
A. MATERIALS:

1. Through fottings - cast iron
2. Below Grade - cast iron or standard weight iron pipe.
3. Above Grade - steel pipe.

B. INSTALLATION

1. Minimum clearance between the pipe and sleeve shall not be less than 25 mm (1") for pipes. 25 mm (1") to 89 mm (3-1/2") and 50 mm (2") clearance for pipes 100 mm (4") and larger. The clearance between pipes and sleeves shall be filled with non-combustible flexible materials such as asbestos rope and furnished with semi- hardening mastic flush.
2. Floor sleeves shall extend at least 76mm (3") above the top of the wearing surface.
3. Drains, fire department connections, test manifolds and other auxiliary pipings connected to risers shall not be cemented into walls or floors.

FPS 1900: PIPE PAINTING

- A. Sprinkler heads, valve stems and the like shall not be painted.
- B. After installation and test and before the installation of ceiling fixtures or boards, all pipings shall be prime painted and coated with two coats of gloss re quick drying enamel.

FPS 2000: ALARM CHECK VALVES

- A. The alarm assemblies shall be so constructed and installed, that any flow of water from the sprinkler system equal to or greater than from a single automatic sprinkler head, will result in an audible and visual alarm bells whether water or electrically actuated shall be capable of being actuated both automatically and annually.
- B. The water actuated alarm check valve assembly shall be complete with all the necessary attachments required to give an alarm and ease in maintenance.

The gong shall be installed as indicated in the plans. The alarm check valve shall consist of but not limited to the following:

1. Retard chamber
 2. Water motor
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3. Weatherproof gong, 300 mm dia.
 4. Strainer
 5. Pressure gages
 6. Drain and attachments
 7. Electrically supervised control valves
 8. Pressure switches

FPS 2100 : FLOOR CONTROL VALVES & WATER FLOW SWITCHES OR DETECTORS.

- A. Flow alarm valves with sizes indicated on the plans shall be provided with two (2) N.O. electrical contacts that will close instantaneously with steady flow of water in the pipe and shall be complete with tamperproof terminal chamber with minimum of 1/2" Ø conduit knock-out. False alarm shall be prevented by an adjustable pneumatic device to retard the flow switch operation due to water surges. The switch shall be actuated only by an unidirectional flow of water. Conduits connections, conduit box, riser, etc. shall be under Electrical Contractor scope of works.
- B. The alarm apparatus shall be substantially supported, located and installed so that all parts shall be readily accessible for inspection, removal and repair.
- C. An actual water flow, through the use of the test connection, shall be employed to tests the operation of the sprinkler alarm units in each floor or as a whole.

FPS 2200 SPRINKLER FIRE ALARM AND SUPERVISORY SYSTEM

The supervisory and sprinkler fire alarm system shall be integrated with the building Fire Alarm System at the control room (security office) at the ground floor. The Sprinkler Fire Alarm System annunciator shall indicate the supervisory switches of the system.

FPS 2300 MARKERS, INSTRUCTION & IDENTIFICATION SIGNBOARD

These signboards shall be made of gauge No. 14 black iron sheet with baked enamel finish and letter of instruction as shown in the plans. Additional signboards shall be mounted on the unobstructed for easy identification reading. Paints shall be basically gloss fire red and white.

FPS 2400 : PUMPS

- A. GENERAL :
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1. Manufacturer's installation drawings shall be submitted together with the proposal. After installation is completed as "as-installed" drawings showing all the field revisions and exact locations/dimensions on reproducible form plus two (2) white print copies shall be submitted to the Owners at the Contractor's Expense.
 2. Pump performances curves shall be submitted together with the proposal. The Pump efficiencies at the various work loads shall be indicated thereon and properly marked.
 3. Test run shall be performed by the supplier after the installation is completed, to demonstrate conformity to the manufacturer's specifications. A successful test shall be a condition to the Owner's acceptance of the installed equipment and to final payment.
 4. A direct statement on the availability of spare parts and maintenance service from pump supplier, for a period of at least three (3) years reckoned from the date of acceptance test shall be submitted.

B. FIRE PUMPS

1. There shall be One (1) unit of Fire Pump for the system. The pumps, electric motor drive, all control and necessary attachments specified herein shall be UL listed. and Fm Approved and shall be furnished under this contract. The pump shall be capable of delivering not less than 150 percent of rated capacity at not less than 65 percent of total head. The shut-off head shall not exceed 120 percent of the rated heads. The fire pump shall be Vertical In Line. Vertically mounted electric motor drive. . Fire Pump to be supplied with accessories to include controllers, circuit breakers, starters and contactors. Fire pump volumetric capacity shall be 750 GPM vs 250 PSIG , approx. 150 HP.

Pump unit major Accessories :

- a. Circulating relief valve
 - b. Hose valve manifold 105Ø, hose valve
 - c. Flow Measuring Device
 - d. Relief valve and discharge cone
 - e. Suction Strainer
 - f. Primary Connection
 - g. Capacity plate
 - h. Automatic Air released valve fittings
 - I. Water level testing device and piping
 - j. Pressure gauge, 80mm Ø
 - k. Pressure switches
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2. Electric Motor Drive :

- HP - 150 HP or as per manufacturer's recommendations
- Voltage - 380 V
- Phase - 3
- Frequency - 60 hz
- Temperature rise - 40 degree C
- Service Factor - 1.15 min.

3. Motor Controller :

- a. Type - Combination circuit breaker and starter; UL listed and FM approved:

1. Circuit Breaker - magnetic trip, 3 phase, 230 V (min.) 300 times motor FLA continuous rating. Interrupting rating not less than 40,000 rms. amps. symmetrical at 230 VAC with external operating handle.
2. Starter - magnetic, wye delta reduced voltage type, close transition with 3-0.L relays and necessary auxiliary contacts.
3. Enclosure - watertight type, NEMA 4 floor mounted.

