the pipe trench, the material shall be hauled away from the work site. If the excavated material meets the requirements for backfill material and proper storage cannot be made alongside the pipe trench, the material shall be stockpiled at convenient locations for later use in backfill.

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

3.04 TRENCHING

A. Comply with the provisions of this Section.

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

1. Prior to backfilling, remove all sheeting.

2. Do not permit sheeting to remain in the trenches except when, in the opinion of the Engineer, field conditions or the type of sheeting or methods of construction such as use of concrete bedding are such as to make removal of sheeting impracticable. In such cases, the Engineer may permit portions of sheeting to be cut off and remain in

the trench.

C. Excavation:

1. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conduit can be installed safely and backfill can be compacted properly into such tunnel.

2. Where it becomes necessary to excavate beyond the limits of normal excavation lines in order to remove boulders or other interfering objects, backfill the voids remaining after removal of the objects at no additional cost to the State, as directed by the Engineer.

3. When the void is below the subgrade for the utility bedding, use select materials and compact to the relative density directed by the Engineer, but in no case to a relative density less than 90%.

4. When the void is in the side of the utility trench or open cut, use suitable earth or sand compacted or consolidated as approved by the Engineer, but in no case to a relative density less than 80%.

5. Excavating for appurtenances:

a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12" clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.

b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer, and at no additional cost to the State.

D. Depressions:

1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.

2. Except where rock is encountered, do not excavate below the depth indicated or specified.

3. Where rock is encountered, excavate rock to a minimum overdepth of 4" below the trench depth indicated or specified.

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

F. Cover:

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

2. Where the minimum cover is not provided, jacket the pipes in concrete as indicated. Provide concrete with a minimum 28 day compressive strength of 2500 psi.

3.05 BEDDING

A. Provide bedding as indicated on the Drawings.

3.06 BACKFILLING

A. General

1. All backfill material shall be placed in the trench by hand or by approved mechanical methods. The compaction of backfill material shall be done by tamping with hand tools or approved pneumatic tampers, by using vibratory compactors, by puddling if the backfill material can be suitably drained, or by any combination of the three. The method of compaction shall be approved by the Engineer and all compaction shall be done to the satisfaction of the Engineer.

2. When removal of unsuitable excavated material creates a shortage of backfill material, the Contractor shall, at no cost to the State, furnish material as specified in this section in the amount required to complete the backfill.

3. When backfill material is delivered by trucks, the material shall not be dumped directly into the trench but the fall of the material shall be broken at the edge of the trench. The backfill material shall then be deposited by hand or by approved mechanical methods.

4. Ensure that no damage is done to structures or their protective coatings.

B. Backfilling Around Pipe:

1. Select pipe cushion material shall be used to backfill the trench from its bottom to one foot above the pipe. Prior to the laying of the pipe, the select pipe cushion material cushion shall be deposited in the trench and shall be leveled off, compacted, and shaped to obtain a smooth compacted bed providing firm uniform bearing along the laying length of the pipe.

2. After the pipe is installed, but prior to testing the line, select material shall be deposited in the trench evenly on both sides and along the full length of the pipe in 6-inch maximum loose lifts. If necessary, additional select pipe cushion material can be deposited over the center of each length of pipe to prevent undue movement during testing of the line. Ensure that initially placed material is tamped firmly under pipe haunches. The bell holes at the pipe joints shall not be backfilled at this time.

3. The pipeline shall then be tested. After the pipeline has passed the test, the Contractor

shall backfill the bell holes with select pipe cushion material. The select pipe cushion material, which had been previously deposited over the pipe in the trench, shall be leveled and compacted.

4. The warning tape shall be installed in the center of the trench on top of the pipe cushion material, 18 inches below the ground surface.

C. Backfilling to Grade:

1. From an elevation six inches above the top of the pipe to grade, the backfill material shall be placed in layers not to exceed 8 inches in loose lifts. Each lift shall be compacted to a relative density not less than 95% of the material's maximum density as determined by the latest edition of ASTM Test Designation D-1557.

2. If the trench section is flooded, no further backfill shall be placed for two (2) days. After this period, the backfill shall again be thoroughly compacted to a relative density of not less than 95% by a method and with equipment approved by the Geotechnical Engineer.

3. The Contractor shall reconstruct the base course and pavement of roadway damaged by the construction of the pipeline as covered elsewhere in these Detailed Specifications.

4. Other improvements such as driveways, sidewalks, curbs, gutters, stonewalls, fences and other structures damaged during construction shall be replaced or repaired to their original condition or better as approved by the Engineer.

3.07 FIELD QUALITY CONTROL

A. The Manager will inspect and approve open cuts and trenches before installation of pipeline or structures, and will make the following tests:

1. Assure that trenches are not backfilled until all tests have been completed;

2. Check the warning tape is installed above the pipe cushion.

3. Check bedding for proper layer thickness and compaction;

4. Verify that test results conform to the specified requirements, and that sufficient tests are performed;

5. Assure that defective work is removed and properly replaced.

3.08 MEASUREMENT AND PAYMENT

Trenching, Backfilling and Compacting will not be measured for payment. Trenching, Backfilling and Compacting shall be considered as incidental and included in the cost for all the waterline pipe installation items in the contract proposal.

Imported Backfill Material, as required, shall be measured for payment by the cubic yard. Payment for Imported Backfill Material shall be full compensation the cost of the material and the hauling of the material. The placement and compaction of the material shall not be included in this payment but shall be included in the cost for the waterline pipe installation items.

END OF SECTION

SECTION 02227

COLD PLANING OF EXISTING PAVEMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section describes removing existing pavement by a cold planing process.

This specification shall follow the requirements specified in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005 unless specified otherwise.

PART 2 - PRODUCTS

2.01 MATERIALS. None.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

(A) Equipment. Use self-propelled cold planing machine capable of removing pavement to depth and cross slope indicated in the contract documents, without tearing or gouging underlying surface to remain and without contaminating milled pavement with underlying base course material.

Equip machine with cutting drum capable of producing a uniform surface finish. Enclose cutting drum in shroud to prevent discharge of loosened material into adjacent work areas. As standard equipment, provide dust suppression system, storage tanks with adequate water, and high- pressure spray bar with spray nozzles. Provide machine capable of cutting crown and depth by tilting drum axis and equipped with guidance system that controls transverse slope and longitudinal profile, matches adjacent pavements, and controls depth of cut.

Where cold planing is required to improve existing pavement profile for subsequent resurfacing, set guidance system grade sensor on string line or mobile reference. If mobile reference is used, provide 30-foot-minimum length of mobile reference to provide average elevation variations.

(B) Planed Surface and Removed Material. Cold plane surface to remove pavement and to eliminate high spots and surface irregularities for roadway resurfacing. Remove thickness of existing pavement to a 2-inch depth as indicated in the contract documents.

Adjust machine blades to avoid damaging existing items that are to remain, such as underlying pavement structure, monuments, manholes, and pipes. Remove and replace or reconstruct items damaged by planning operations.

For roadways open to traffic, cold plane each day across full width of traffic lane to avoid longitudinal pavement drop-off between passes. At end of each day's production, construct tapered transitions along longitudinal and transverse pavement drop-offs. Use maximum slopes of 6:1 for longitudinal and 48:1 for transverse tapered transitions. Limit drop-off depths to maximum of 3 inches. Remove transition material before resurfacing.

Provide for drainage of cold-planed surface and adjacent pavement. Perform this operation on same day as cold planing.

Finish surface shall be suitable for maintaining traffic. Except at crown areas, limit surface deviations to maximum of 3/8 inches, measured along 10-foot straight edge laid longitudinally and transversely.

Clean and sweep surface of planed pavement in accordance with Section 310 - Brooming Off before opening cold-planed area to public traffic. Dispose of cold-planed and removed transition materials in accordance with Subsection 201.03(F) - Removal and Disposal of Material.

Minimize dust escaping from cold planing operation and contain or remove runoff water used for dust control in accordance with Section 620 - Dust Control of the "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

Cold plane surface no more than three calendar days prior to placement of resurfacing material. Do not expose cold-planed surface to public traffic for more than three calendar days.

3.02 MEASUREMENT AND PAYMENT

Cold planing will not be measured for payment. Cold planing shall be considered as incidental and included in the cost for the Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02230

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 MATERIALS

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

Aggregate	703.06
Water	712.01

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A Placing

1. The base material shall be placed on the prepared surface without segregation. Segregated materials shall be remixed until a uniform distribution is obtained. The material shall not be dumped in piles on the prepared surface.

2. Depositing and spreading shall commence at that part of the work farthest from the point of loading the material and shall progress continuously without breaks, unless otherwise directed by the Engineer.

3. If the required compacted depth of the base course exceeds 6 inches, the base shall be constructed on 2 or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

4. If the contractor uses a vibratory roller weighing 9 tons or more, the lift thickness may be increased to 7 inches.

5. Spreading of binder material over the surface of the compacted base will not be permitted. Additional material if required shall be incorporated uniformly throughout the thickness of the compacted material by scarifying and blading. The combined material shall meet all quality requirements as specified.

B. Shaping and compacting

1. The Contractor shall perform such shaping work as necessary and such that the finished base shall conform to the required grade and cross-section. The finished base where not controlled by adjacent structures or features shall not vary more than 0.04 foot above or below the theoretical grade.

2. Compaction of each layer shall continue until a density of not less than 95 percent of the maximum density, determined in accordance with the requirements of Subsection 106.09 - Special Test Methods, of the "Standard Specifications for Road and Bridge Construction, has been achieved. Field density determination will be made in accordance with Hawaii Test Method HWY-TC 1. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture is produced and the aggregates firmly keyed. Water shall be uniformly applied over the base materials during compaction in the quantity necessary for proper consolidation.

3. Should high or low spots develop during rolling operations, such spots shall be smoothed out by blading with a self-propelled and pneumatic-tired motor grader having a wheel base not less than 15 feet long and a blade not less than 10 feet long.

4. Each layer shall be compacted initially by rolling with three-wheel rollers followed by intermediate rolling with pneumatic-tired rollers. Final rolling shall be done with three-wheel rollers.

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

3.02 MEASUREMENT AND PAYMENT

Aggregate Base Course will not be measured for payment. Aggregate Base Course will be considered as incidental and included in the cost for the Waterline Under Pavement items in the contract proposal.

END OF SECTION

SECTION 02512

ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Asphaltic Concrete Pavement shall follow the requirements specified Section 401 – Hot Mix Asphalt (HMA) Pavement, in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005, unless specified otherwise.

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

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

1.02 SUBMITTALS

Establish and submit job-mix formula for each type of HMA pavement mix indicated in the contract documents as follows:

A. Design percent of aggregate passing each required sieve size.
B. Design asphalt content added to aggregate, based on total weight of mix.
C. Design proportion of processed RAP.
D. Design temperature of mixture at point of discharge at paver.
E. Source of aggregate.
F. Grade of asphalt cement
G. Test data used to develop job-mix formula

With the exception of D. in this subsection, if design requirements are modified after the Engineer accepts job-mix formula, submit new job mix formula before using HMA produced from modified mix design.

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

PART 2 - PRODUCTS

2.01 MATERIALS

All materials shall meet the requirements specified in the State of Hawaii, Department of Transportation "Hawaii Standard Specifications for Road and Bridge Construction," 2005, with the following subsections of Division 700 - Materials.

Asphalt Cement	702.01
Emulsified Asphalt	702.04
Aggregate for Hot Mix Asphalt Pavement	703.09
Filler	703.15
Hydrated Lime	712.03

Leveling or base course mixture shall be Mix No. 2, surface wearing course mixture shall be as shown on the plans or called for in the special provision or proposal.

A. Grading and Composition Requirements: The aggregate grading requirements shall conform to Table 1 below:

TABLE 1-AGGREGATE GRADING REQUIREMENTS

MIX NO.	II	III	IV	V
		COMBINED AGGREGATE		
SIEVE SIZE		Total Percent Passing by Weight		
1-1/4"	100	-	-	-
1"	85-100	100	-	-
3/4"	-	90-100	100	-
1/2"	60-85	70-90	90-100	100
3/8"	-	-	72-90	80-100
No. 4	36-55	40-57	48-66	55-75
No. 8	26-41	30-47	32-48	35-52
No. 16	17-32	20-36	21-37	22-38
No. 30	12-25	16-28	15-27	14-26
No. 50	8-18	10-22	9-21	8-20
No. 100	5-14	8-17	6-16	6-15
No. 200	1- 8	4-8	4-8	4-8
Ashphalt Content (Percent of Total Weight of Mix)				
	3.8-6.1	4.3-6.1	4.3-6.5	4.8-7.0
Minimum to Maximum Compacted Thickness for Lifts (Inches)				
	2-1/4 to 3	2 to 3	1-1/2 to 3	1-1/4 to 3

Provide Hot Mix Asphalt within allowable tolerances of accepted job mix formula as specified below:

Passing No. 4 and larger sieves	7% above or below
Passing No. 8 and No. 100 sieves	4% above or below
Passing No. 200 sieves	3% above or below
Bituminous Binder	0.4% above or below
Temperature of Mixture on Delivery	20^{o}F above or below

PART 3- EXECUTION

3.01 DETAILS

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

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

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

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

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

The mixture as prepared above shall be brought to the work in suitable vehicles at a temperature of not less than 250NF. Tarpaulins shall be provided and used upon all loads.

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

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

shall be discontinued and other acceptable equipment shall be furnished by the Contractor.

If more than one course is to be laid in any area, not more than 24 hours shall elapse between the spreading and finishing of any two successive courses in that area.

The self-propelled mechanical spreading and finishing machine shall be capable of propelling the vehicle being unloaded in uniform manner and, if necessary, the load of the haul vehicle shall be so limited that satisfactory spreading will be obtained. While being unloaded, the vehicle shall be firmly attached to the machine and the brakes on the vehicle shall not be depended upon to obtain contact between the vehicle and the machine.

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

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

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

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

Wearing surface mixture shall not be spread from hauling vehicles.

No wearing surface shall be spread when the atmospheric temperature is below 50^{o}F or during other unsuitable weather, or when the base is wet.

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

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

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

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

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

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

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

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

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

3.02 MEASUREMENT AND PAYMENT

Payment for RESTORATION OF ASPHALTIC PAVEMENT will be made by Square Yard of asphalt concrete pavement laid. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, compacting, and other incidentals required to complete the work.

Included in the payment for RESTORATION OF ASPHALTIC PAVEMENT shall be the following work: cold planing, roadway striping, restoration of street monuments, prime coat, tack coat and all other incidentals required to complete the work, in place complete.

END OF SECTION

SECTION 02513

PRIME COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of prime coat.

PART 2 - PRODUCTS

2.01 MATERIALS

Bituminous Material: Bituminous material for prime coat shall emulsified asphalt, Type CSS-1h or SS-1h, conforming to the applicable requirements of Section 420 – Primer for Untreated Permeable Base Course, and Section 702 - Bituminous Materials, of the "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

Water shall conform to the requirements of Subsection 712.01 - Water.

The Engineer reserves the right to waive any of the requirements for the MC-30 provided that its performance is not affected.

2.02 SUBMITTALS

The Contractor shall submit a Certificate of Compliance accompanied by certified test data, in accordance with AASHTO M 208 (Type CSS-1h) or AASHTO M 140 (Type SS-1h)

PART 3 - EXECUTION

3.01 DETAILS

A. Immediately before applying the prime coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable material.

Prime coat shall not be applied when the surface to be treated is appreciably damp or when weather conditions are unsuitable.