4. Flow Measuring Device

Fire pump shall be acquired also with "Flow Measuring Device" consisting of flow meter and flow indicator.

Flow pump flowmeter shall be orifice type 1/8" thk 304 Stainless steel " Meriam: series 951B30 or approved equal; flange meriam Series 952 or approved equal; Flowmeter Manometer " Meriam" Model 30EB25 for wall mounting, with single indicating tube, rated 250 PSIG. maximum operating pressure, scale for direct GPM reading and complete with mercury fluid, return well, valve and piping manifold; Flowmeter bellows or D/P Dial Option differential pressure indicator, beryllium copper with forged brass housing, 500PSIG. maximum pressure rating, GPM scale reading and complete with pulsation dampener, valve and manifold.

5. Installation Drawings:

Manufacturer's installation drawings shall be submitted as part of Shop drawings, section 500 of the Specifications.

6. Performance Curves:

Performance curves shall be submitted together with the requirements of section 500. The pump efficiencies at various work loads shall be indicated thereon and properly marked.

7. Installation :

The Contractor shall assume unit responsibility and shall provide the services of a qualified Engineer to supervise the complete installation of equipment who shall be available conducting the final acceptance test as stated under Section 600 of the Specifications.

C. Jockey Pump

1. There shall be One (1) unit of Jockey Pump for the system. Pump rating shall be 25 GPM vs 250 PSIG . Vertical in line, complete with pump bowl assembly and riser pipes drive with controllers and accessories to be installed inside Fire Storage Tank and shall be setting for a maximum of 10 ft. depth. Jockey pump to be supplied with accessories to include controllers, circuit breakers, starters and contactors. The drive shall be Vertical mounted electric motor, 1800 rpm complete with controls and accessories, 380 Volts, 3-phase 60Hz, approx. 10 HP.
2. Jockey Pump Control Panels : furnish ready for wiring jockey pump, General Electric CRI 35 type "F" with "H-O-A" switch and timer run relay, with three overload relays, Clark Controller, Cutter Hammer, Inc. " Firetrol of as approved.

D. PUMP SEQUENCE OF OPERATION

Adjust pressure switches to control the fire pump operation in the following sequence :

Pump	Pump on	Pump off
a. 25 gpm Jockey Pump	250 PSIG	160 PSIG
b. 750 gpm Fire Pump	250 PSIG	Manual

E. SYSTEM REQUIREMENTS :

(Minimum Requirement)

F. SPARE PARTS:

Furnish spare parts and maintenance service part lists for a period of at least one (1) year reckoned from the date after termination of warranty as indicated in Section 2700 of this Specifications.

MOTORS :

1. General Requirements:

- a. Motor type required for project: Refer to other parts of specifications.
 - b. Motor shall be furnished with driven equipment to assure proper coordination of motor and control characteristics with requirements of driven equipment. Contractor is responsible for proper correlation of horsepower, starting torque, other characteristics of electrical equipment, with requirements of driven equipment.
 - c. Horsepower nameplate rating shall be at least as great as the brake horsepower required to drive the equipment under the maximum specified conditions without consideration of service factor.
 - d. Conform to NEMA Standard No. MG1 entitled "Motor and Generator", except where specifically noted otherwise.
 - e. Conform to ANSI Standard No. C50, 2-1955 " Alternating - Current Induction Motors, Induction Machine is in General and Universal Motors.
 - f. Torque and speed characteristics, suited to requirements of driven equipment, including gear reducers if specified.
 - g. Maximum speed : 1750 rpm unless specified otherwise.
 - h. Horsepower :
 - 1). Motor HP rating specified shall be nameplate rating without consideration of motor service factor.
 - 2). Nameplate HP not less than HP required by driven equipment operated at maximum conditions specified.
 - i. Duty : continuous
 - j. Service factor: as specified herein, unless specifically stipulated otherwise in detailed equipment specifications.
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- k. Bearings: ball, unless otherwise specified; provide for in-service lubrication of enclosed motors, unless specifically noted otherwise.
 - l. Base :
 - 1). Provide cast iron or steel motor base with provision for motor alignment on direct coupled drives.
 - 2) Provide sliding or hinge motor base with screw type, automatic gravity type, or other manufacturer's standard means of adjustment for belt or chain drives.
 - m. Accessories: lifting lugs as required.
 - n. Motor specified as 460-volts, three phase or 230-volts single-phase, may be designed for single or dual voltage in accordance with manufacturer's standard for horsepower and speed required.
 - o. Frequency: 60 Hz.
2. Enclosure and Insulation :
- a. Suitable for 40 degree C ambient duty, with standard service factor, unless otherwise specified.
 - b. Drip-proof encapsulated : encapsulated moisture sealed insulation system, with weather resistant conduit box; bearing shielded against entrance of moisture and dirt; and anti corrosion treatment of exposed metal parts, 40 degree C ambient, continuous duty, with 1.15 (min.) service factor.
 - c. Totally enclosed non-ventilated or fan-cooled; 40 degree C ambient, continuous duty, with 1.15 (min.) service factor.
 - d. If other types of insulation are proposed, operating temperature must be guaranteed satisfactory for proposed installation.
3. Types:
- Single-phase induction; method of starting suited to driven load requirement; constant or multi-speed, and method of starting as specified.

FPS 2500 : ACCEPTANCE TESTS

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- A. The Contractor shall conduct test in the presence of inspector or authority having jurisdiction (The Philippine Fire Protection Association of Fire Protection Associates).
 - B. To remove foreign materials which may have entered the piping during installation of same, flushing or underground connection is required before sprinkler piping is connected.
 - C. Hydrostatic Tests :
 - 1. Test pressure not less than 200 psi for two hours.
 - 2. No visible leakage for inside sprinkler piping will be allowed. For underground mains and lead-ins, exceeding the permissible leakage or joints necessary repair shall be made.
 - 3. All control valve water pressure to insure proper operating tests. Use clean, non-corrosive water.
 - 4. Fire connection shall be tested.
 - D. Testing of drainage facilities shall be made by opening the main drain valve while the control valve is wide open.
 - E. Test certificate shall be filled out and signed by the Owner's and Contractor's representative.
 - F. System operations and maintenance chart shall be submitted to the Owner's upon completion of the Contract. This shall include, among others, the locations of the control valves and care of the new equipment.

FPS 2600 MINOR MODIFICATIONS AND TIME COMPLETION

- A. The plans as drawn should conditions as accurately as it is possible to indicate them in scale. The Plans are diagrammatical and do not necessarily show all fittings, etc. necessary to fit the building conditions. The location of valves, fittings and the fixture shown on the plans are approximately. The contractor shall be responsible for the proper location in order to make them fit with architectural details and instructions.
 - B. The Contractor shall complete the work herein described in accordance with the specific schedules set by the Owners in accordance with General Contractor's Schedule of Work.
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FPS 2700: GUARANTEE

The Contractor shall guarantee that the installed sprinkler system complies with the requirements of the authorities and free from all defective workmanship and materials and will remain so, for a period of one (1) year from the date to final inspection and acceptance of the work. Any defect appearing within one year shall be corrected by the Contractor at no additional cost to the Owner.

FPS 2800: CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall provide temporary fire protection system during the construction period. This shall be of sufficient capacity to put any fire that may break out at any floors due to construction operations. This is in addition to temporary fire extinguisher required.
- b. The Contractor shall identify and save the Owner, the Architect and the Consulting Engineer harmless from and against all liabilities for damage to property occasioned by any or omission of this Contractor on any of this Sub-contractors, including any and all expenses, legal or otherwise which may be insured by the Owner, the Architect or the Consulting Engineer, in the defense of any claims, action or suits.

13.03 PRESSURE TEST FOR WATER LINES:

- a. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section therefore, shall be subjected to hydrostatic pressure 1 1/2 the designed working pressure of the system or as specified by the Architect.
- b. The duration of each pressure test shall be at least 10 minutes unless otherwise specified by the Architect.
- c. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump lowest elevation, shall applied by means of a pump connected to the pipe in a manner satisfactory to the Architect. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this type shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expenses. The test shall then be repeated until satisfactory results are obtained.

13.04 DEFECTIVE WORK

- a. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated unless until satisfactory to the Architect.
- b. All repairs to piping shall be made with new materials at the expense of the contractor.
- c. No caulking of screwed joints of holes will be accepted

13.05 DISINFECTION OF WATER DISTRIBUTION SYSTEM & WATER TANKS (as per AWWA C-601)

- a. The entire water system shall be thoroughly flushed and disinfected with chlorine before it is place on operation. Water tanks shall be washed and swabbed.
- b. Chlorination materials shall be liquid chlorine or hypochlorite, as specified and shall be introduced into water lines in a manner approved by the Engineer. Tank shall be thoroughly cleaned of all debris, dirt or dust before swabbing.

ELECTRONICS SPECIFICATIONS

GROUNDING AND BONDING

Part 1 – GENERAL

1.1 DESCRIPTION

- A. Provide grounding system in accordance with the Contract Documents

1.2 QUALITY ASSURANCE

- A. Utility company approval of service installation

1.3 STANDARDS

- A. American National Standards Institute (ANSI):

ANSI/IEEE 81 – Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System Part 1: Nominal Measurements

- B. National Fire Protection Association (NFPA)

- C. Philippine Electrical Code (PEC): PEC (PART 1 and 2: 2019)

- D. Underwriter 's Laboratories, Inc. (UL):

UL 44 – Thermoset Insulated Wires and Cables

UL 83 – Thermoplastic Insulated Wires and Cables

UL 467 – Grounding and Bonding Equipment

- E. Utility Company Requirements

1.4 SUBMITTALS

- A. Shop Drawings:

1. Showing the location of system grounding electrode connections and the routing of grounding electrode conductor.

10.05 SEWAGE EJECTOR PUMP

- a. Number of Units — SE1/ SE2
- b. Capacity of each Unit: 50 GPM vs. 20 Ft. TDH. Approximately 0.5 HP each.
- c. Type: Sewage Ejector Pump, coupled to electric motor, bronze fitted with electric motor drive on a common base with control and accessories.
- d. Electric Motor Drive: 230 volts, 1-Phase, 60 cycles, 5.0.HP.
- e. Motor Controls:
- f. Accessories: Vibration insulating hose connection at suction and discharge line.

10.06 SUMP PUMP

- a. Number of Units — SP1/ SP2
- b. Capacity of each Unit: 130 GPM vs. 60 Ft. TDH. Approximately 5.0 HP each.
- c. Type: Submersible Pump, coupled to electric motor, bronze fitted with electric motor drive on a common base with control and accessories.
- d. Electric Motor Drive: 230 volts, 1-Phase, 60 cycles, 5.0HP.
- e. Motor Controls:
- f. Accessories: Vibration insulating hose connection at suction and discharge line.

PART 11: WATER RESERVOIR:

11.01 GROUND TANK - Reinforced concrete

Capacity: 33,632 gallons for potable water

Capacity: 30,000 gallons for fire water

ELEVATED WATER TANK

Capacity: 2-5,000 gallons

11.02 PIPING, FITTINGS AND MISCELLANEOUS METAL WORKS

- a. Furnish and install all pipe fittings, valves, specials, pipe supports, miscellaneous metal work and all required appurtenances as shown on the plans and as required to make the entire piping system operable.
- b. All materials furnished and installed shall be new and guaranteed free from defect in design, materials and workmanship.
- c. Adequate protective measures shall be provided to protect pipes, fittings, valves and all other materials from damage or injury during storage and installation.