B. The material shall be uniformly applied by a vehicle, mounted, pressure operated, sprayer type distributor at an approximate rate of 0.35 of a gallon per square yard. The exact rate of application shall be determined by the Engineer. After the prime coat has penetrated the surface, deficient areas shall receive additional applications and areas of excess bituminous material shall be blotted with clean sand. Traffic shall be kept off the prime coat until the material has been completely absorbed.

C. Curbs, sidewalks and gutters shall be protected from prime coat. Any material sprayed on adjoining improvements shall be immediately cleaned off. The edges of existing asphalt paving, manholes and catch basin frames, concrete gutters, etc., against which asphaltic concrete pavement is to be placed shall be given a prime coat.

3.02 MEASUREMENT AND PAYMENT

Prime coat will not be measured for payment. Prime coat will be considered as incidental and included in the cost for the Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02514

TACK COAT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing bituminous tack coat.

PART 2 - PRODUCTS

2.01 All sections or subsections called for in the specifications shall be referred to the State of Hawaii, Department of Transportation, "Hawaii Standard Specifications for Road and Bridge Construction," 2005.

2.02 MATERIALS

Bituminous material for tack coat shall be slow-setting emulsified asphalt, Type SS-1 or Type SS-1h, conforming to the applicable requirements of Section 407 - Tack Coat and Section 702 – Bituminous Material.

Water shall conform to the requirements of Subsection 712.01 - Water.

2.03 SUBMITTALS

Submit certificate of compliance for emulsified asphalt, accompanied by certified test data in accordance with AASHTO M 140 (Type SS-1 or SS-1h).

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Weather Limitations: Tack coat shall not be applied on a wet surface or when weather conditions otherwise shall prevent proper construction.

B. Equipment: The Contractor shall provide equipment for heating and applying the bituminous material. This equipment shall meet the requirements of Subsection 405.03(B) - Equipment.

C. Preparation of Surface: Immediately before applying the tack coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable matter. A power broom or power blower, supplemented by hand methods if necessary, shall be used.

D. Application of Bituminous Material: The emulsified asphalt shall be diluted with water at a rate of one part emulsion to one part of water by volume. The quantity, rate of application, temperature, and areas to be treated will be approved prior to application.

Tack coat shall be placed only so far in advance of the surface course placement as is necessary for it to cure to the proper condition for placement of such surface course.

Unless otherwise specified, tack coat shall be applied at the rate of 0.12 - 0.18 gallon per square yard on surface of base course.

3.02 MEASUREMENT AND PAYMENT

Tack coat will not be measured for payment. Tack coat will be considered as incidental and included in the cost for the Asphalt Pavement item in the contract proposal.

END OF SECTION

SECTION 02605

VALVE BOXES, MANHOLES & MARKERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section shall apply to furnishing and installing valve boxes, manholes and markers. Unless otherwise noted, reference made to the Standard Details shall be the "Water System Standards, 2002 and Amendments".

1.02 SUBMITTALS

Materials shall be submitted for Manager's approval prior to installation.

1.03 VALVE BOXES

Valve boxes for gate valves, air relief valves and butterfly valves and cleanouts shall be installed in accordance with the Standard Details.

1.04 MANHOLES

Manholes shall be constructed wherever specified on the plans. Manholes shall be constructed in accordance with the Standard Details or as shown on the plans.

Manhole in lieu of valve box shall be constructed over any valve whenever the depth from the finish grade of the pavement or ground to the top of the stem of the valve exceeds five (5) feet unless directed otherwise by the Manager.

1.05 MARKERS

Valve markers for establishing the location of valves shall be installed at the locations shown on the plans or as directed by the Manager. Markers shall conform to the dimensions and notes shown on the Standard Details.

PART 2 - PRODUCTS

2.01 GENERAL

A. Cast iron for frames and covers shall conform to ASTM Designation A-48.

B. All castings shall be of tough, close-grained, gray iron, sound, smooth, clean, and free from blisters, blowholes, shrinkage, and cold shuts.

C. Allowance shall be made in the patterns so that the finished castings shall have the specified dimensions.

D. The seats of manhole and valve box frames and covers shall be machined, not ground to secure flat and true surfaces. Castings for cover and reading lid seats shall be chipped and ground where necessary to secure flat and true surfaces.

E. All castings shall be thoroughly cleaned and painted before leaving the shop with one coat of high-grade asphaltum.

2.02 VALVE BOX COVERS AND FRAMES AND STANDPIPES

Valve box covers and frames shall be made in accordance with the dimensions and notes shown on the Standard Details.

Valve box standpipes shall be either cast iron pipe, R.C.P., PVC, or approved equal. Standpipes shall be as shown on the Standard Details.

PART 3 - EXECUTION

3.01 VALVE BOXES

The standpipe shall be set plumb and centered over the valve stem. Backfill around the valve and standpipe shall be made by hand to 8 inches below the surface of the ground and compacted. Compaction of backfill shall be done with approved pneumatic tampers.

The cast iron frame and cover shall set firmly to grade. The 4-inch thick DWS 2500 concrete slab shall be poured to secure the frame.

All cast iron covers shall be close fitting to avoid rattling due to the passing traffic. All defective frames and covers shall be replaced to the satisfaction of the Manager.

Upon completion of installation, valve box frames and covers shall be cleaned and painted with one coat of approved asphaltum paint.

Existing valve boxes to be reconstructed to the required elevation shall be done in accordance with the applicable provisions of the Water System Standards. The existing standpipe shall be replaced with one having the correct length to bring the valve box to the required elevation. The existing standpipe may be reused if so approved by the Manager.

3.02 MANHOLES

A. Upon completion, all manholes, including reconstructed or adjusted manholes, shall be thoroughly cleaned of all debris and the frames and covers painted with one coat of approved asphaltum paint.

B. Manhole walls shall be constructed of concrete, brick, or hollow block with reinforcing as required in accordance with standard masonry practice. The sizes and dimensions shall be as shown on the Standard Details.

C. A space of at least 2 inches shall be left between the wall and the upper half of the barrel of the pipe. This space shall be filled with asphalt or premolded asphaltic filler.

D. If any portion of the manhole is below the 4-foot elevation, City and County Datum, or where water is encountered, that portion thereof shall be given a plaster coating of cement mortar 5/8-inch thick on the inside and outside. The plaster coating shall be composed of one part Portland cement and three parts of fine aggregate by volume. Hydrated lime may be used in the mortar but shall not exceed 10% by volume.

E. Manhole top and bottom slabs shall be of concrete with reinforcing steel and shall be constructed in accordance with the dimensions and notes shown on the Standard Details.

3.03 MEASUREMENT AND PAYMENT

Payment for the furnishing and installation of VALVE BOXES will be made at the Unit Price Bid per each unit, based on the actual number installed and accepted.

The Unit Price Bid for the furnishing and installation of VALVE BOXES shall be full compensation for all labor, materials, tools and equipment for all excavation and backfill, cast iron frames and covers, 8-inch pipe collar, concrete anchoring pad, brick leveling course, pipe cushion, painting, cleaning up and all other incidentals necessary to complete the work.

No separate payment for backfilling around valve boxes with black sand, sand or coral chips and for temporary backfill and additional excavation to expose the risers after chlorination will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for installing valve boxes.

END OF SECTION

SECTION 02606

PRESSURE REDUCING VALVES

PART 1 - GENERAL

1.01 SCOPE

A. This section includes pressure reducing valves (PRV) and all appurtenances for the main water line and individual PRVs for laterals.

1.02 SUBMITTALS

A. Submit manufacturer's product data for proposed valves for approval.

PART 2 - PRODUCTS

2.01 MATERIALS

PRVs for 8-inch waterline main and laterals shall include all items detailed in the Water System Standards, 2002 and in the Drawings. See Drawing sheets DT-1, DT-2, DT-3.

A. PRVs for 8-inch waterline main. Use CLA-VAL Model 90-01 or approved equivalent:

Valve Body & Cover		Pressure Class				
		Flanged			Grooved	Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400	400
Note: * ANSI standards are for flange dimensions only. Flanged valves are available faced but not drilled. ‡ End Details machined to ANSI B2.1 specifications.						

1. Valve body and cover: Ductile iron, Class 150, flanged, globe pattern.
2. Valve internals:
   a. Provide top and bottom single moving disc and diaphragm assembly.
   b. Use flexible nylon fabric reinforced elastomer diaphragm integral with assembly.
   c. Provide valve internal trim (seat ring, disc guide, and cover bearing) made of stainless steel.
   d. Provide heat fusion bonded epoxy coating to internal and external surfaces of valve body including disc retainer and diaphragm washer. Holiday test coating applied to valve body.
   e. Treat stem and seat with penetrative salt nitride process.

f. Use Xylan coated seat.

g. Do not use leather parts.

B. Control Tubing: Contain shutoff cocks with Y-strainer.

C. Provide approved PRV in location and arrangement as shown on Drawings or as directed by the Engineer.

D. Provide basket strainer upstream of PRV as shown on Drawings or as directed by the Engineer.

1. Strainer body: Quick-opening type, fabricated-steel construction with ANSI B 16.1, Class 150, flanges.
2. Basket: Type 304, stainless steel.
3. Model: Provide basket strainer compatible with the manufacturer of the pressure reducing valve.

E. PRV: Equip with visual valve position indicator. Fit valve position indicator with air-bleed petcock. Initially set in field by authorized manufacturer's representative.

F. Valve Vaults: Provide as shown on Drawings. Reference Section 303.03 – CONCRETE WORK in the Water System Standards, 2002 for PRV vault concrete.

G. Individual PRVs for laterals. Use CLA-VAL Model CRD-L or approved equivalent:

1. Sizes of Individual PRVs shall appropriately match the size of the existing service lateral upon which it is installed.
2. Temperature Range
   a. Water: to 140°F (70°C) Max
3. Diaphragm: EPDM
4. Disc: EPDM
5. Materials
   a. Body and Cover: Low Lead Bronze CuZn21Si3P
6. Pressure Ratings
   a. Maximum Inlet Pressure: 400 psi (25 Bar)
   b. Maximum Outlet Pressure: 150 psi (10 Bar)
   c. Minimum Differential Pressure: 14.5 psi

H. Provide pressure reducing pilot that has adjustable range of 20 - 175 psi. Provide and install pilot system components according to manufacturer's recommendations unless otherwise approved by Engineer.

PART 3 - EXECUTION

3.01 SETTING VALVES

A. Provide services of technical representative of valve manufacturer on site during installation of valves and to serve as adviser on aspects of installation. Take necessary precautions to protect pilot system during PRV installation.

B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

C. The PRV shall maintain a constant downstream pressure regardless of varying inlet pressures.

3.02 PAINTING OF PIPING AND VALVES

A. Paint piping and valves located in vaults, stations, and above ground using paint approved by Engineer.

3.03 MEASUREMENT AND PAYMENT

Payment for the Pressure Reducing Valve Assembly and Pressure Reducing Valve Station shall be made by lump sum.

Payment for the Pressure Reducing Valve Assembly shall include the pressure relief valve, the flap valve and all other appurtenance , in place complete. Payment shall include the removal and disposal of the existing assembly.

Payment for the Pressure Reducing Valve Station shall include the concrete vault and all other appurtenances, in place complete.

Measurement and Payment for the Individual Pressure Reducing Valves shall be made by each. Payment for the Individual Pressure Reducing Valves will be made at the unit bid price for the various sizes of Individual Pressure Reducing Valve that are installed, in place complete.

END OF SECTION

SECTION 02607

BACKFLOW PREVENTION ASSEMBLIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing backflow preventers and appurtenances.

A. Backflow prevention assemblies shall be furnished and installed as shown on the plans, as specified in the specifications, or as directed by the Manager. A backflow prevention assembly, is a device used to prevent the reversal of flow of water or mixtures of water and other liquids, gases or other substances into the distribution pipes of the potable supply of water from any source or sources.

B. All work shall conform to the Rules and Regulations of the Department and the "Uniform Plumbing Code" as adopted by the City or County or as modified herein.

C. Only reduced pressure principle assemblies and double check valve assemblies meeting AWWA C511 and C510, respectively, as amended, and pressure vacuum breakers meeting International Association of Plumbing and Mechanical Officials (IAPMO) Standards PS 31-71 as amended, approved by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California (FCCCHR-USC) shall be allowed.

1.02 SUBMITTALS

A. Unless otherwise approved by the Manager, the construction plans, insofar as the backflow prevention assemblies are concerned, shall be on 22" x 36" tracing film or tracing paper. After receipt of the Manager's approval, four copies of the construction plans shall be submitted to the Engineer. The construction plans shall be as specified in Division 100, Section 112 - CONSTRUCTION PLANS of the Water System Standards, 2002.

B. Details of the backflow prevention assembly showing both plan and elevation views including size and location of the assembly shall be submitted to the Manager for review and approval prior to installation.

PART 2 – PRODUCTS (none)

PART 3 - EXECUTION

3.01 INSTALLATION

A. The backflow prevention assembly shall be installed above ground on the property side of the property line and as close to the property valve or meter's emergency by-pass connection and before any branches, as physically possible. Connections or tees between the meter and the backflow prevention assembly will not be permitted without written approval by the Manager. Installation heights of backflow prevention assemblies shall conform to Table 3.1:

Table 3.1

Size of RP and DC Assemblies (inches)	Dimension (inches) Ground Level to Centerline of Backflow Prevention Assembly	
	Minimum	Maximum
¾ to 1 ½	18	48
2 to 3	24	48
4 to 6	30	48
8 to 10	36	48

B. Backflow prevention assemblies shall not be installed underground without written approval by the Manager. Approval for underground installations of the backflow prevention assemblies will be based solely on public safety.

C. If it is not possible to install the assembly as close as physically possible to the property valve or meter's emergency by-pass connection, plans indicating the new location including plan and elevation views shall be submitted to the Manager for approval.

D. In all cases, the backflow prevention assembly shall be installed in a horizontal, upright position, properly protected from external damage, in an easily accessible location, and in an area free of any obstruction within two feet surrounding the device. Drainage satisfactory to the Manager shall be provided.

The Manager shall determine the type of backflow prevention assembly to be used. Selection shall be based on the actual or potential threat of contamination or pollution to the public water supply (refer to the guidelines for Backflow Prevention Requirements).

E. The following guidelines relating to backflow prevention assemblies for irrigation systems shall apply:

1. Pressure Vacuum Breakers shall be installed at the beginning of each irrigation circuit and at a minimum of twelve (12) inches above the highest irrigation head on the circuit. Individual irrigation circuits having quick coupling valves or other similar type heads that will permit pressure to be retained in the circuit shall have a pressure vacuum breaker installed as a minimum requirement for each circuit.

Irrigation systems using the subsurface drip method shall have a pressure vacuum breaker on each circuit. A pressure vacuum breaker may not be installed where a double check valve assembly, reduced pressure principle backflow prevention device, or air gap separation is required.

2. Double Check Valve Assembly may be installed to serve multiple irrigation circuits in lieu of vacuum breakers on each individual irrigation circuit.

3. Reduced Pressure Principle Backflow Prevention Assembly or air gap separation shall be required before any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system.

3.02 TESTING

Backflow Prevention Assemblies shall be tested by a certified Backflow Prevention Assembly General Tester acceptable to the Engineer.

3.03 MEASUREMENT AND PAYMENT.

Payment for furnishing and installing BACKFLOW PREVENTION ASSEMBLIES and appurtenances will be made at the Unit Price Bid per each unit, based on the actual number of backflow prevention assemblies and appurtenances installed and tested.

The Unit Price Bid for furnishing and installing BACKFLOW PREVENTION ASSEMBLIES and appurtenances shall be full compensation for all labor, materials, tools and equipment for all handling, unloading, excavating, placing, testing, grading and all other work required to install the backflow prevention assemblies and appurtenances, in place complete.

Payment for REMOVAL AND DISPOSAL OF EXISTING BACKFLOW PREVENTION ASSEMBLIES and appurtenances will be made at the Unit Price Bid per each unit, based on the actual number of backflow prevention assemblies removed and disposed.

The Unit Price Bid for REMOVAL AND DISPOSAL OF EXISTING BACKFLOW PREVENTION ASSEMBLIES and appurtenances shall be full compensation for all labor, materials, tools and equipment for all handling, unloading, excavating, removing, disposing, and all other work required to remove and dispose of the existing backflow prevention assemblies.

END OF SECTION

SECTION 02608

METERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing smart meters, endpoints and appurtenances in place and complete.

The Contractor shall be required to set up and activate the Beacon Advanced Metering Analytics (AMA) system for DHHL and provide introductory and data exchange training to DHHL staff on the use of the AMA system.

1.02 SUBMITTALS

Submit manufacturer's product data for proposed meters and endpoints for approval by the Engineer.

PART 2 - PRODUCTS

2.01 The smart meters used shall be an advanced metering infrastructure (AMI), an integrated system of smart meters, communications networks, and data management systems that enables two-way communication between the water system management company and customers via the cellular network. Additional smart meters shall be purchased by the Contractor which will not be installed but handed over to DHHL to be used as spares.

A. Meter – New smart meters shall be the same size as the existing water meters that they are replacing. The smart meters shall be E-Series Stainless Steel Ultrasonic Meters by Badger Meter (or approved equal). The meter shall use solid-state technology, in a compact, totally encapsulated, weatherproof, and UV-resistant housing, suitable for residential applications. The meters shall feature a stainless steel, lead-free meter housing, an engineered polymer and stainless steel metering insert, a meter-control circuit board with associated wiring, an LCD display and battery. The meter shall comply with applicable portions of ANSI/AWWA Standard 700 and NFS/ANSI Standard 61, Annex G. The meter must be compatible with the Badger ORION Cellular LTE Endpoint (or approved equal). The meters must follow the specifications in the table below.

Meter Size	5/8”	3/4” (short)	1”	1-1/2” (HEX)	2” (HEX)
Typical Operating Rang	0.1…25 gpm	0.1…32 gpm	0.4…55 gpm	1.25…100 gpm	1.5…160 gpm
Low Flow	0.05 gpm	0.05 gpm	0.25 gpm	0.40 gpm	0.50 gpm
Max. Continuous	25 gpm	32 gpm	55 gpm	100 gpm	160 gpm

Operation					
Pressure Loss	4.3 psi @ 15 gpm	2.0 psi @ 15 gpm	1.8 psi @ 25 gpm	3.8 psi @ 100 gpm	5.2 psi @ 160 gpm
Measured Fluid Temp. Range	34° F - 140° F	34° F - 140° F	34° F - 140° F	34° F - 140° F	34° F - 140° F
Max. Operating Pressure	175 psi	175 psi	175 psi	175 psi	175 psi
Register Capacity	10,000,000 gal	10,000,000 gal	10,000,000 gal	100,000,000 gal	100,000,000 gal
Lay Length	7.5”	7.5”	10.75”	12.62”	15.25”

B. Endpoint – The endpoint shall be an ORION Cellular LTE, two-way water endpoint by Badger Meter (or approved equal). The endpoint shall utilize existing cellular infrastructure to deliver meter reading data to the utility via the cellular network. The endpoint top diameter shall be 1.75 inches and height 5.125 inches. The housing shall be an engineered polymer enclosure with an ORION RF board, battery and antenna. The endpoint shall broadcast through the LTE cellular network, with fallback to the 3G where LTE is unavailable. The endpoint shall take meter readings every 15 minutes.

The endpoint communicates with the meter encoder and captures readings and meter status information. At a predetermined interval, the endpoint broadcasts readings, status, and event data via the cellular network, and the information is captured and analyzed using BEACON AMA software, or approved equal.

C. Endpoint Pipe Mounting Equipment – Endpoints mounted in polymer meter boxes beneath polymer lids shall be mounted with a Pipe Install Kit by Badger Meter (No. 64394-003) or approved equal.

D. Endpoint Thru-the Lid Mounting Equipment – Endpoints mounted in concrete County Standard meter boxes with cast-iron lids shall be mounted with an ADA-Compliant Thru-the-Lid Install Kit by Badger Meter (No. 64394-030) or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Meter and endpoint shall be installed at locations shown on the plans in accordance with the manufacturer’s guidelines.

B. Meter size shall correspond with the size of the lateral pipe with which it is connecting to as indicated in the Water System Standards, Standard Details L1, L2, L4, L5 & L6. The

existing meter size indicated on the plans is based on As-builts and must be verified in the field.

C. Installation of Endpoints shall follow the recommendations of the Manufacturer.

D. When installing an Endpoint in a County Standard meter box with a cast-iron lid, the Contractor shall be required to drill a 1.75” diameter hole in the lid to be used with the Thru-the-Lid install kit.

3.02 MEASUREMENT AND PAYMENT

Payment for furnishing and installing E-SERIES ULTRASONIC STAINLESS STEEL BADGER METERS, or approved equal, will be made at the respective Unit Price Bids per each meter assembly, based on the actual number of the various sizes and types of meters installed and tested.

The Unit Price Bids for furnishing and installing E-SERIES ULTRASONIC STAINLESS STEEL BADGER METERS shall include the Orion Cellular LTE Endpoint and appropriate Endpoint install kit, and be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, jointing, setup, testing, and all other incidentals necessary to complete the work.

Payment for furnishing SPARE E-SERIES ULTRASONIC STAINLESS STEEL BADGER METERS, or approved equal, will be made at the respective Unit Price Bids per each meter, based on the actual number of the various sizes and types of meters purchased.

The Unit Price Bids for furnishing SPARE E-SERIES ULTRASONIC STAINLESS STEEL BADGER METERS shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, and all other incidentals necessary to complete the work.

Payment for furnishing SPARE ORION CELLULAR LTE ENDPOINTS, or approved equal, will be made at the respective Unit Price Bids per each endpoint purchased.

The Unit Price Bids for furnishing SPARE ORION CELLULAR LTE ENDPOINTS shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, and all other incidentals necessary to complete the work.

Payment for conducting SETUP, TRAINING, ACTIVATION, AND FEES FOR THE AMA CELLULAR SYSTEM FOR SMART METERS will be made at the respective Lump Sum Price in the Bid.

The Lump Sum Price for conducting SETUP, TRAINING, ACTIVATION, AND FEES FOR THE AMA CELLULAR SYSTEM FOR SMART METERS shall represent full compensation for furnishing all materials, labor, tools, equipment and all other incidentals necessary to activate DHHL’s Beacon AMA portfolio and initial licensing of the Beacon

AMA software. The Lump Sum Price shall be full compensation for training of DHHL staff on how to set up their endpoints in the Beacon AMA cloud-based software, provide a walkthrough of the basic software functionality and user interface, how to use the Beacon Data Exchange module to import its meter and account data from the billing system into the Beacon AMA software and then export read data from Beacon AMA back to the billing system.

Payment for REMOVAL AND DISPOSAL OF EXISTING METERS and appurtenances will be made at the Unit Price Bid per each unit, based on the actual number of meters removed and disposed.

The Unit Price Bid for REMOVAL AND DISPOSAL OF EXISTING METERS and appurtenances shall be full compensation for all labor, materials, tools and equipment for all handling, unloading, excavating, removing, disposing, and all other work required to remove and dispose of the existing meters.

END OF SECTION

SECTION 02611

PIPE AND FITTINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing of County Standard pipe and fittings. The Water System Standards, 2002, for State of Hawaii, including any amendments, shall be followed unless specified otherwise in this specification.

A. The class of water mains shall be determined by the maximum pressure to be expected in the line.

B. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, water pipes in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.02 SUBMITTALS

A. Submit manufacturers' information bulletins, catalog cuts, drawings and other data to show that the proposed items conform to the specifications requirements. The manufacturer and details of the flanged pipe and fittings must be approved by the Engineer before the piping layout drawings are submitted.

B. Submit six sets of piping layout drawings. Drawings shall show all dimensions, valves, piping, fittings, and appurtenances.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe: Pipe materials shall meet County Standards. Pipes shall be furnished in lengths not shorter than 18 feet nor longer than 20 feet.

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

2.02 FITTINGS: Fittings shall meet the County Standards. Compact fittings are not allowed.

2.03 INTERIOR LINING: All pipes, fittings, and special castings, except sleeves and plugs, shall be cement mortar lined in accordance with ANSI A-21.4 and AWWA C104. Interior linings shall have tapered ends and shall be sealed with a bituminous seal coat.

2.03 GASKET:

A. Gaskets shall meet the County Standards.

B. Gaskets shall be vulcanized natural or vulcanized synthetic rubber, free of porous areas, foreign materials, and visible defects. No reclaimed rubber shall be used.

2.04 BOLTS AND NUTS:

A. All bolts and nuts shall meet the County Standards

B. All bolts and nuts shall be either silicon bronze (ASTM F467 and F468) or stainless steel (ASTM F593 and F594, type 316). All bolts and nuts shall be silicon bronze only if submerged in water. Bolts and nuts installed shall be compatible in strength and material characteristics. Bolts shall protrude beyond the nuts and protrusion shall be a minimum of 1/8-inch but shall not exceed 1/2-inch. All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

PART 3 - EXECUTION

3.01 SCHEDULING

Waterline “A-1” shall be required to be constructed prior to Waterlines “B-1”, “B-2” and “B-3” to facilitate an uninterrupted supply of water to the residences at Anahola subdivision. This is a requirement due to the planned concurrent construction of this project with the Anahola Phase II – Water Tank Replacement project.

3.02 INSTALLATION

Prior the installation of the pipe, the circumference of the spigot ends shall be marked showing the depth of the bell of the pipe.

Prior to installation, the contractor shall confirm existing waterline locations by toning. The waterline locations on the plans are based on record drawings, not surveyed locations.

A. After the trench bottom has been prepared, each pipe shall be laid so that the barrel of the pipe shall have bearing along its laying length with the bell end properly set to grade and alignment. The spigot end of the pipe shall then be centered and firmly embedded against the bell end of the pipe previously laid. There shall be uniform clearance around the bell. The pipe shall be firmly held in place by proper blocking on each side of the pipe.

B. No pipe "springing" or "buckling" into place between installed pipe or special castings shall be allowed.

C. Whenever it is necessary to install pipe sleeves, the space between the ends of the adjoining pipes shall be filled by inserting a full ring piece. The filler piece shall be of the same material as the pipe.

F. Install polyethylene loose wrap around pipes and fittings as required by the County

Standards. Installation of polyethylene loose wrap shall be in accordance with AWWA C105. The wrap shall consist of an 8-mil thickness polyethylene tube or flat sheet installed to completely encase the pipe and fittings and secured thereto with 2-inch wide plastic adhesive tape.

G. When pipe laying is interrupted or delayed, all openings shall be tightly closed with removable plugs or caps. The plugs shall be held securely in place.

H. Mechanical Joint. In making the joint, the bell and the spigot ends of the pipe as well as the rubber gasket shall be thoroughly cleaned before assembly. The gland, followed by the gasket, shall be placed over the spigot end of the pipe. The spigot end of the pipe shall be inserted into the bell of the pipe previously laid. The small side of the gasket and the lip side of the gland shall face the bell. The gasket shall then be pushed into position so that it is evenly seated in the bell. The gland shall be moved against the face of the gasket.

a) Bolts shall be inserted with threaded ends on the gland side. Nuts shall be screwed on by hand and made hand tight in pairs, 180 degrees apart. Bolts shall be alternatively tightened (180 degree apart) to the required tension with an ordinary ratchet wrench, beginning at the bottom, then the top and so on. The ranges of bolt torques to be applied shall be as follows:

Bolt Size, Inches	Range of Torque, Ft. Pounds
5/8	45-60
3/4	75-90
1	85-100
1-1/4	105-120

b) The following lengths of wrenches should satisfactorily produce the above ranges of torques when used by the average man:

Bolt Size, Inches	Length of Wrench, Inches
5/8	8
3/4	10
1	12
1-1/4	14

c) When the joint is assembled, the distance between the face of the bell and the face of the gland shall be uniform all around the pipe.

d) All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

I. Push-on Joint. The gasket and gasket seat in the socket of the pipe shall be wiped clean.

The gasket shall be placed in the socket with the large round end entering first. The gasket shall be sprung into place. The groove of the gasket shall fit over the bead in the seat.

a. A thin film of non-toxic lubricant, supplied by the manufacturer, shall be applied to the inside of the gasket that comes in contact with the pipe. A thin film of lubricant may also be applied to the outside of the plain end of the pipe.

b. The joint shall be assembled by entering the plain end of the pipe past the gasket until contact is made with the base of the socket.

c. When pipes are cut in the field, the outside edges of the cut end shall be tapered with a coarse file or portable grinder. The taper shall be about 1/8 inch at an angle of about 30 degrees with the center line of the pipe.

J. Flanged Ends. All flanged pipes, fittings and valves shall be installed to the lines and grade shown on the plans. The face of flanges shall be true and free of projections and shall be cleaned of all rust and foreign matter. Gaskets shall be "full face" carefully cut to fit flanges and bolt holes. "Flange-Tyte" gaskets may also be used. Flanges shall be brought up to true alignment and fit with uniform tension on all bolts. All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation.

3.03 MEASUREMENT AND PAYMENT

Payment for the furnishing and installation of the various sizes of County Standard Pipe will be made at the respective Unit Price Bids per linear foot based on the actual linear feet of pipe installed, cleaned or pigged and successfully hydrotested.

The Unit Price Bid for the furnishing and installation of pipe shall be full compensation for all labor, tools, equipment for all handling, hauling, unloading, placing, cutting, jointing, cleaning or pigging, hydrotesting, painting, pavement sawcutting and demolition, unclassified trench excavation and backfill for pipe and appurtenances, pipe cushion, warning tape, polyethylene wrap, temporary SC-4 patch, restoration of improvements (curbs, gutters, sidewalks, concrete driveways, concrete pavement, landscaping etc.), sheeting and shoring as required, dewatering, and all incidental work necessary to construct the water system as indicated on the plans, in place complete.

Payment for the furnishing and installation of the various sizes of pipe fittings shall be paid for by each fitting as shown on the Proposal items.

END OF SECTION

SECTION 02614

VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 This section covers the requirements for furnishing and installing valves including all appurtenances as shown on the Plans. This shall include but is not limited to:

A. Gate Valves
B. Tapping Valves and Sleeves
C. Air Relief Valve
D. Backflow preventers
E. Meters
F. Horizontal Reaction Blocks
G. Vertical Thrust Blocks

1.02 Gate valves and all appurtenances shall conform to the Water System Standards.

1.03 SUBMITTALS

A. Contractor shall submit shop drawings of tapping sleeves for approval prior to installation.

PART 2 – PRODUCTS

2.01 GATE VALVES

A. Gate valves shall have non-rising stems, with inside screw and shall open to the left or counterclockwise. All valves shall be full body and not thin-walled or reduced wall-type. Valves shall have the manufacturer's name, size, catalog number and working pressure molded or stamped thereon in places where the name and number may be easily seen when the valves are installed. Interior and exterior surfaces of valves shall be shop coated with fusion-bonded epoxy meeting AWWA C550. Valves shall be furnished complete with all accessories and appurtenances.