11.03 FLANGES, GASKETS, AND BOLTS:

- a. Flanges shall conform in dimensions and drilling to ASA B-161 Class 125.
- b. Gaskets shall be ring-type.
- c. Bolts shall be standard square head machine bolts with heavy, hot, pressed hexagon nuts. Threads shall conform to ASA-B-1.1, coarse thread series, Class 2 fit.

11.04 MANHOLE AND COVER:

- a. All castings for manhole frames shall be tough, gray iron free from warps, cracks, holes, swells and cold shuts, and approximately 3 mm thick.
- b. All casting shall conform to the requirements of ASTM Standard A-48 for gray from castings.

11.05 LADDER RUNGS

- a. Ladder Rungs shall be of 20 mm diameter round stainless-steel bar placed in the wall as shown from castings.

11.06 INSTALLATION

- a. All pipes shall be carefully placed and supported at the proper lines and grade where possible shall be sloped to permit complete draining.
- b. Piping runs shown on Drawings shall be followed as closely as possible, except for minor adjustments to avoid adverse effect on architectural and/or structural features. If major relocations are required, they shall be subjected to the approval of the Architect.
- c. Carefully inspect all pipe and fittings before installation. Inspection of pipe shall include light tapping with a hammer to detect cracks or defects. No pipe fittings or valve which are cracked or shown defects shall be used
- d. Piping shall be properly supported by suitable anchors, brackets, or hangers. Vertical pipes shall be anchored by suitable galvanized steel straps. Pipe supports shall be provided as shown on the Plans and whenever else necessary to prevent stain on joints or to facilitate taking down pipe

- e. Piping through the Walls - Where the pipe pass through walls, care shall be exercised to ensure these joints are watertight.

11.07 TEST FOR WATER:

- a. Tightness of completed Tank - The completed reinforced concrete ground and structural steel tanks shall be tested for water-tightness by filling it up with clean water after cleaning out all dirt and debris inside the tank. The water shall be allowed to stand for a minimum period of 24 hours reckoned from the time the free-board line was reached during filling up. After the 24 hours period there shall be no drop-in water level in the tank more than 40 mm, otherwise, the leaks shall be located and plugged properly and the test for water-tightness be repeated.

11.08 DEFECTIVE WORK:

- a. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated until satisfactory to the Owner.
- b. All repairs to piping shall be made with new material at the expense of the Contractor.
- c. No caulking of screwed joints of holes will be accepted.

11.09 TEST CERTIFICATE

- a. Test Certificate shall be filled out and signed by the Owner's representative

PART 12: SITE PLUMBING UTILITIES

12. 01 GENERAL

- a. The entire site plumbing utilities system shall be laid out and installed consistent throughout with the given slopes in the plans. Pipe joints and connections to area drains, catch basin, and junction boxes shall possess such leak-proof and seepage-proof integrity achievable with the works called for under this particular section of the Specifications.
- b. Junction Boxes for storm & sanitary (sewer) drainage lines outside the building shall be cast-in-place reinforced concrete sections and pre-cast concrete cover.
- c. Trench excavation and backfilling shall be as specified in excavation, trenching and backfilling for utility system.
- d. Concrete Drainage Pipe:
 - 1. Material, Pipe shall be reinforced concrete pipe (300 mm IZI & larger) non-reinforced Concrete pipe 250 mm CI & smaller conforming to ASTM C14-75.
 - 2. Installation
 - a. Bedding surfaces shall provide a firm foundation, carefully shaped true to line and grade.
 - b. Concrete pipe shall be laid carefully with hubs up grade and ends fully and closely joints. Joints shall be cement mortar. Cement mortar shall consist of one-part Portland Cement and 1-1/2 parts clean sharp sand with only enough water for workability. A gasket

of closely twisted hemp or Oakum shall be placed around the pipe. The gasket shall be in the (1) piece of suitable diameter (not less than 19 mm and shall be lapped at the top. The gasket shall be saturated. With that cement before being placed and rammed. The joint shall be

completely filled with cement mortar and rammed thoroughly with a wooden caulking tool. The joint shall then be overfilled and finished to a smooth level outside.

12.02 EXCAVATION FOR STORM AND SANITARY (SEWER DRAINAGE SYSTEM)

- a. General. The Contractor shall do all excavation of whatever substances encountered below depth shown on drawings. Excavated materials not required for fill or backfill shall be removed from site as directed by the Engineer and disposed of by the Contractor. Excavation for accessories to have mm minimum and 60 mm maximum clearance in all side. Excavation shall not carry below the required depth. Excess excavation below required level shall be backfilled at the Contractor's expense with earth, sand, gravel, or concrete, as directed by Engineer, and thoroughly tamped unstable soil shall be removed and replaced with gravel or crushed stone, which shall be thoroughly tamped. The Engineer shall determine the depth of removal of unstable soil. Ground adjacent to all excavation shall be graded to prevent water running. The Contractor shall remove by pumping or other means approved by the Engineer any water accumulated in excavation and keep trench un-watered until the bedding is complete.
- b. Trench Excavation. Banks of trenches shall be vertical. Soft materials shall be reported to the Engineer. In rock, excavation shall be carried 200 mm below bottom of pipe. Loose earth or gravel shall be used for backfill, and tamped thoroughly and rounded to received pipe as above.
- c. Rock Excavation. Rock excavation shall include removal of boulders larger than 1/2m³ in volume and ledge rock concrete or masonry structures that required drilling, melting.
- d. Bracing and Shoring. The Contractor shall do all bracing sheathing and shoring necessary to perform and protect all excavation as indicated on the plans, as required for safety, as directed by the Architect, or to conform to governing laws.