B. Gate valves shall be resilient seat type conforming to AWWA C509 with cast iron body and shall be furnished with 2-inch operating nuts. Stuffing boxes shall be of an O-ring design with a minimum of three O-rings. No gasket material made of asbestos shall be used. "Resilient-Seated Gate Valves For Water and Sewerage Systems". Valves shall be either 4, 6, 8, or 12-inch in size and rated for service at 200 psi working pressure. Valves shall have non-rising stems, opening by turning left and provided with 2-inch square nut with arrow cast in metal to indicate direction of opening. Each valve shall have manufacturer's name, pressure rating and year in which manufactured cast on the body.

All bolts and nuts shall be either silicon bronze (ASTM F467 and F468) or stainless steel (ASTM F593 and F594, type 316). All bolts and nuts shall be silicon bronze only if submerged in water. Bolts and nuts installed shall be compatible in strength and material characteristics. Bolts shall protrude beyond the nuts and protrusion shall be a minimum of 1/8-inch but shall not exceed 1/2-inch. All stainless steel bolt and nut threads shall be precoated with anti-seizing graphite compound before installation. Dimensions of bolting

material shall meet ANSI B18.2.1 specifications. Bolting of the valve body parts shall be by bolts and nuts. Tapped bolt holes into the valve body are unacceptable.

Stuffing boxes shall be of an O-ring design with a minimum of three O-rings. No gasket material made of asbestos shall be used.

Interior and exterior coating shall be fusion epoxy meeting AWWA C550, "Standard For Protective Interior Coatings For Valves and Hydrants".

Stem shall be bronze meeting the requirements of Grade D or Grade E Bronze as specified in AWWA C509.

Low friction torque reduction thrust bearings shall be located both above and below the stem collar.

If guides for the gate are required, there shall be no metal-to-metal contact, only metal-to rubber.

2.02 TAPPING VALVES AND SLEEVES

Tapping valves and sleeves shall fit the A.P. Smith and Mueller tapping machines. All tapping valves and sleeves shall be furnished complete with bolts, nuts, and other standard accessories.

Valve ends to accommodate tapping machines shall be mechanical or flange joint for taps up to 24-inches in diameter. For taps larger than 24-inch mains, the materials, tools and equipment shall be provided by the Contractor and shall be verified with pipe manufacturer prior to approval by the Manager. The nominal tap size shall be smaller than the nominal main size.

Ends of sleeves shall be mechanical joint to fit Class 52 cast iron pipe, Class 150 or 200 PVC C-900 pipe, or Class 150 PVC C-905 pipe. Sleeves shall have flanged end outlets for the valve connections. External surfaces of valves shall be shop coated with fusion-bonded epoxy coating or with two coats of an asphalt coating conforming to Federal Specifications TT-C-494B.

Tapping sleeves for use with concrete cylinder pipe shall be modified according to the drawing shown in the Standard Details, unless otherwise approved. Contractor shall submit shop drawings for approval prior to installation.

All bolts and nuts shall be either silicon bronze (ASTM F467 and F468) or stainless steel (ASTM F593 and F594, type 316). All bolts and nuts shall be silicon bronze only if submerged in water. Bolts and nuts installed shall be compatible in strength and material characteristics. Bolts shall protrude beyond the nuts and protrusion shall be a minimum of 1/8-inch but shall not exceed 1/2-inch. All stainless steel bolt and nut threads shall be pre-coated with anti-seizing graphite compound before installation. Dimensions of bolting material shall meet ANSI B18.2.1 specifications. Bolting of the valve body parts shall be by bolts and nuts. Tapped bolt holes into the valve body are unacceptable.

2.03 AIR RELIEF VALVES/COMBINATION AIR VALVES AND APPURTENANCES.

Air Relief Valves/Combination Air Valves and Appurtenances (ARV) shall conform to AWWA C512, "Standard For Air-Release, Air/Vacuum, and Combination Air Valves For Water Services". ARV shall be configured for underground installation with a threaded body inlet and a threaded cover outlet. Air relief valve bodies and covers shall be of gray cast iron conforming to ASTM A126, Class B or ASTM A48, Class 35 or ductile iron conforming to ASTM A536, Grade 65-45-12. ARV inlet size and rated maximum working pressure shall be as called for on the plans.

Valve and valve seat shall be of bronze, conforming to ASTM B62, type 316 stainless steel, or Buna-n-rubber. However, no stainless steel to stainless steel or Buna-n-rubber to Buna-n-rubber shall be allowed.

Valve trim, including the levers, float arms, pins, and vent cocks shall be bronze conforming to ASTM B62 or type 316 stainless steel.

Floats shall be of the highest quality seamless copper or stainless steel and shall operate with adequate force to insure positive valve action.

External surfaces of ARVs shall be shop coated with fusion-bonded epoxy coating or with two coats of an asphalt coating conforming to Federal Specifications TT-C-494B.

Fittings and nipples for connections of air relief valves shall be cast bronze or "Standard" brass (Grade A) screwed joint with metal conforming to Section 211 - BRASS PRODUCTS.

Vertical check valve shall be designed to operate on upward flow only and shall be brass or bronze. Valves shall be for 200-pound working pressure unless otherwise specified.

Ball corps and ball stops shall be as specified under "Service Laterals and Appurtenances". Orifice size for ARV shall be as shown in Table 2.1 below.

Table 2.1 ARV

ARV Inlet Size	**Maximum Working Pressure (PSI)**	**5% Air Content (Standard Cubic Feet Per Minute)**	**Corresponding Orifice Size**
3/4-inch	150	25	1/8-inch
3/4-inch	250	25	7/64-inch
1-inch	150	32	5/32-inch
1-inch	250	32	1/8-inch
2-inch	150	88	1/4-inch
2-inch	250	88	7/32-inch

All air relief valve nuts and bolts shall be silicone bronze or stainless steel.

2.04 LOCKING CAP

A locking cap for the KDOW interconnect shall be a secure system with three components: an adapter, plug and keywrench.

The adapter should have a hard anodized aluminum metal face with 3 stainless steel set screws. It should be compliant with DIN Standard and NFPA 1963 Standard for Fire Hose Connections. The adapters should be Knox StorzGuard or an approved equivalent.

The plug should be etched with a unique serial number on the face, and the size and diameter on the back of the plug. The plug thread should match the size of the connection coupling thread. The plug should be the Knox FDC Plug or an approved equivalent.

The keywrench should fit the lock head on the plug. The keywrench should be the Knox StorzGaurd Keywrench or an approved equivalent.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The Contractor shall furnish and install all valves at the locations shown on the Plans. Unless otherwise specified, the installation shall be in accordance with Section 300 and the Standard Details of the Water System Standards.

B. The term "appurtenances" shall mean to include all fittings, nipples, unions, ball corp and vertical check valves if required.

A. Unless otherwise specified, all direct buried valves shall be encased in polyethylene loose wrap installed by the Contractor. Installation of polyethylene loose wrap shall be in accordance with AWWA C105. The wrap shall consist of an 8-mil thickness polyethylene tube or flat sheet installed to completely encase the valve and secured thereto with 2-inch wide plastic adhesive tape.

B. All valves shall be thoroughly inspected to insure proper working order before being installed. When valves show leakage at any point under pressure tests, the valves will be rejected and shall be replaced at no additional cost to the State.

C. All gate valves installed with plastic pipe shall be secured in position with reinforced concrete blocks and non-corrosive straps. Straps, including bolts, nuts and washers; and valve anchorage shall be as shown in the Standard Details.

D. Only proper standardized tools shall be used in operating valves.

E. The locking cap on the inter-connect should be installed by following the manufacturer’s guidelines. This shall include removing all debris from the connection and inside the pipe and flushing the system prior to installation.

3.02 MEASUREMENT AND PAYMENT

Payment for furnishing and installing GATE VALVES, TAPPING VALVES, TAPPING SLEEVES and AIR RELIEF VALVES will be made at the respective Unit Price Bids per each valve, based on the actual number of the various sizes and types of valves installed and tested.

The Unit Price Bids for furnishing and installing GATE VALVES, TAPPING VALVES, TAPPING SLEEVES and AIR RELIEF VALVES shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, jointing, testing, painting and all other incidentals necessary to complete the work.

No separate payment for the furnishing and installation of (1) ball corp(s) and brass plugs for flushing and chlorinating the mains, or (2) risers for flushing and chlorination will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for CHLORINATION AND FLUSHING.

Payment for furnishing and installing the LOCKING CAP will be made at the respective Unit Price Bids per each locking cap, based on the actual number of the various sizes installed and tested.

The Unit Price Bids for furnishing and installing the LOCKING CAPS shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, jointing, testing and all other incidentals necessary to complete the work.

END OF SECTION

SECTION 02645

FIRE HYDRANTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing fire hydrants and appurtenances. Unless otherwise noted, reference made to the Standard Details shall be the "STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, September 1984", as amended of the Departments of Public Works, County of Kauai, County of Maui, County of Hawaii and City and County of Honolulu, of the State of Hawaii.

A. Hydrants shall be manufactured in accordance with the requirements of AWWA C-502 or C-503 unless otherwise approved by the Engineer.

B. All hydrants shall be subjected to a hydrostatic pressure test of 300 pounds per square inch, and the pressure test shall be guaranteed by the manufacturer. Two copies of the Certification of Test shall be furnished before delivery.

C. Lengths of hydrant buries are from the face of the flange to the center line of the 6-inch intake pipe.

D. No hydrants or valves shall be operated by the Contractor unless authorized by the Manager. Existing fire hydrants within the planned project area shall be accessible at all times to the Fire Department. The contractor shall maintain sufficient source water flow to meet firefighting needs at all times during construction.

PART 2 - PRODUCTS

2.01 Unless noted otherwise, the bell end of the 6-inch intake pipe (hydrant bottom elbow) shall be mechanical joint or push on joint and shall conform to all applicable requirements of ANSI A-21.11 and AWWA C-111.

2.02 All hydrant parts shall be distinctly marked with its name, part number, length, size, and maker's name. The markings shall be on cloth tags securely fastened to the parts with wire or shall be painted on the parts by such other means as will insure the positive identification of the parts upon delivery.

2.03 Each hydrant body shall be furnished with a set of break-off bolts, nuts, and full face gasket. Bolts shall be hot-dipped galvanized 5/8"x3" machine bolts with hexagon heads American Standard heavy. Bolts shall be breakoff type drilled 11/32"x1-3/8." Nuts shall be hot-dipped galvanized American Standard heavy cold punched, hexagon nuts. Gaskets shall be 1/8 inch cloth inserted rubber.

2.04 The manufacturer shall make and test at least one test bar from each heat of metal used in accordance with ASTM Specifications pertaining thereto.

2.05 Hydrants shall receive minimum SSPC SP3 surface preparation and coated as follows:

A.	Primer:	Mobil 13-W-10 water epoxy enamel or approved equal.
B.	Intermediate Coat:	Mobil 98 Series water epoxy hi-build or approved equal 0.5 mil DFT
C.	Finish:	Mobil 91 Series water epoxy enamel 2 mil DFT (color: Osha Yellow)

2.06 Prepare surface between coats to proper condition for painting. Coating shall not be applied until preceding coat is hard and dry.

Fire hydrants shall be provided with bonnets, stuffing boxes and other appurtenant features all made of silicon bronze conforming to ASTM B98 and as specified in the approved material list. Fire hydrants shall be provided with bolts and nuts made of silicon bronze (ASTM F467 and F468) or stainless steel (ASTM A738 and A836). The break-off bolts and nuts shall be heavy stainless steel drilled as previously described.

No plastic caps allowed for all fire hydrants.

2.07 WET-BARREL HYDRANTS

All hydrants shall comply with AWWA Standard "Wet-Barrel Fire Hydrants for Ordinary Water Works Service," C-503. All hydrants shall have one (1) 4-1/2-inch and one (1) 2-1/2-inch outlet with Type B valves.

Body design shall be as approved by the Engineer.

Composition of valving shall be Balata Gum. Valve and valve carrier shall be attached to the operating stem utilizing an "0" ring seal to prevent leakage through the valve. Stem packing shall be of the "0" ring type incorporating two "0" rings in the stem sleeves.

2.08 HYDRANT MARKERS.

Hydrant markers shall be reflective, Type DB (Two-Way blue reflective), and shall conform to Section 712.40(c) Reflective Pavement Markers of the Hawaii Standard Specifications for Road, Bridge and Public Works Construction, of the State of Hawaii, Department of Transportation, Highways Division.

Adhesive for hydrant markers shall be standard set type epoxy. The Manager may require, in writing, the use of rapid set type adhesive at no additional cost to the Department. Adhesives shall conform to the requirements of Section 712.41 Adhesives for Pavement

Markers of the Hawaii Standard Specifications for Road, Bridge and Public Works Construction, of the State of Hawaii, Department of Transportation, Highways Division. Contractor shall submit certification that adhesive conforms to the specifications.

PART 3 - EXECUTION

3.01 FIRE HYDRANT

A. Hydrants shall be installed at locations shown on the plans in accordance with the Standard Details.

B. All fire hydrants shall be installed with the 4-1/2 inch nozzle faced no more than 15 degrees to the left or right of the line running from the center of the hydrant and perpendicular to the street curb.

C. The height of the centerline of the 4½-inch streamer nozzle shall be set above the curb or finish grade at a height of 22 + 2 inches.

D. Hydrants shall be installed with the barrel vertical. After the hydrant has been checked for alignment and grade, the barrel shall be wedged tightly against the side of the trench to prevent any lateral movement. The wedges may be removed after the concrete anchor block poured at the bottom elbow has set.

E. The concrete anchor block shall be placed to at least 12 inches above the invert of the bottom elbow and shall not be disturbed for a minimum of seven days or as requested by the Engineer. For dry barrel fire hydrant, anchor block shall be placed so that the drain holes are not plugged.

F. Only standard tools shall be used in operating fire hydrants.

G. Prior to final inspection, all exposed fire hydrants and parts to 4 inches below grade shall be cleared of all oil, grease, dirt or other foreign material, sanded and painted in accordance with DIVISION 200, Section 206.01 – GENERAL of the Water System Standards, 2002.

3.02 MEASUREMENT AND PAYMENT

Fire Hydrants Assemblies will be measured for payment by each assembly. Payment for furnishing and installation of each Fire Hydrant Assembly shall be full compensation for all labor, materials, tools, and equipment for all handling, hauling, unloading, placing, testing, painting and other incidentals necessary to complete the work.

Fire Hydrant Reflective Road Markers shall be measured and paid for by each, in place complete.

Remove and Dispose Existing Fire Hydrant Assembly; Remove and Dispose Existing Fire Hydrant Assembly and Riser; and Remove and Dispose Existing Fire Hydrant Assembly,

Fittings, Gate Valve and Valve Box Frame and Cover shall be measured and paid for by each.

Measurement and payment for 6” pipe and trench excavation for hydrants shall not be paid for under this section and shall be paid for under Section 02611 – Pipes and Fittings.

Measurement and payment for concrete reaction blocks, tees, gate valves and valve boxes shall not be paid for under this Section, but shall be paid for under Sections 02205, 02611, 02614 and 02605, respectively.

END OF SECTION

SECTION 02646

SERVICE LATERALS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing service laterals.

A. The Contractor shall furnish and install all service laterals, copper or plastic pipes and appurtenances as shown on the plans.