12.03 TESTING

- a. Test: Test for workmanship on utility lines shall be conducted in accordance with the applicable utility specification before backfilling.

13.04

density equal to that of adjacent original material so that pavement can be placed immediately.

3. Structures: All forms, trash, and debris shall be removed and cleared away. Approved backfill material may be from excavation or borrow, it shall be free from rock, lumber or debris. Backfill material shall be placed symmetrically on all side in eight-inch maximum layers. Each layer shall be moistened and compacted with mechanical or hand tampers. In area to be paved, each layer shall be compacted to density equal to that of adjacent materials so that pavement can be placed immediately.

a. Maintenance. The Contractor shall refill for settlement all backfilled areas.

b. Clean-up the Contractor shall clean up and dispose of all excess materials, trash, wood forms and other debris.

PART 13: TEST AND DISINFECTION

13.01 DRAINAGE SYSTEM TEST

- a. The entire drainage and venting system shall have all necessary openings which can be plugged to permit the entire system to be filled with water to the level of the highest stack vent/or vent stack above the roof.
- b. The system shall hold this water for a full thirty (30) minutes during which time there shall be no drop more than 100 mm.
- c. Each section of pipeline shall be slowly filled water and the specified test pressure, measured at the point of lowest elevation shall be applied by means of satisfactory to the Architect. During the filling of the pipe in and before applying the test pressure, all air shall be expelled from the pipe line. To accomplish this tap shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified.
- d. During the test, all expose pipes, fittings, valves joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the contractor with sound materials at his own expense. The test shall be repeated until satisfactory result has been obtained.

13.02 PRESSURE TESTS FOR WATER LINES

- a. After the pipe have been installed, the joints completed and with joints exposed for examination, all newly installed pipe or any valve section shall be subjected to hydrostatic pressure 1 1/2 the designed pressure of the system or as specified by the Architect.
- b. The duration of each pressure test shall be at least 10 minutes unless otherwise specified by the Architect.
- c. Each section of pipeline shall be slowly filled water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of satisfactory to the Architects. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish, this tap shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified.

During the test, all exposed pipes, fittings, valves, joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expenses. The test shall then be repeated until satisfactory result has been obtained.

13.03 PRESSURE TEST FOR WATER LINES:

- a. After the pipe have been installed, the joints completed and with joins exposed for examination, all newly installed pipe or any valve section, therefore, shall be subjected

to hydrostatic pressure 1 1/2 the designed working pressure of the system or as specified by the Architect.

b. The duration of each pressure test shall be at least 10 minutes unless otherwise specified by the Architect.

c. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a pump lowest elevation, shall applied by means of a pump connected to the pipe in a manner satisfactory to the Architect. During the filling of the pipe and before applying the test pressure, all air shall be expelled from the pipeline. To accomplish this type shall be made, if necessary, at point of highest elevation, and after completion of the test the taps shall be tightly plugged unless otherwise specified. During the test, all exposed pipes, fittings, valves, joints and couplings will be carefully examined. If found to be cracked or defective, they shall be removed and replaced by the Contractor with sound materials at his expenses. The test shall then be repeated until satisfactory results are obtained.

13.04 DEFECTIVE WORK

a. If the inspection or test shows any defect, such defective work or material shall be replaced and the test shall be repeated unless until satisfactory to the Architect.

b. All repairs to piping shall be made with new materials at the expense of the contractor.

c. No caulking of screwed joints of holes will be accepted

13.05 DISINFECTION OF WATER DISTRIBUTION SYSTEM & WATER TANKS (as per AWWA C-601)

a. The entire water system shall be thoroughly flushed and disinfected with chlorine before it is place on operation. Water tanks shall be washed and swabbed.

b. Chlorination materials shall be liquid chlorine or hypochlorite, as specified and shall be introduced into water lines in a manner approved by the Engineer. Tank shall be thoroughly cleaned of all debris, dirt or dust before swabbing.

CIVIL WORKS SPECIFICATIONS

SECTION 01010 SUMMARY OF WORK

1.0 GENERAL

- 1.1 The works to be undertaken in this Contract includes the furnishing of all materials, labor, supervision, tools, equipment, all required permits, licenses, and other services necessary to complete the items of works in accordance with the plans, specifications and all related contract documents.
- 1.2 All applicable provisions of the different divisions of the Specifications shall apply to all items cited in this summary of work.
- 1.3 Omissions from the drawings or specifications or the misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications or which are customarily performed shall not relieve the Contractor from performing such omitted or misdescribed details of the work but shall be performed as if fully and correctly set forth and described in the Drawings and Specifications.
- 1.4 The Contractor shall be responsible for coordinating his work with the other Bid Package Contractors necessary to avoid conflicts and to ensure the satisfactory completion of the Project.
- 1.5 All works shall conform to the requirements of the applicable codes and standards specified in these specifications.
- 1.6 All works and materials shall conform to all local codes and regulations covering this installation.
- 1.7 The contractor shall be responsible for filing all documents, paying for all fees, and securing all permits, inspections and approvals necessary for conducting this work.
- 1.8 Preparation and submission of reproducible as-built drawings (hard copy & electronic file).

2.0 SPECIFICS

The different features of the work of this project are divided into different packages. They are as follows:

2.1 MOBILIZATION AND DEMOBILIZATION

The Contractor shall mobilize equipment and manpower in accordance or ahead of the approved equipment and manpower deployment schedule.

The Contractor shall not demobilize equipment without the approval of the Construction Manager.

Mobilization and demobilization cost shall be included in the bid cost.

2.2 TEMPORARY FACILITIES

The Contractor shall provide its temporary facilities complete with utilities at its own expense. This shall include but not limited to office, conference room, fabrication area, warehouse and office for the Owner's Representative. The Owner's Representative office shall be not less

than 20 sq. meters in floor area provided with four sets of tables and chairs, 3-drawer filing cabinet, air conditioning unit and plan rack.

The Contractor shall maintain the Temporary Facilities.

Upon completion of the project, the Contractor shall remove the temporary facilities and clean the area. Removal shall only start upon the approval of the Construction Manager.

2.3 All Other Infrastructures

Among the specific scope of work intended for a General Contractor are:

PART 1 - Roadways

This will consists of Portland Cement Concrete Pavement (PCCP), curb and gutters and sidewalks.

b.) Site Grading

c.) Drainage System

The Storm drainage system shall include drainage pipes, manholes, curb-inlets, drainage junction boxes, trenches, connection to existing lines/manholes, relocation of existing lines (where applicable) and all necessary appurtenances.

d.) Water Line Distribution System

e.) Slope protection

2.4 Other relevant miscellaneous works.

***** End of Section *****

SECTION 01100 SUBMITTALS

1.0 GENERAL

Wherever submittals are required hereunder, all such Contractor submittals shall be submitted to the Owner or any of his authorized representatives at the construction site for recording.

2.0 SHOP AND AS-BUILT DRAWINGS

Whenever called for in these specifications or on the drawing, or where required by the Owner, the Contractor shall furnish shop drawings for review and approval.

The Contractor shall prepare as-built drawings and submit same to the Owner within one (1) month after the completion of the work. As-built drawings shall show the actual revisions as installed at Site, incorporating all modifications carried out during the progress of the works.

3.0 SUBMITTAL OF PROPOSED EQUIVALENT PRODUCTS

All materials, processes, or equipment which are to be offered by the Contractor as equivalent to those indicated or specified in the Contract Documents shall be submitted within 30 calendar days after date of execution of the Contract to the Engineer for approval.

4.0 SAMPLES

Unless otherwise specified, whenever in the Specifications samples are required, the Contractor shall submit not less than two (2) samples of each such item or material to the Owner for approval at no additional cost to the Owner.

Samples, as required herein, shall be submitted for approval a minimum of seven (7) working days prior to ordering such material for delivery to the jobsite, and shall be submitted in an orderly sequence so that dependent materials or equipment can be assembled and reviewed without causing delays in the work.

All samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and manufacturer's names for identification and submit to the Engineer for approval. Upon receiving approval, one (1) set of the samples will be stamped and dated by the Engineer and returned to the Contractor until completion of the work.

Unless otherwise specified, all colors and textures of specified items will be selected by the Engineer from the manufacturer's standard colors and standard product lines.

***** End of Section *****

SECTION 01200 VARIATIONS

PART 1 - GENERAL

Variations from contract requirements require Owner approval and will be considered where advantageous to the Owner. When proposing a variation, submit a written request to the Engineer with documentation of the nature and features of the variation and why the variation is desirable and beneficial to the Owner. If lower cost is a benefit, also include an estimate of the cost saving. Identify the proposed variation separately and include the documentation for the proposed variation along with the required submittal for the item. When submitting a variation for approval, the Contractor warrants the following:

1.1 Variation is Compatible

The Variation has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of the work.

1.1 Contractor is Responsible

The Contractor shall take actions and bear the additional costs, including review costs by the Owner, necessary due to the proposed variation.

PART 2 - REVIEW PERIOD IS MODIFIED

In addition to the normal submittal review period, a period of 15 working days will be allowed for consideration by the Owner of variations or submittals with variations.

***** End of Section *****

**SECTION 01300
WARRANTIES**

PART 3 - GENERAL

1.1 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 Summary

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 1 Section "Submittals" specifies procedures for submitting warranties.
 - 2. Division 1 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.
 - 3. Certification and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- C. Disclaimer and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 Definitions

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 Warranty Requirements

- A. **Related Damages and Losses:** When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. **Reinstatement of Warranty:** When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. **Replacement Cost:** Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. **Owner's Recourse:** Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. **Rejection of Warranties:** The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the work or part of the work, the Owner reserves the right to refuse to accept Work, until the contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 Submittals

- A. Submit written warranties to the Consultants prior to the date certified for Substantial Completion. If the Consultant's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Consultant.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Consultant within 15 days of completion of that designated portion of the Work.

- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Consultants, for approval prior to final execution.
- C. Form of Submittal: A Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by11-inch (115-by-280-mm) paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
 - 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

***** End of Section *****

**SECTION 02100
DEMOLITION AND REMOVAL**

1.0 GENERAL

1.1 Scope

This section includes demolition and removal of existing work in the way of new construction.

1.2 References

- a. The National Building Code of the Philippines
- b. Department of Environmental and Natural Resources

1.3 General Requirements

Do not begin demolition until authorization is received from the Owner or Engineer. Remove rubbish and debris from the project site. Store materials that cannot be removed daily in areas specified by the Engineer.

1.4 Submittals

1.4.1 Demolition plan

Submit proposed demolition and removal procedures to the Engineer for approval before work is started. Include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.5 Regulatory and Safety Requirements

Comply with local hauling and disposal regulations.

1.6 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding, or pollution.

1.7 Protection

1.7.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement. Notify the Engineer prior to beginning such work.

1.7.2 Existing Work

Protect existing work which is to remain in place, be reused, or remain the property of the Owner. Repair items which are to remain and which are damaged during performance of the work to their original condition, or replace with new ones. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Engineer's approval.

1.7.3 Weather Protection

For portions of a building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.7.4 Trees

Comply with Department of Environment and Natural Resources (DENR) regulations for protection of natural resources.