B. Unless otherwise specified, the term "appurtenances" shall include all fittings, valves, ball corp, ball stops, corporation stops, and stopcocks which may be required.

C. All galvanized laterals shall be replaced or reconnected with copper tubing as allowed in the approved material list unless otherwise noted on the plans.

D. Upon completion of excavation, the trench bottom shall be brought up to the required invert grade by backfilling and compacting the trench.

E. All pipes and appurtenances shall be thoroughly inspected and tested prior to installation. The various types and sizes of service laterals and connections shall be installed at the locations shown on the plans in accordance with the Standard Details. Where possible, no joints will be permitted in the paved areas.

PART 2 - PRODUCTS

2.01 COPPER TUBING

A. Copper Service Lateral shall be soft temper Type "K" and shall conform to ASTM Designation B-88. See Section 402 – APPROVED MATERIAL LIST in the “Water System Standards, 2002” for approved copper pipe manufactures, and model numbers for Kauai.

B Solder-joint fittings shall be cast bronze or wrought copper and shall conform with ANSI B-16. Cast bronze shall conform with ASTM Designation B-62. Wrought copper fittings shall be made of copper conforming with ASTM Designation B-251 or 85-5-5-5 brass.

C. Compression fittings shall be of cast bronze or stainless steel and conform to applicable AWWA, ANSI, and/or ASTM Standards.

D. Fittings conforming with AWWA C800 shall be required for the various sizes and combination of service laterals and connections and shall be as shown on the Standard Details.

E. Nipples shall be of the same quality as copper pipe.

F. Solder shall be 1/8-inch diameter, and shall not contain more than 0.2 percent lead.

G Flux shall be LA-CO Flux Regular Stay-Clean Flux, Oatey Paste Flux, #95 Tinning Flux, General Purpose Soldering Flux or approved equal. Flux shall conform with Federal Specifications O-F-506C, Type I.

H. Solder and flux shall be delivered in their original containers.

2.02 BRASS PIPE

A. Brass Pipe shall be Grade A, Standard or Extra Strong as called for in the proposal. Pipe shall conform in all respect to Federal Specification for "Pipe; Brass, Seamless; Iron Pipe Size, Standard and Extra Strong", WW-P-351(1), as amended.

2.03 PLASTIC TUBING

A. All plastic tubing shall be approved by the Manager and shall be polyethylene (PE), copper tubing size as specified on the plans and specification.

B. Polyethylene Tubing. PE tubing shall conform to all applicable requirements of the following standards, unless otherwise specified herein:

AWWA C901 - Standard for Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 1/2-inch through 3-inch, for Water

ASTM D1248 - Specification for Polyethylene Molding and Extrusion Materials

ASTM D2737 - Specification for Polyethylene Plastic Tubing

PE tubing shall be manufactured from ultra-high molecular weight polyethylene, meeting the requirements of ASTM Material Classification PE 3406. PE tubing shall meet the requirements of Type III, Class C, Category 5-P34 as defined by ASTM Specification D1248. PE tubing shall be made from all virgin material approved for potable water service by the National Sanitation Foundation (NSF) and shall conform to ASTM D2737. PE tubing shall not fail, balloon, burst, or weep as defined in ASTM D1598 when tested in accordance with the sustained pressure test method of ASTM D2737.

PE tubing shall be rated for use with water at 73.4^{N} F at a hydrostatic design stress of 630 psi and a maximum working pressure of 160 psi.

PE tubing shall have a Dimension Ratio (DR) of 9. The average outside diameter, minimum wall thickness and respective tolerances for any cross-section shall be as specified below when measured in accordance with ASTM D2122.

Nom. Tubing Size (in.)	Outside Diameter (in.)	Minimum Wall (in.)	Wall Tolerance (in.)
3/4	0.875 ± .004	0.097	+0.010
1	1.125 ± .005	0.125	+0.012
1-1/4	1.375 ± .005	0.153	+0.015
1-1/2	1.625 ± .006	0.181	+0.018
2	2.125 ± .006	0.236	+0.024

All PE tubing shall be permanently imprinted with manufacturer's brand name or trade mark, pipe size, identification of National Sanitation Foundation approval, ASTM Specification No., maximum working pressure and production code.

PE tubing shall be packaged for protection against sunlight, dirt, and damage during shipment, handling and storage. Packages shall be fully labeled with brand name and manufacturer, NFS seal, size, and coil length.

C. Plastic Tubing Markings. Plastic tubing markings shall be permanently imprinted with the following markings:

1. Nominal size

2. Material code designation (PE3408)

3. The word "Tubing" and dimension ratio (DR9 for PE)

4. AWWA pressure class (PC200)

5. AWWA designation number (AWWA C901 for PE)

6. Manufacturer's name or trademark and production record code

7. Seal (mark) of the testing agency that certified the suitability of the tubing material for potable water products

All tubing shall be packaged for protection against sunlight, dirt, and damage during shipment, handling, and storage. Cartons shall be labeled with manufacturer's name or trademark, AWWA designation number, nominal size, and total length.

Fittings to be used with plastic tubing shall be approved by the Department. Fittings shall be compression type, brass (with stainless steel stiffeners) or PVC, or approved equal.

Solvent cement type jointing shall not be used.

2.04 BALLCORPS

Ball Corps shall conform to the requirements of AWWA C800 and the following:

1. Components shall be constructed of heavy brass conforming to ASTM B62, 85-5-5-5.

2. Shall have a rated pressure of 300 psig.

3. Shall be full port, straight through design. Ball corp waterway shall be the same size as the corp, except for 2-1/2-inch laterals. For example: 1" ball corp shall have a 1" waterway. For 2-1/2-inch laterals, install 2” x 2-1/2” bushings or adapters as required.

4. Inlet threads shall be AWWA taper (Mueller) threads.

5. Outlet threads shall be male iron pipe threads.

6. Ball shall be Polytetrafluoroethylene (PTFE) coated, capable of full 360 degrees rotation with nitrile (Buna-N) seals that provide shut-off from either direction.

7. Shall have double O-Ring seals at top.

8. Head shall have a raised boss or groove indicating the position of the ball.

9. Shall have a blowout proof stem design.

10. Shall have suitable marking indicating the manufacturer.

2.05 BALL STOPS

Ball Stops shall conform to the requirements of AWWA C800 and the following:

1. Components shall be constructed of heavy brass conforming to ASTM B62, 85-5-5-5.

2. Shall have a rated pressure of 300 psig.

3. Shall be full port, straight through design. Waterway shall be the same size as the stop. For example: 1" ball stop shall have a 1" waterway.

4. Shall have female IPT threads, unless otherwise noted. Shall have female IPT threads by meter coupling nut.

5. Ball shall be PTFE coated, capable of full 360 degrees rotation with two nitrile (Buna-N) seals that provide shut-off from either direction. Seals shall be blow-off proof to the atmosphere.

6. Shall have double O-Ring seals at top.

7. Head shall have a raised boss or groove indicating the position of the ball.

8. Shall have a blowout proof stem design.

9. Shall have suitable marking indicating the manufacturer.

2.06 CORPORATION STOPS

A. Corporation stops shall have "Mueller" type taper threads and following dimensions:

1/2"Corp. Stop shall have 1/2" waterway and 3/4" I.P.T. outside

3/4"Corp. Stop shall have 3/4" waterway and 1" I.P.T. outside

1" Corp. Stop shall have 1" waterway and 1-1/4" I.P.T. outside

1-1/4" Corp. Stop shall have 1-1/4" waterway and 1-1/2" I.P.T. outside

1-1/2" Corp. Stop shall have 1-1/2" waterway and 2" I.P.T. outside

2" Corp. Stop shall have 2" waterway and 2-1/2" I.P.T. outside

B. The metal composition of the corporation stop shall be as specified in ASTM Designation B-62.

C. Unless otherwise specified, Corporation stops shall conform to the requirements of AWWA C-800-84.

2.07 STOPCOCKS

A. Stopcocks shall be as shown on the Standard Details. The metal composition of the stopcock shall be as specified in ASTM Designation B-62. Cocks shall be carefully cored to insure evenly balanced walls. The keys shall be properly machined and ground. The stopcocks shall have either a raised boss on the head or a groove cut into the head to indicate the open and closed position of the stopcock. The taper of the plug of the stopcock shall be approximately 1-5/8 inches to the foot. Suitable markings on all stopcocks must be made to indicate the manufacturer.

2.08 SERVICE SADDLE.

A. Service saddles, straps, nuts, and washers shall be made of bronze, or approved equal.

B. Unless otherwise specified, service saddles shall be furnished with single straps and shall be used as called for on the plans or as directed by the Manager.

C. Service saddles on PVC pipes shall provide full support and contact around the complete circumference of the pipe with the clamping arrangement fully contoured to the outside of the PVC pipe. Metal composition for service saddles, including saddles, straps, nuts, and washers shall be of bronze, Type 304 stainless steel, or approved equal.

D. All service saddles shall have outlets tapped with Mueller tapered threads of the sizes called for on the plans. Saddles shall be furnished with closed cell neoprene gaskets.

2.09 COUNTY STANDARD METER BOX (CONCRETE BOX W/ CAST IRON COVER)

A. Meter boxes shall be made in accordance with the dimensions and notes shown in the Standard Details.

B. The cement shall be Portland cement conforming to ASTM Designation C150, Type I. Fine and coarse aggregates shall conform to ASTM Designation C-33 or C-330. Mixing water shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other deleterious substances. An admixture which increases durability and reduces permeability, and when used properly is in no way detrimental to the concrete, may be used. The combined aggregates shall be of such composition of sizes so that the surface of the finished product shall be continuous and of a uniform texture.

C. The maximum density of the concrete in the finished product shall be 115 pounds per cubic foot and the maximum absorption shall be 15 pounds per cubic foot. The compressive strength of the concrete shall be at least 2500 psi to be determined in a manner and at intervals satisfactory to the Department.

D. The County Standard meter boxes are matched to water meter sizes as follows:
1. 5/8” & 3/4” Meters: Use Type “B” Meter Box
2. 1” & 1-1/2” Meters: Use Type “X” Meter Box
3. 2” Meters: Use Type III Meter Box

E. County Standard meter boxes and cast iron lids can be used when Polymer meter boxes are called out on the Construction Plans, only with prior approval from the Engineer. If County Standard meter boxes with cast iron lids are used, a Thru-the-Lid Install Kit (Badger Meter, Orion Water Endpoint Kit No. 64394-030 or approved equal) shall be required to be used. The Contractor shall drill a 1-7/8” diameter hole through the cast iron lid for placement of the Orion Water Cellular LTE Endpoint (or approved equal).

2.10 POLYMER METER BOX & LIDS

A. Polymer box shall be constructed of Linear Low Density Polyethylene (LLDPE). Wall thickness shall be a minimum of 3/8”.

B. Polymer lid shall be constructed of High Density Polyethylene (HDPE). The lid shall have have the words “WATER METER” formed onto the top of the lid.

C. The Polymer meter boxes are matched to water meter sizes as follows:
1. 5/8” & 3/4” Meters: Use DFWA481C-12-1 by DFW Plastics or approved equal. The DFWA481C-12-1 is equivalent in size to the County Standard Type “B” Meter Box.
2. 1” & 1-1/2” Meters: Use DFW1425C4-12-4 WS by DFW Plastics or approved equal. The DFW1425C4-12-4 WS is equivalent in size to the County Standard Type “X”

Meter Box.

3. 2” Meters: Polymer meter box shall not be used for 2” meters. Use County Standard Type III Meter Box.

D. Mounting of the Orion Water Cellular LTE Endpoint (or approved equal) under the polymer lid shall be done using the Orion Pipe Install Kit No. 64394-003, or approved equal.

PART 3 - EXECUTION

3.01 SERVICE LATERALS AND CONNECTIONS

A. Location: Service laterals and connections shall be constructed in accordance with the Standard Details as part of the project. Where practicable, laterals shall not be located adjacent to electric and telephone lines leading into the property to be served.

B. The stopcock at the beginning of the branch of the service lateral serving two or more meter sites shall be located in front of the boundary line between lots. Usually, the stopcock shall be on a prolongation of this boundary line.

C. Where the street is of unusual width or where it is not permissible to connect laterals directly to the main, the Manager may require the installation of service mains in the sidewalk area parallel to the main. This installation should not be confused with a parallel main in the paved area.

3.02 COVER

A. Laterals shall have a minimum cover of 18-inches or as specified elsewhere herein.

3.03 DIAMETER

A. Contractor shall verify the diameters of the existing service laterals to be cut and plugged and replace them with new service laterals of the same diameter. The lateral pipe diameters on the plans are based on as-built data and must be field verified. Should the lateral diameter differ from that on the plans the Officer-in-Charge must be notified.

3.04 TYPE OF LATERAL AND CONNECTION

A. Laterals and connection shall be of copper pipe or approved plastic tubing with appropriate valves, stops and fittings as described and as shown in the Standard Details. In special cases, subject to special design, 2-1/2-inch copper or larger ductile iron laterals and connections may be installed.

3.05 CONNECTION TO MAIN

A. Laterals shall be connected to the various types of mains as shown in the Standard Details

and as specified in Table A, subject to the following conditions:

1. The connection to the main shall be by a corporation stop with Mueller (tapered) threads tapped into the main. Main shall not be tapped closer than 36 inches center to center.

2. Laterals shall not be connected to 16-inch or larger mains unless specifically permitted by the Manager.

3. Direct taps into asbestos cement pipe or plastic pipe shall not be permitted.

4. Where the size of the corporation stop is larger than allowed in Table A, service saddle or double hub tee with boss (tapped with Mueller threads) as listed in Table A, shall be installed to receive the corporation stop. Double hub crosses are not permitted.

TABLE A: MAXIMUM ALLOWABLE DIRECT TAPS INTO MAIN

Main Size	Largest Corporation Stop Size
4"	1"x1-1/4"
6"	1-1/4"x1-1/2"
8"	1-1/2"x2"
10"	1-1/2"x2"
12"	2"x2-1/2"

3.06 SERVICE LATERALS, CONNECTIONS, AND PIPES

A. Upon completion of excavation, the trench bottom shall be brought up to the required invert grade by backfilling and compacting the trench.

B. All pipe and appurtenances shall be thoroughly inspected and tested prior to installation. The various types and sizes of service laterals and connections shall be installed at the locations shown on the plans in accordance with the Standard details.

C. Copper Service Laterals and Pipes: All Joints and fittings for copper pipe or service laterals and connections shall be of the soldered type, or other types as approved by the Manager.

In making solder joints, the following procedure shall be followed:

1. Copper tube shall be cut to the desired length with a tube cutter or fine hack saw (32-tooth blade). Burrs shall be removed with a file or scraper.

2. The outside of the end that fits into the solder cup of the fitting shall be cleaned with

sandcloth or sandpaper. Dark spots shall be removed.

3. Before soldering, the Contractor shall ensure the copper pipe end section is circular in shape and not deformed. The Contractor shall use shaping/sizing tools on non-circular sections to provide a proper connection.

4. For 2-inch and larger pipe, sweat/dress ends of pipe with solder before inserting fittings.

5. The solder cup of the fitting shall be cleaned carefully with a wire brush, sandcloth or sandpaper. Dark spots shall be removed.

6. Only specially prepared no-lead flux or approved equal shall be used. Flux shall be stirred thoroughly. A light, even coating of flux shall be brushed on to the outside of the tube and half way into the inside of the fitting. ACID OR ZINC CHLORIDE SHALL NOT BE USED.