1.7.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.8 Burning

Burning will not be permitted. Where burning is permitted, adherence to local regulations shall be required.

1.9 Relocations

Perform the removal and reinstallation of relocated items as indicated. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Engineer.

2.0 MATERIAL REQUIREMENTS (Not Applicable)

3.0 CONSTRUCTION REQUIREMENTS

3.1 Existing Facilities To Be Removed

3.1.1 Structures

Remove indicated existing structures to grade to new finished grade.

3.1.2 Utilities and Related Equipment

Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Engineer. Remove meters and related equipment and deliver to a location in accordance with instructions of the Engineer. If utility lines are encountered that are not shown on drawings, contact the Engineer for further instructions.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

3.2 Disposition of Material

3.2.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Owner's property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Engineer of the Contractor's demolition and removal procedures, and authorization by the Engineer to begin demolition.

The Owner will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed and indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated and specified to be removed by the Contractor and that are to remain the property of the Owner, and deliver to a storage site selected by the Engineer.

3.3 Cleanup

3.3.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets or adjacent areas. Clean up spillage from pavements, streets and adjacent areas.

***** End of Section *****

SECTION 02200 SITE PREPARATION

1.0 DESCRIPTION

This section shall consist of clearing, grubbing, removing and disposing of all vegetation and debris within the limits of the project site, including the borrow site, as designated in the Contract except those objects that are designated to remain in place or are to be removed in consonance with other provisions of this specification. The work shall also include the preservation from injury or defacement of all objects designated to remain.

2.0 CONSTRUCTION REQUIREMENTS

2.1 General

The Engineer will establish the limits of work and designate all trees, shrubs, plants and other things to remain if there are any.

2.2 Protection of Existing Utilities

Contact the Engineer 72 hours prior to construction for the location of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during grading shall be at the Contractor's risk. For exposing a utility or other buried obstruction, use hand or light equipment for excavation. Start hand or light equipment stripping on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract grading until approval for filling is granted by the Engineer. Report damage to utility lines or subsurface construction immediately to the Engineer. It will be the responsibility and expense of the Contractor to repair and restore the damage to its original state or even better.

2.3 Clearing and Grubbing

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain, shall be cleared and/or grubbed, including mowing as required, except as provided below:

- a. Removal of undisturbed stumps and roots and non-perishable solid objects with a minimum of 900mm (36 inches) below natural ground surface.

- b. Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.
- c. In areas outside of the grading limits of cut and embankment areas, stumps and non-perishable solid objects shall be cut off not more than 150mm (6 inches) above the ground line or low water level. However, trees in these areas shall not be cut or removed.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted to the required density.

If perishable material is burned, it shall be burned under the constant care of competent watchman at such times and in such a manner that the surrounding vegetation, and other adjacent property or anything designated to remain within the limits of the property will not be jeopardized. If permitted, burning shall be done in accordance with applicable laws, ordinances and regulations.

Materials and debris which cannot be burned and perishable material may be disposed of by methods and at locations approved by the Engineer on or off the project site. If the disposal location is outside the project area, the Contractor shall make all necessary arrangements with the property owner or owners in writing for obtaining suitable disposal locations. The cost involved shall be included in the unit bid price. A copy of such agreement shall be furnished to Owner or Engineer.

2.4 Method of Measurement

The work to be paid shall be the number of square meters and fractions thereof acceptably cleared and grubbed within the limits indicated on the plans.

***** End of Section *****

SECTION 02300 SHORING/SHEETING/EXCAVATION SUPPORT SYSTEMS

1.0 GENERAL

This section shall include the use of shoring, sheeting, bracing and all the other excavation support system required during trench excavations for structures and pipes as specified and directed herein.

2.0 TECHNICAL REQUIREMENTS

2.1 General

The Contractor shall furnish, install and maintain such sheeting, shoring, bracing and other support system as may be required to support the sides of trench or structural excavations, to prevent any earth movement which could diminish the excavation width to below that necessary for construction, and to protect adjacent structures from damage. The Engineer may direct that additional trench supports be installed by the Contractor, at the Contractor's expense, should the existing supports be deemed insufficient. Provision of additional supports (or acceptance of existing supports) shall not relieve the Contractor of his sole responsibility for the provision of adequate support of excavations, especially for the protection of workmen.

1.4 Submittals

1.4.1 Demolition plan

Submit proposed demolition and removal procedures to the Engineer for approval before work is started. Include procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations.

1.5 Regulatory and Safety Requirements

Comply with local hauling and disposal regulations.

1.6 Dust and Debris Control

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding, or pollution.

1.7 Protection

1.7.1 Traffic Control Signs

Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement. Notify the Engineer prior to beginning such work.

1.7.2 Existing Work

Protect existing work which is to remain in place, be reused, or remain the property of the Owner. Repair items which are to remain and which are damaged during performance of the work to their original condition, or replace with new ones. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Engineer's approval.

1.7.3 Weather Protection

For portions of a building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent displacement.

1.7.4 Trees

Comply with Department of Environment and Natural Resources (DENR) regulations for protection of natural resources.

1.7.5 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.

1.8 Burning

Burning will not be permitted. Where burning is permitted, adherence to local regulations shall be required.

1.9 Relocations

Perform the removal and reinstallation of relocated items as indicated. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by the Engineer.

2.0 MATERIAL REQUIREMENTS (Not Applicable)

3.0 CONSTRUCTION REQUIREMENTS

3.1 Existing Facilities To Be Removed

3.1.1 Structures

Remove indicated existing structures to grade to new finished grade.

3.1.2 Utilities and Related Equipment

Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Engineer. Remove meters and related equipment and deliver to a location in accordance with instructions of the Engineer. If utility lines are encountered that are not shown on drawings, contact the Engineer for further instructions.