7. The tube shall be inserted into the fitting as far as it will go and turned back and forth a few times to distribute the flux evenly. THE JOINTS SHALL NOT BE WIPED (TINNED) BEFORE INSERTING INTO PLACE.

8. The fitting shall be heated uniformly with a torch until the solder melts on contact with the heated fitting. The flame shall be removed from the fitting. Solder shall be fed to the joint at only one or two points and not around the full circumference of the tube. When a ring of solder appears around the tube at the fitting, the feeding of solder shall be stopped. The excess solder shall be wiped off with a cloth.

9. For tubes 1-1/4 inch and larger, the fitting shall be moved on the tube or tapped as the solder is fed. This will break surface tension and help insure even solder distribution.

10. See Division 500 of the “Water System Standards”, 2002 for the corrosion control requirements for copper services as applicable to the project.

D. Plastic Service Laterals and Pipes

1. Installation shall be in accordance with the manufacturer's recommendation and shall comply with the applicable laws and regulations of the State of Hawaii and respective County. Minimum curving radius for tubing shall be as follows:

Tube Size (inches)	3/4"	1"	1-1/4"	1-1/2"	2"
Min. Radius (inches)	11"	14"	19"	21"	21"

Conducting cable shall be installed over tubing for "toning" purposes from corporation stop to stopcock in meter boxes or as directed by the Engineer. Conducting cable shall be solid one piece copper wire, No. 8 gage (American or Brown and Sharpe Gage) or larger.

The conductive cable shall not be tied to or in contact with any other metallic fitting. The ends shall be terminated inside a test box and/or meter box or property valve box

2. Fittings to be used with PE tubing shall be of the brass compression type or flare type as manufactured by Ford Meter Box Company or approved equal. Stainless steel insert stiffeners for PE tubing shall be used at all compression joints.

E. Testing

Tests: All pipes, laterals and appurtenances shall be hydrostatically tested separately or in conjunction with the water main.

Upon completion of the test, the trench shall be backfilled as specified.

3.07 METER BOXES

Meter boxes shall be installed for all services at the locations shown on the plans in accordance with the Standard Details.

A. Type III, IV, and V meter boxes shall be built with sound concrete bricks set in full mortar beds according to standard masonry practice. A precast concrete box as shown on the Standard Details may be used in lieu of bricks. The cast iron frames and covers shall be set in full mortar beds and shall be flush and square with the sidewalk.

B. Where meter boxes are installed in sidewalk areas or with concrete slabs, the top of the box and the cover shall be flush and square with the sidewalk or slab. Meter boxes shall be 3 feet minimum clear from driveway flares or aprons, ramps and any structures. Meter boxes shall also be 12 inch minimum clear from right-of-way or property lines.

C. All meter boxes shall be installed to give a neat and finished appearance.

3.08 MEASUREMENT AND PAYMENT.

Unless otherwise specified, the various items of payment covered under service laterals and connections and appurtenances shall be as follows:

Payment for furnishing and installing various sizes of SERVICE LATERALS and types of service connections, regardless of the lengths of the laterals or connections, will be made at the Unit Price Bid per each unit based on the actual number installed and tested.

The Unit Price Bids for the furnishing and installation of SERVICE LATERALS, service connections and appurtenances shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, testing and all other incidentals necessary to complete the work.

Payment for excavation and backfill for service laterals will be included in the Unit Price Bids for the Service Laterals including pipe cushion. No separate payment for excavation, backfill and pipe cushion for copper service connections will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for copper service laterals, service connections and appurtenances.

No separate payment for the furnishing and installation of taps into mains including the tapped tees and service saddle; reconnections to existing services; transferal of meters; ball corps; ball stops; globe valves; meter splices; brass pipes; caps; PVC conduits; polyethylene wrap; plastic lateral for isolation and all other appurtenances will be made. The compensation for such work shall be deemed to be included in the Unit Price Bid for Service Laterals.

Payment for CUT AND PLUG of existing water service lateral will be made at the Unit Price Bid per each unit based on the actual number laterals cut and plugged.

The Unit Price Bids for the CUT AND PLUG to the existing water service lateral shall be full compensation for all labor, materials, tools and equipment, and all other incidentals necessary to complete the work.

Payment for various sizes of INDIVIDUAL PRESSURE REDUCING VALVES refer to Section 02606 Pressure Reducing Valves.

Unless otherwise specified, payment for the furnishing and installation of COUNTY STANDARD METER BOXES including cast iron frames and covers and concrete slab will be made at the Unit Price Bid per each unit, based on the actual number of METER BOXES installed at the various sizes of boxes.

The Unit Price Bid for the furnishing and installation of COUNTY STANDARD METER BOXES shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, bricks, concrete, cast iron frames and covers, painting, concrete slabs and all other incidentals necessary to complete the work.

Unless otherwise specified, payment for the furnishing and installation of POLYMER METER BOXES AND LIDS including HDPE lid will be made at the Unit Price Bid per each unit, based on the actual number of POLYMER METER BOXES AND LIDS installed at the various sizes of boxes.

The Unit Price Bid for the furnishing and installation of POLYMER METER BOXES AND LIDS shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, HDPE lids, and all other incidentals necessary to complete the work.

Unless otherwise specified, payment for the furnishing and installation of POLYMER METER BOX LIDS will be made at the Unit Price Bid per each unit, based on the actual number of POLYMER METER BOXES LIDS installed at the various sizes of lids.

The Unit Price Bid for the furnishing and installation of POLYMER METER BOX LIDS shall be full compensation for all labor, materials, tools and equipment for all handling, hauling, unloading, placing, and all other incidentals necessary to complete the work.

Unless otherwise specified, no separate payment for excavation and backfill of meter boxes will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for meter boxes.

END OF SECTION

SECTION 02650

CONNECTIONS, RELOCATIONS & LOWERING OF WATER MAINS AND LATERALS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for connections to existing potable water mains.

A. Whenever connections to existing mains are required, the Contractor shall perform all work necessary for the installation of the water mains and appurtenances as shown on the plans, under the coordination of the Engineer.

1.02 SUBMITTALS

A. The Contractor shall submit to the Engineer, for approval, a detailed sketch of the connections, showing all pertinent fittings and data in relation to the existing main, as well as schedule delineating the method or steps the Contractor proposes to follow to accomplish the connection.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. The Engineer will schedule the connection only after the Contractor's detailed sketch and schedule are submitted and approved. The Contractor shall provide the labor, materials and equipment, whether shown on plans or not, necessary to complete the connection work within the allowable shutdown period as noted on plans or as determined by the Engineer.

B. The Contractor shall verify in the field, prior to submitting the sketch and schedule for approval, the materials required for connection based on the schematic layout. Should additional materials (pipes, fittings, etc.) be required, the Contractor shall obtain written approval from the Engineer.

C. The Contractor shall notify the Engineer and DHHL at least five (5) working days prior to the scheduled connection. The duration for doing the work will be determined by the Engineer in order that water consumers will be inconvenienced as little as possible.

D. The Contractor shall have at the site all necessary pipe and appurtenances, jointing materials and all other materials for the work and shall also have completed all the necessary excavation as directed by the Engineer. At all connections to the existing main, like materials (except asbestos cement pipes) shall be used to replace the existing main. For

connection to existing asbestos cement pipes, the Contractor shall remove the entire pipe length between joints and replace it with an approved pipe. Direct tap to existing asbestos cement pipes is not permitted.

E. For connections, the Contractor shall chlorinate the entire inside surface of each connecting pipe, fitting and material with disinfection solution of five ounces of sodium hypochlorite mixed with ten gallons of water.

F. The Contractor shall complete the connection to the existing main only after cleaning, disinfection and flushing of newly installed mains are accomplished. Any exceptions will be determined by the Engineer.

G. The Contractor shall take precaution while working on existing Asbestos Cement Pipes and shall follow all applicable OSHA, State, and Federal Regulations in the handling and disposal of the removed sections of pipe. Disposal must be at an approved asbestos material disposal site.

H. Unless otherwise specified, all abandoned lines shall be cut and plugged with class DWS 2000 concrete. Payment for cutting and plugging shall not be made directly but shall be considered incidental to this line item. The Contractor shall verify the size and type of line to be plugged.

I. With the Engineer's approval, the Contractor may rent from the Owner any specialized tools or equipment, required for connections, which are carried only by the Owner. Any rental of specialized tools or equipment shall include the Owner's operator and other personnel deemed necessary by the Owner.

J. The Contractor shall be responsible for any damages made to the existing water system during connections. Any costs incurred by the Department to repair any damages to the existing water system shall be paid for by the Contractor.

3.02 MEASUREMENT AND PAYMENT

Unless otherwise specified, payment for WATERLINE CONNECTION TO EXISTING MAIN, which may include the furnishing and installing of pipes, fittings, tapping sleeves and valves, service saddles, hub clamps, concrete blocks, sleeves, couplings, concrete encasement, and other appurtenant materials, will be made at the respective Unit Price Bids per each water line connection, based on the actual number of the various sizes and types of connections made.

The Unit Price Bids shall represent full compensation for furnishing all materials and for all labor, tools, equipment and incidentals required for connections to existing mains as shown on the plans and in accordance with these specifications and inclusive of all incidentals required to complete the work.

No separate payment for cutting, plugging and abandoning existing mains will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for WATERLINE CONNECTION TO EXISTING MAIN.

END OF SECTION

SECTION 02675

TESTING AND CHLORINATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for testing and chlorination requirements for potable water mains.

A. Upon completion of the installation of the water system and pressure testing, the Contractor shall flush and disinfect the water system.

1.02 SUBMITTALS

A. The Contractor shall submit to the Engineer, for approval, a sketch showing locations of sampling points and a plan or schedule delineating the method or steps he proposes to use to accomplish the work.

B. The Contractor shall submit a certification that the water system has been disinfected according to these standard specified here.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PIPE PRESSURE TESTS

A. All water mains and appurtenances including service laterals, fire hydrants and service connections shall be subjected to a 150 psi hydrostatic pressure test for either:

1. One (1) hour with a drop in pressure of no more than three (3) psi. Pipe and joints may be backfilled.
2. Thirty (30) minutes with a drop in pressure of no more than ten (10) psi. All joints of the pipe must be exposed during test.

B. A separate test shall be made on each section of the pipeline and its appurtenances whenever any section of the work can be segregated as a unit. If valves are available at each end of the section, the test shall be made between the valves. If valves are not available, a plug or cap shall be installed and properly braced to withstand the required test pressure. When a section of the work is ready for testing, the ball corp installed in accordance with the Standard Details, shall be connected by suitable pipeline to the test pump. A ball stop shall be installed between the tap and pump. A pressure gage furnished by the Manager shall be installed between the ball stop and the tap.

C. The section of pipe to be tested shall be completely filled with water. Care shall be taken to insure that no air pockets exist. The ball stop shall be opened and the hydrostatic pressure raised to the required pressure called for on the plans.

D. The ball stop shall be shut and the gage observed for 30 minutes. During the 30 minutes, the pressure shall not drop more than 10 psi.

E. The Manager may require tests to cover any section or any combination of sections, and may require additional tests to be made at any time.

F. All equipment and material necessary for tests shall be furnished and installed by the Contractor.

G. After all leaks have been stopped and the test completed, brass tapered thread plugs shall be furnished and installed by the Contractor in holes made for testing purposes.

3.02 CHLORINATION OF WATER PIPELINES

A. The Contractor shall install temporary risers adjacent to certain valves for disinfection purposes prior to the start to backfill. After the water mains have been certified by the department or otherwise directed by the Manager, the Contractor shall remove the risers. The excavation necessary to expose these risers and the final backfill shall be performed by the Contractor.

The Contractor shall expose all service connections for chlorination. After completion of the chlorination and flushing, the Contractor shall backfill the connections.

B. Disinfection Procedure. The Contractor shall perform all work necessary for the disinfection of water pipelines under the supervision of the Manager. The Contractor shall submit to the Manager, for approval, a sketch showing the locations of sampling points and a plan or schedule delineating the method or steps the Contractor proposes to use to accomplish the work.

C. Preliminary Flushing. Where conditions permit, mains shall be flushed with maximum available pressure and velocity. Adequacy of turnovers shall be determined by the absence of particles. During all flushing operations, the Manager or his authorized representative shall determine the rate of water use.

D. Chlorination. The following methods for chlorination may be used:

1. Flush new system adequately with chlorinated water of at least 50 mg/1 concentration
2. Retention of chlorinated water (50 mg/1) overnight
3. Expose interior surfaces of pipes with chlorinated water (300 mg/1) for three (3) hours

E. Sampling. Unless otherwise directed, microbiological samples shall be taken in all cases after all chlorine has been flushed out as evidenced by readings from a low range chlorine test kit. Sampling shall be done by the Contractor, under the coordination of the inspector assigned to the project, with sampling bottles furnished by a certified laboratory. Under no circumstances shall sample bottles be rinsed out.

The Contractor shall collect two (2) water samples per sample point. The first sample shall be taken immediately after the main is flushed of chlorine and the second sample shall be taken 20 to 28 hours later.

F. Disposal of Chlorinated Water. The Contractor shall be responsible for the proper disposal of chlorinated water to safeguard public health and environment in accordance with applicable Department of Health requirements and NPDES requirements.

G. Certification. The water samples shall be analyzed by a laboratory certified by the State Department of Health. The laboratory shall be certified to test for coliforms in potable drinking water.

The disinfection procedure shall be considered acceptable after the laboratory test results show the following for each water sample collected:

1. Total coliform counts equal to zero (0); and
2. Total bacteria count is less than 200 colonies per 100 mils.

If any water sample fails to meet the criteria noted above, the disinfection of mains shall be repeated. After the main is re-disinfected, new water samples shall be collected at all sample points.

The Manager reserves the right to evaluate additional samples before certifying a main.

All costs associated with the microbiological testing shall be at the Contractor's expense.

H. Repetition of Procedure. Disinfection of mains shall be repeated until samples show absence of coliforms.

I. Procedure Guideline. The disinfection procedures hereinabove are guidelines only and the Manager does not guarantee certification after one application.

3.03 MEASUREMENT AND PAYMENT

Hydrotesting of the water system shall be considered as incidental and included in the cost of the installation of the various sizes of County Standard Pipe.

Payment for the CHLORINATION AND FLUSHING of the water system will be made at

the respective Lump Sum Price in the Bid. The Lump Sum Price shall represent full compensation for furnishing all materials and for all labor, tools, equipment and incidentals required for the chlorination and flushing of the water system inclusive of all incidental work. No additional payment will be made due to repeat operations. The Contractor shall provide and install at the Contractor's own expense all water supply equipment and materials, including all temporary pipes and fittings and all pumping facilities which are necessary for transporting water from the nearest available source to the project site.

END OF SECTION

SECTION 02831

GALVANIZED CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing galvanized chain link fences and gates. The work shall consist of furnishing all material, labor, tools, equipment and incidentals required to install chain link fence, chain link gate, and all appurtenances in place complete, as shown on the plans and as specified in this specification.

1.02 SUBMITTALS

Before construction, submit six (6) sets of shop drawings and product catalog cut sheets for the galvanized fencing.

1.03 SUBSTITUTIONS

A. All material products shall be provided as specified in Part 2 of this specification section unless submitted to and approved by the Engineer in writing.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials for the fence work shall be heavily galvanized by hot-dip process.

A. Fabric. Fence fabric shall be No. 9 gauge and have a uniform diamond mesh measuring approximately 2 inches between its parallel sides. It shall be woven of copper bearing steel wire, heavily galvanized by hot dip process before weaving. Top and bottom selvages shall have twisted and barbed finish. All barbing to be done by cutting wire on bias, thus creating sharp points.

B. Posts. All posts shall be standard full weight galvanized steel pipes. Galvanizing shall be in accordance with ASTM A153 and sizes shall be as specified in Table 2.1:

Table 2.1 CHAIN LINK FENCE POST			
Type Of Post	Nominal Diameter (in.)	Outside Diameter (in.)	Weight (lbs./lin. ft.)
Line Posts	2	2.375	3.65
Terminal, end corner, walk gate, angle and pull post	2½	2.875	5.79
Gate post to 14 feet	3½	4.0	9.11
Gate post to 16 feet	3½	4.0	9.11 fully grouted with one #5 rebar

C. Top Rail. Top rails shall be 1-1/4-inch Nominal, 1.660 O.D. galvanized steel pipe, 2.27 pounds per linear foot and shall be connected with galvanized couplings. Welding shall not be permitted.

D. Bracings. Braces shall be 1-1/4-inch Nominal, 1.660 O.D. galvanized pipe, 2.27 pounds per linear foot.

E. Fittings. All fittings used in connection with chain link fencing shall be hot-dipped galvanized, malleable wrought iron or pressed steel.

F. Tension Wire. Tension wire for bottom of fence fabric shall be No. 8 gauge extra heavy galvanized high carbon coiled steel wire.

G. Gate. Gate shall be chain link sliding gate as called for on the plans. Gate frame shall be 2-inch O.D. galvanized steel pipe. Corner fittings shall be galvanized malleable castings. Gate fabric shall be as specified for fencing. The gate shall be furnished complete with special sliding gate, catch, stops and locking device for padlock. Gate shall be securely braced and trussed to prevent sagging.

H. Extension Arm. Post extension arms for supporting barbed wires shall be formed from .090-inch steel sheet and hot dip galvanized. Arms shall be designed to extend at a 45° angle with lock to securely fasten strands of barbed wire equally spaced with top strand located 12 inches above the fabric and 12 inches out from the fence line.

I. Barbed Wire. Barbed wire shall be composed of 3 strands of No. 12-½ gauge wire with 4 point barbs spaced 5 inches apart and heavily galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION AND WORKMANSHIP

A. Prior to setting fence posts, contactor shall tone existing lines and confirm waterline locations.

B. The ground along the fence line shall be properly graded on a straight grade. All obstructions shall be removed.

C. Line posts shall be spaced 10 feet apart maximum, measured from center to center of posts. Post spacing shall be determined by measurement parallel to the slope of the ground. All posts shall be placed plumb.

D. All posts shall be set in DWS 2500 concrete footings. Size of footings for the posts shall be as shown on the Standard Details.

E. End, corner and gate posts shall be braced to the nearest line post with horizontal braces and each brace shall be diagonally trussed using galvanized 3/8-inch steel rods with tighteners and necessary fittings.

F. Top rail shall pass through the base of post top and form a continuous brace from end to end of each stretch of fence. Top rail shall be securely fastened to end, gate, and corner posts by means of suitable connectors.

G. The bottom tension wire shall be stretched tight and installed on a straight grade between posts. Wire shall be parallel to the top rail approximately 2 inches above the bottom of fabric and be securely fastened to the posts.

H. Chain link fabric shall be mounted on the side of the posts designated by the Manager with the bottom of fabric not more than 3 inches nor less than one inch above the ground.

I. The fabric shall be stretched taut and securely fastened to the posts. Fabric shall be fastened to line posts, approximately 12 inches apart, and to top rail and bottom tension wire, approximately 24 inches apart. Tie wire to be used as fasteners shall be No. 9 galvanized wire.

J. The fabric shall be fastened to end, corner and gate posts with 1/4"x3/4" stretcher bar and 1/8"x3/4" stretcher bar bands spaced at 12-inch intervals.

K. Chain link fence and gate shall not be painted unless otherwise directed by the Manager.

L. The contractor shall furnish padlocks for all gates. Padlocks shall be “Best” Model 41B722-L-P5-1534X1534 manufactured by Best Lock Corporation d/b/a Best Access Systems. The Contractor shall provide the cores and four (4) keys for each padlock. Two (2) keys shall be given to the Department of Hawaiian Homelands and two (2) keys shall be given to the Kauai Department of Water. Two (2) padlocks shall be stamped “D.O.W.” on one side and “County of Kauai” on the other side. The Department of Water (DOW) will assign the core numbers and insert the cores into the padlocks with the DOW control key. The padlocks shall be hand carried to the DOW office for core insertion. The Kauai Department of Water security system is master keyed to the Best Lock Corporation system and therefore no substitutes will be accepted.

3.02 FINAL CLEANUP

A. All exposed metal surfaces shall be clean and free of cement. All surplus earth resulting from fencing work that is not used in the grading work shall be cleaned up and disposed of offsite.

3.03 MEASUREMENT AND PAYMENT

Payment for GALVANIZED CHAIN LINK FENCES AND GATES will be made by Lump Sum Bids. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, concrete and other incidentals required to complete the work.

END OF SECTION

SECTION 02843

METAL GUARDRAILS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing galvanized steel guardrails, metal posts, and all appurtenances.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Posts and Guard Rails: Steel posts shall be of the section and length as specified or as shown on the plans. Steel shall conform to the requirements of ASTM A 36. All steel posts shall be galvanized after fabrication.

Unless specified otherwise, metal guard rails, curved and flared ends, shall be corrugated sheet steel beams conforming to AASHTO M 180, ASTM A307, A525 & E376. The rail dimensions and gage shall be not less than 12 inches in width, three inches in depth and not less than 12 gage thick. See page R-22 and R-23, Standard Details for Public Works Construction, September 1984.

B. Bolts, Washers, and Nuts shall be stainless steel.

PART 3 - EXECUTION

3.01 GENERAL

A. The line and grade of the guardrail shall be true to that shown on the Plans. All posts shall be constructed vertically. All joints shall be welded and ground smooth. All shop and field welding shall conform to AWS "Structural Welding Code: AWS D1.72."

B. The construction of guardrail shall conform to the details shown on the Plans, and pages R-22 and R-23, Standard Details for Public Works Construction, September 1984.

3.02 STORAGE OF MATERIALS

Guardrail materials shall be stored off the ground on platforms, pallets, or other supports. These materials shall be kept free from grease and dirt and shall be protected from moisture, as far as practicable, until they have been properly installed.

3.03 CONDITION OF MATERIALS

Guardrail materials, before being installed or worked, must be straight. If straightening is necessary, it shall be done by methods that will not injure the appearance or body of the metal. Sharp kinks and bends shall be cause for rejection of the material.

3.04 LAYOUT

Spacing of posts shall be as shown on the Plans. Guardrail post locations are to be kept to a minimum clear distance of 18 inches to any 2-1/2-inch or smaller water lines and meter boxes. No post driving will be allowed when post is to be installed closer than 3 feet from 3-inch and larger water mains.

3.05 FABRICATION AND ERECTION

A. Metal Posts and Guardrails. All metal work shall be fabricated in the shop and galvanized before delivery to the job site. The posts and rails shall be free from kinks, twist or bends, and shall be uniform in appearance.

B. Joining of the Material. Guardrail shall be carefully adjusted prior to being fixed in place to insure proper matching at abutting joints with correct alignment, curvature and camber throughout its length. Guardrail on curves or return bends shall be fabricated to a smooth curve throughout the length of the curve as specified above. All exposed ends of rail shall be covered with an Engineer approved seal.

C. Bending: To facilitate bending, materials may be heated to a temperature not exceeding 400 °F for a period not exceeding 30 minutes.

D. Cutting: Material of 0.5-inch thickness or less may be sheared, sawed or milled. Cut edges shall be true, smooth and free from burrs or ragged breaks.

Re-entrant cuts shall be coped for proper fitting and welding. Torch or flame cutting will not be permitted.

E. Post anchoring shall be in accordance with the Plans.

3.06 MEASUREMENT AND PAYMENT

Payment for METAL GUARDRAILS will be made by Lump Sum Bids under “Guardrail” in the Proposal. Payment shall include removal and disposal of the existing guardrail. Payment shall represent full compensation for furnishing all materials, labor, tools, equipment and incidentals, including excavation, backfill, grading, and other incidentals required to complete the work.

END OF SECTION

SECTION 02930

GRASSED SURFACES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for preparation of areas designated on the plans, and in accordance with the requirements of the contract (shoulder and other areas) for planting with grass. All referenced sections and subsections are from the "Hawaii Standard Specifications for Road and Bridge Construction", 2005.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified, the grass to be planted shall be Bermuda (Cynodon dactylon) except giant varieties.

B. Grass seed shall conform to Section 619 – Planting.

C. Hydromulching materials, if used, shall conform to Section 641 – Hydro-mulch Seeding.

D. Contractor shall provide 6-inches of topsoil in planting areas. Topsoil shall be imported and shall comply with Section 617.02(C)

E. Herbicides shall conform to Section 619 – Planting.

F. Fertilizer shall conform to Section 619 – Planting.

PART 3 - EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Ground Preparation. Prior to planting, the areas to be grassed shall be cleared of all unwanted plants (including their root system), stones over 3 inches in diameter, papers, trash and debris and graded to the dimension and elevations shown on the plans or as directed.

Planting soil shall be spread and graded to conform to the finish surface shown on the plans.

The Contractor shall be responsible for the disposal of all excavated material.

B. Planting: Planting shall be by sprigging, matting, seeding, mulch seeding or other methods

at the option of the Contractor. If planting is by sprigging or matting, the surface shall be rolled with a suitable lawn roller after planting is completed.

Planting by Seed: Ground surface shall e raked to a smooth even plane, broadcast seeds uniformly by mechanical sower at a minimum rate of 5 lbs per 1,000 square feet. Sow seed in a grid pattern with one-half the seeds in one direction and the remainder at right angles to the first direction. The seeds shall be incorporated to the top ¼ to ½ inch of soil. After sowing, the seeded area shall be compacted by hand or mechanical roller weighing 60 to 90 pounds per lineal foot of roller.

Planting by Hyromulching: Planting by hydromulching shall comply with Section 641 Hydro-mulch Seeding.

Planting by Sodding: Soil shall be graded to 6 inches below finish grade. Sod shall be laid in one direction with all edges butt jointed and with transverse joints staggered, and longitudinal joints aligned. At headers, curbs and discontinued edges, cut sod 3 inches beyond limit of grassing and fold excess sod under sod strip. After the sod has been laid, roll sod with 50 pound roller and apply water. The ground shall be kept continuously moist to the depth of the sod until grass is established.

Water shall be applied within the same day of planting in such quantities as to moisten the soil to the depth of the planted grass. Additional application shall be made so that the planted areas are continually kept damp at all times to the grass depth and until the commencement of plant establishment work. Continue to water in quantity and frequency to sustain plan growth.

Fertilizer shall be added to the soil after the delivery of the soil to the site and shall be done to achieve a homogeneous mix.

After the planting along a 1/4 mile section of road or smaller areas as determined by the Engineer has been satisfactorily planted in accordance with the specifications the planted area upon written notice from the Engineer shall be cared for as specified hereinafter under (C) Plant Establishment.

All planting shall be completed by end of the contract time.

C. Plant Establishment: Plant establishment is required for all planted areas until final acceptance for a period of 90 days from the date of the completed and approved planting. During this plant establishment period, the grassed areas shall be watered, fertilized, weeded, and mowed with approved equipment whenever the average height of the grass becomes 3 inches.

Weeding shall be defined as the removal of undesirable plants and their root systems except nut grass.

Surplus earth, papers, trash and debris which accumulate in the planted areas shall be removed and disposed of and the planted areas shall be cared for as to present a neat and clean condition at all times.

Watering equipment shall be of a type that will not cause damage to the planted area or its surroundings. Water systems that cause erosion or runoff and deemed unacceptable by the Engineer shall be corrected by the Contractor. Should the planted area or its surroundings be eroded due to the watering method, the Contractor shall immediately remove the runoff material and restore the area to the original grade and condition.

Fertilizer shall be applied at not less than the rate of 300 pounds per acre, 23 to 30 days after the grass has been planted.

Any area that does not show a thorough "catch" shall be replanted, and this replanting and subsequent care shall be repeated until the entire area meets its satisfactory growth in accordance with these specifications. The 90-day Plant Establishment period, for the area that has been replanted, will be start over when an area needs to be replanted.

At the completion of the 90-day plant establishment period an inspection shall be performed by the manager.

The acceptability of the planted areas will be determined at the end of the period of establishment during which the Contractor shall employ all possible means to promote the grass to healthy growth condition. Final acceptance will be upon providing 98 percent coverage with healthy grass. In no case shall any 100 square feet area have more than a total of 2 square feet of bare spots.

The Contractor shall be responsible for protecting the planted areas until final acceptance of this work. He shall repair at his own expense any damage by pedestrians or vehicular traffic or other causes.

3.02 MEASUREMENT AND PAYMENT

Grassed Surfaces shall not be measured for payment. Payment for Grassed Surfaces shall be considered to be included in the price for the installation of County Standard Pipe under earth or installation of water service laterals.

Grassed surfaces planted that are not associated with the trenching for installation of County Standard Pipe or water service laterals shall be considered incidental and shall not be separately paid for.

END OF SECTION

SECTION 03210

REINFORCING STEEL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

Reinforcing steel shall consist of furnishing all labor, materials, tools, equipment and incidentals required for placing concrete reinforcement in accordance with the Water System Standards and the details shown on the plans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All reinforcing steel shall be of grade 60, billet steel, deformed type and shall conform with ASTM A615, "Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement." The use of re-rolled rail steel or cold twisted bars will not be permitted.

B. All reinforcing steel shall be new, free from dirt, detrimental scale, paint, oil or other foreign substances. No material cleaned by sandblasting will be allowed. In the absence of manufacturer's quality mark, the Manager may require standard ASTM tests be made on representative samples before acceptance. All cost incurred in connection with these tests shall be borne by the Contractor.

C. Fabrication. Reinforcing steel shall be fabricated in accordance with approved standards of American Concrete Institute. No reinforcing steel shall be cut or bent with the use of a welding torch.

PART 3 - EXECUTION

3.01 CONSTRUCTION

Unless otherwise specified, the installation of reinforcing steel shall conform to the requirements of "ACI Standard Building Code Requirements for Reinforced Concrete" and "Concrete Reinforcing Steel Institute."

A. Fabrication. Reinforcing steel shall be fabricated in accordance with approved standards of American Concrete Institute. No reinforcing steel shall be cut or bent with the use of a welding torch.

B. Placing. Reinforcing steel shall be accurately placed as shown on the plans and adequately secured in position by tying and by use of concrete blocks or metal chairs and spacers.

Metal chairs and spacers shall be in accordance with the specification of the Concrete

Reinforcing Steel Institute. All vertical legs shall be of the turned-up type.

Concrete blocks shall consist of 1:3 mortar. For miscellaneous concrete structures, such as manhole slabs and pipe reaction blocks, blocks split from sound cement brick may be used.

Tie wires shall be black annealed iron wire No. 16 B.W.G. for No. 5 bars or lighter, and No. 14 B.W.G. for heavier bars.

Distance from forms and between layers of reinforcing shall be maintained by means of approved commercial chairs, stays, blocks, ties, hangers, or other approved supports. The use of pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks shall not be permitted.

No concrete shall be placed prior to the inspection and approval of the size and placement of all reinforcement by the Engineer.

B. Splicing. Reinforcing steel shall be in full lengths as shown on the plans. Where splices are required, the bars shall be lapped a length sufficient to transfer the entire stress from bar to bar without exceeding the allowable bond and shear stresses in accordance with the ACI Building Code. The minimum overlap for a lapped splice in reservoir hoop reinforcement shall be 40 bar diameters.

C. Protection of Material. Reinforcing steel and appurtenances to be used on the project shall be stored under cover, off the ground and protected from damage at all times. Steel reinforcement shall be protected at all times from damage. When placed in the work, all reinforcing steel shall be new, free from dirt, detrimental scale, paint, oil, or other foreign substances. No material cleaned by sandblasting will be allowed. In the absence of manufacturer's quality mark, the Engineer may require standard ASTM tests be made on representative samples before acceptance. All costs incurred in connection with these tests shall be borne by the Contractor.

B. Bending Diagrams and Order Lists: Two copies of all reinforcing steel order lists and bending diagrams shall be furnished directly to the Engineer and at the site for his use in administering the contract.

Furnishing such lists and diagrams to the Engineer shall not be construed to mean that the lists and diagrams will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and diagrams and for furnishing and placing all bar reinforcing steel in accordance with the details shown on the plans as specified.

C. Bending: Bends for stirrups and ties shall be made around a pin having a diameter not less than two times the minimum dimensions of the bar. Bends for other bars shall be made around a pin having a diameter not less than six times the minimum dimension of the bar, except that for bars larger than one inch, the pin shall be not less than eight times the bar thickness. All bars shall be bent cold before placing in forms.

3.02 MEASUREMENT AND PAYMENT

Reinforcing Steel will not be measured for payment. Reinforcing Steel shall be considered as incidental and included in the cost for the Pressure Reducing Valve and Vertical Thrust Block items in the contract proposal.

END OF SECTION

SECTION 03300

CONCRETE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This specification covers the requirements for furnishing, hauling, mixing, placing, and curing of concrete.

1.02 SUBMITTALS

A. The Contractor shall submit concrete mix design for approval.

B. The Contractor shall submit a certificate of a test with each lot of cement proposed for use on the project. The Manager may require additional test of the cement as required.

C. The Contractor shall submit to the Manager the test reports for all classes of concrete 3000 psi and above to be used on the project. The report shall include the following:

1. Class of concrete.
2. Proportion of materials by weight - cement shall be as specified in Table 300-9 of the WSS.
3. Water cement ratio.
4. Slump.
5. Compressive strengths for 7, 14, 21 and 28 days based on the average of three specimens for each age.

No concrete work for the project shall be allowed until the test report is submitted to the Manager and the requirements of Table 300-9 of the Water System Standards are fulfilled.

D. The Contractor shall submit their proposed detailed repair method for each type of problem area for Manager's review and approval. No repair work shall be done prior to Manager's approval.

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Concrete Aggregates

1. Coarse aggregate shall be a mixture of No. 3 coarse and No. 3 fine crushed, dense, close grain, blue lava rock unless otherwise specified. The specific gravity of rock

shall not be less than 2.65. The gradation of No. 3 crushed rock shall conform to the requirements as shown in Table 300-7.

2. Fine aggregate shall be a combination of 40% sand and 60% No. 4 Fine by weight. No. 4 Fine shall be of like quality as No. 3. The gradation of No. 4 Fine shall conform to the following requirements as shown in Table 300-8. Sand shall be clean, free from sticks, dirt, organic matter or other deleterious substances.

C. Concrete Reinforcement

1. Reinforcing steel shall be deformed bars conforming to ASTM A615, grade as shown on plans.

2. Welded wire fabric for concrete reinforcement shall conform to ASTM A185 and shall be galvanized.

3. Metal accessories such as spaces, chairs, ties, and other devices necessary for properly placing, supporting and fastening reinforcement in place shall be provided. Chairs shall be galvanized. Annealed steel wire or not less than 16-gauge shall be used to secure reinforcement.

D. Water used in mixing concrete shall be potable.

E. Non-slip grit shall be an abrasive aggregate of silicon carbide or aluminum oxide.

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

G. Curing compound shall conform to ASTM C309.

PART 3 - EXECUTION

3.01 DESIGN OF CONCRETE MIXES

A. All concrete throughout shall be either job or plant mixture in an approved type of power operated mixer that will insure uniformity and homogeneity of the concrete produced.

B. Mixing at jobsite shall be done in accordance with ACI 614.

C. Ready-mixed and mixed-in-transit concrete shall be mixed to conform to the provisions of ASTM C94.

D. Concrete shall be mixed only in such quantity as is required for immediate use. No retempering will be permitted and concrete that has started to harden shall be discarded and promptly removed from the job.

E. Admixtures conforming to paragraph 2.1 may be used in the concrete as recommended by

the supplier and approved by the Engineer.

3.02 PLACING CONCRETE

A. No concrete shall be placed in the absence of the Manager or his representative who shall be given one day advance notice of starting time of concrete pour.

B. Preparation

1. Concrete shall be placed upon clean, damp surfaces with no free water, or upon properly compacted fills but never upon soft mud or dry, porous earth.

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

C. Conveying

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

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

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

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

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

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

D. Depositing

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

2. Placing of the concrete shall be started at the far end of work so that each batch will be dumped against previously placed concrete, not away from it.

E. Compaction

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

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

3.03 REINFORCEMENT

A. Reinforcing steel bars, wire and wire fabric shall be provided in the sizes, length and configurations as indicated on plans and shall be thoroughly cleaned, before placing, of loose mill scale, loose flaky rust, oil, and all coatings that will destroy or reduce bond. If necessary, they shall be cleaned again before placing of concrete. All items shall be fabricated, positioned and secured in place as indicated in the plans and as herein specified. Annealed steel wire of not less than 16-gauge shall be used to secure reinforcement. Unless otherwise noted, cleaning, bending and placing of reinforcement shall be done in accordance with the standard practice of the Concrete Reinforcing Steel Institute.

B. Concrete or metal support and spacers shall be used to secure the proper spacing of reinforcement over formwork. Stirrups shall be accurately and securely wired to the bars at both top and bottom. At slabs, footings and beams in contact with earth, pre-cast concrete blocks (not bricks or hollow tile) shall be used to hold reinforcement at a proper distance above earth.

C. Bars shall be tied at all intersections, and distances from forms shall be maintained by means of pre-cast concrete blocks, ties, hangers or other approved supports.

D. Bars shall be bent cold to the shapes shown on the plans. Bends shall be made around a pin having a diameter not less than 6 times the bar diameter except that for bars of larger

than 1-inch diameter the pin diameter shall be 8 times the bar diameter. If required, bars may be bent in the field using a "hickey" bar.

E. All reinforcing steel bars shall be furnished in the lengths indicated on the plans. Splicing of bars, except where shown, will not be permitted without the approval of the Engineer.

3.04 CONCRETE SLABS ON GRADE

A. Concrete slabs on earth shall be placed over a structural fill as specified in another section.

B. All slabs shall be reinforced with 6 x 6 - W1.4 by W1.4 welded wire fabric unless otherwise shown or called for on the plans.

C. Care shall be taken in handling and placing the reinforcement as follows:

1. Reinforcing fabric shall not be rolled over by trucks, buggles or wheelbarrows, nor trampled to the extent that it is bent out of the plans of the fabric. Material which has been so bent that it cannot be laid out flat shall be rejected.

2. Reinforcing fabric shall be positively set, either prior to or during the placement of concrete, to the levels required within the slabs as indicated on the plans or as otherwise called for herein.

D. A bond-break filler shall be provided where edge of slab abuts any vertical surface and where indicated on plans. Width of filler strips shall equal depth of floor slab.

3.05 FINISHING OF SLABS

A. Broom Finish for Slabs: The concrete slabs shall be given a coarse transverse scored texture by drawing a broom across the surface. The operation shall follow immediately after steel troweling.

3.06 REPAIR OF DEFECTS

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

B. Where concrete which is exposed to view requires repairing or patching, the texture of the surface of such repair or patch shall closely match that of the surrounding surface.

3.07 CURING AND PROTECTION

A. All concrete shall be cured for a period of not less than seven (7) days by one of the methods listed below. During this curing period, the concrete shall be maintained with minimal moisture loss at a relatively constant temperature. Fresh concrete shall be

protected from heavy rains, flowing water, mechanical injury, and injurious action of the sun. Curing method selected must be compatible with the finish to be applied to the concrete.

Curing shall immediately follow the finishing operation.

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

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

D. Curing Compounds: Curing compounds shall not be used on concrete surfaces that are to receive paint finish, acid stain or resilient flooring, except those that are recommended by the manufacturer to be compatible with the applied finish. The Contractor shall submit to the Engineer a letter certifying that the curing compound is compatible with the applied finish. Application shall be in accordance with the manufacturer's recommendations. If curing, sealing or other compounds are used which are incompatible with applied finish, such compound shall be thoroughly removed by grinding with a terrazzo grinder.

E. Waterproof Paper: Waterproof paper or opaque polyethylene film conforming to ASTM C171 may be used. The paper or film shall be anchored securely and all edges sealed or applied in such a manner as to prevent moisture escaping from the concrete.

3.08 SAMPLING AND TESTING

A. Sampling - ASTM C 172: Collect samples of fresh concrete to perform tests specified. ASTM C 31 for making test specimens.

B. Slump Tests - ASTM C 143: Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 10 cubic yards (maximum) of concrete.

C. Compressive Strength Tests - ASTM C 39: Make four test cylinders for each set of tests in accordance with ASTM C 31. Test one cylinder at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Provide concrete cylinders for compression tests not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5,000 square feet of surface for slabs or walls. If the average strength of the 28-day test cylinders is less than f'c and a maximum of one single cylinder is less than f'c minus 300 psi, take three ASTM C 42 core samples and test. If the average strength of the 28-day test cylinders is less than f'c and two or more cylinders are less than f'c minus 300 psi, take six core samples and test. Concrete represented by core tests shall be considered structurally adequate if the average of the three cores is equal to at least 85 percent of f'c and if no single core is less than 80 percent of f'c. Locations represented by erratic core

strengths shall be retested. Remove concrete not meeting strength criteria and provide new, acceptable concrete at no additional cost to the State. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

D. Testing: All sampling and testing shall be performed by an independent testing agency and all test results submitted to the Engineer for approval. All cost of sampling and testing shall be borne by the contractor.

3.09 MEASUREMENT AND PAYMENT

Concrete will not be measured for payment. Concrete shall be considered as incidental and included in the cost for related items in the contract proposal.

END OF SECTION

SECTION 03305

CONCRETE THRUST AND REACTION BLOCKS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

This section covers the requirements for furnishing and installing concrete thrust block, reaction blocks, and appurtenances. Unless otherwise noted, reference made to the Standard Details shall be the “STANDARD DETAILS FOR WATER SYSTEM STANDARDS, 2002”.

1.02 SUBMITTALS

Type of soil condition: Submit data from Geotechnical Engineer on the field verified soil type which shall be used by the Contractor to determine the minimum bearing areas required for concrete thrust blocks and beams.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified, concrete for thrust and test blocks, jackets, reaction beams, curb guards and slabs for fire hydrants shall be DWS 2500, mixed, placed and cured as specified under Section 303.03 - CONCRETE WORK of the Water System Standards.

B. At connections, all fittings requiring "strut-type" design for thrust blocks shall be reinforced externally with a ½-inch steel plate as shown on the Standard Details. Joint shall conform with the type of joint fabricated for the pipe.

PART 3 - EXECUTION

3.01 GENERAL

A. All fittings such as tees, plugs, caps, bends, offsets, reducers, and valves, as well as all other pipeline appurtenances which are subject to unbalanced thrust, shall be properly braced with thrust blocks of reinforced DWS 2500 concrete. At all top vertical bends, blocks shall be reinforced. Due to the various types and sizes of vertical bends and field conditions, the size, dimensions and reinforcing for the blocks will vary. The Contractor shall be responsible for the design and details of all concrete thrust blocks.

B. Wherever connection to existing mains is to be made, the design of the thrust block shall include structural steel struts in connection with reinforced concrete thrust blocks as shown in the Standard Details. Concrete thrust beams shall be constructed at the valves of all branch lines and dead-end lines that are to be extended in the future. The thrust beams

shall be constructed in conjunction with a reversed bell pipe when installed at valves and shall be in accordance with the Standard Details. In instances where the valves are secured by means of metal strap and concrete, the thrust beam may be eliminated. Thrust beams may also be required at flanged by bell adaptors.

3.02 CONSTRUCTION METHODS

A. Wherever concrete thrust blocks, beams or test blocks are required, the necessary excavation shall be performed by the Contractor as directed by the Manager.

B. All pipelines and appurtenances subject to unbalanced thrusts shall be properly braced with plain or reinforced concrete reaction blocks.

C. Contractor shall notify the Department two days prior to concreting operations. No concrete shall be placed before the forms, reinforcing, and other details have been checked and specific authorization to proceed with concreting operations is given by the Manager. Concrete placed without such authorization will result in rejection of the concrete placed, and the Contractor shall bear all cost of removal and replacement.

D. Wherever required, thrust and test blocks shall be constructed of reinforced concrete. All jackets and thrust beams shall be of reinforced concrete and shall be constructed to the dimensions and details shown on the plans or the Standard Details.

E. Concrete thrust blocks, beams, test blocks, and jackets shall be allowed to cure for not less than seven (7) days prior to the application of pressure, or as approved by the Manager.

F. Concrete curb guards or slabs for fire hydrants shall be constructed to the dimensions shown on the Standard Details and at the location shown on the plans or as directed by the Manager.

G. All sections of water main that require reinforced concrete jackets shall be ductile iron pipe with ductile iron fittings, or concrete cylinder pipe with concrete cylinder fittings. All reinforced concrete jackets on existing utilities shall conform with the City, County, State or the utility owner’s standards.

H. Due to varying soil conditions, whenever test or thrust blocks or beams for horizontal or horizontal-vertical bends are required, the dimensions and details of the blocks shall be determined by the Contractor after their Geotechnical Engineer has determined the existing soil type. The design of the blocks shall be determined after the Contractor has excavated the trench at the required location and their Geotechnical Engineer has been able to verify the ground conditions.

I. Where connections to existing mains are to be made, the Contractor shall construct whatever concrete blocks are required and furnish all structural struts or steel materials required to temporarily secure the fitting in place until the concrete is poured and has hardened.

3.02 MEASUREMENT AND PAYMENT

Unless otherwise specified payment for concrete thrust and reaction blocks and beams will be made at the Unit Price Bid per each block as detailed in the proposal.

The Unit Price Bid for concrete shall be full compensation for all labor, materials, tools and equipment for all concrete, forms, tie wire and chairs, bracings, straps, structural struts, surface finishing, curing, mixing, hauling, furnishing and placing reinforcing steel and all other incidentals necessary to complete the work, regardless of soil type and required block size. The Unit Price Bid shall be inclusive of the sizing of the blocks based on the soil type in the field.

The quantity and payment of excavation and backfill for thrust blocks, reaction blocks and thrust beams shall be the considered inclusive in bid items for VERTICAL THRUST BLOCKS, HORIZONTAL REACTION BLOCKS and CONCRETE THRUST BEAM.

No separate payment for reinforcing steel, straps and structural struts will be made; the compensation for such work shall be deemed to be included in the Unit Price Bid for VERTICAL THRUST BLOCKS, HORIZONTAL REACTION BLOCKS and CONCRETE THRUST BEAMS.

END OF SECTION