3.1.3 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

3.2 Disposition of Material

3.2.1 Title to Materials

Except where specified in other sections, all materials and equipment removed, and not reused, shall become the property of the Contractor and shall be removed from Owner's property. Title to materials resulting from demolition, and materials and equipment to be removed, is vested in the Contractor upon approval by the Engineer of the Contractor's demolition and removal procedures, and authorization by the Engineer to begin demolition.

The Owner will not be responsible for the condition or loss of, or damage to, such property after notice to proceed. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed and indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated and specified to be removed by the Contractor and that are to remain the property of the Owner, and deliver to a storage site selected by the Engineer.

3.3 Cleanup

3.3.1 Debris and Rubbish

Remove and transport debris and rubbish in a manner that will prevent spillage on pavements, streets or adjacent areas. Clean up spillage from pavements, streets and adjacent areas.

***** End of Section *****

SECTION 02200 SITE PREPARATION

1.0 DESCRIPTION

This section shall consist of clearing, grubbing, removing and disposing of all vegetation and debris within the limits of the project site, including the borrow site, as designated in the Contract except those objects that are designated to remain in place or are to be removed in consonance with other provisions of this specification. The work shall also include the preservations from injury or defacement of all objects designated to remain.

2.0 CONSTRUCTION REQUIREMENTS

2.1 General

The Engineer will establish the limits of work and designate all trees, shrubs, plants and other things to remain if there are any.

2.2 Protection of Existing Utilities

Contact the Engineer 72 hours prior to construction for the location of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during grading shall be at the Contractor's risk. For exposing a utility or other buried obstruction, use hand or light equipment for excavation. Start hand or light equipment stripping on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract grading until approval for filling is granted by the Engineer. Report damage to utility lines or subsurface construction immediately to the Engineer. It will be the responsibility and expense of the Contractor to repair and restore the damage to its original state or even better.

2.3 Clearing and Grubbing

All surface objects and all trees, stumps, roots and other protruding obstructions, not designated to remain, shall be cleared and/or grubbed, including mowing as required, except as provided below:

- a. Removal of undisturbed stumps and roots and non-perishable solid objects with a minimum of 900mm (36 inches) below natural ground surface.

- b. Grubbing of pits, channel changes and ditches will be required only to the depth necessitated by the proposed excavation within such areas.
- c. In areas outside of the grading limits of cut and embankment areas, stumps and non-perishable solid objects shall be cut off not more than 150mm (6 inches) above the ground line or low water level. However, trees in these areas shall not be cut or removed.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed shall be backfilled with suitable material and compacted to the required density.

If perishable material is burned, it shall be burned under the constant care of competent watchman at such times and in such a manner that the surrounding vegetation, and other adjacent property or anything designated to remain within the limits of the property will not be jeopardized. If permitted, burning shall be done in accordance with applicable laws, ordinances and regulations.

Materials and debris which cannot be burned and perishable material may be disposed of by methods and at locations approved by the Engineer on or off the project site. If the disposal location is outside the project area, the Contractor shall make all necessary arrangements with the property owner or owners in writing for obtaining suitable disposal locations. The cost involved shall be included in the unit bid price. A copy of such agreement shall be furnished to Owner or Engineer.

2.4 Method of Measurement

The work to be paid shall be the number of square meters and fractions thereof acceptably cleared and grubbed within the limits indicated on the plans.

***** End of Section *****

SECTION 02300 SHORING/SHEETING/EXCAVATION SUPPORT SYSTEMS

1.0 GENERAL

This section shall include the use of shoring, sheeting, bracing and all the other excavation support system required during trench excavations for structures and pipes as specified and directed herein.

2.0 TECHNICAL REQUIREMENTS

2.1 General

The Contractor shall furnish, install and maintain such sheeting, shoring, bracing and other support system as may be required to support the sides of trench or structural excavations, to prevent any earth movement which could diminish the excavation width to below that necessary for construction, and to protect adjacent structures from damage. The Engineer may direct that additional trench supports be installed by the Contractor, at the Contractor's expense, should the existing supports be deemed insufficient. Provision of additional supports (or acceptance of existing supports) shall not relieve the Contractor of his sole responsibility for the provision of adequate support of excavations, especially for the protection of workmen.

ASTM D1557	Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D 698	Standard Test Method for Moisture-Density Relations of Soil and Soil Aggregate Mixtures Using 5.5-lb (2.49 kg) Rammer and 12-in. (305 mm) Drop
ASTM D1883	Standard Test Method for Bearing Ratio of Laboratory-Compacted Soils
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soil and Fine Aggregate
ASTM D2922	Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Standard Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D2487	Standard Test Method for Classification of Soils for Engineering Purposes
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM D1682	Standard Test Methods for Breaking Load and Elongation of Textile Fabrics
ASTM D1777	Standard Method for Measuring Thickness of Textile Materials

1.6 Definitions

1.6.1 Area Excavation

The most general class of excavation including earthmoving with dozers and grades, resulting in the general shaping of the site to meet design grades and the preparation of structural foundation sub-bases.

1.6.2 Trench Excavation

The excavation of trenches primarily for the installation of pipelines or ducts, in which the depth to width ratio of the excavation exceeds 1.0. Typically, trench excavation requires sheeting and bracing for safety and structural integrity.

1.6.3 Common Excavation

The removal of all soil materials not specifically defined as rock, by digging or ripping. The physical difference between rock and material removable by ripping is given elsewhere in this section.

1.6.4 Additional Excavation

Any excavation of any class not originally planned for, but performed at the specific direction of the Engineer. Additional excavation will be paid for at the respective Unit Prices listed in the Bid Form, and is different from over-excavation performed by the Contractor for his own reasons and at his own expense.

1.6.5 Structural Fill

The placement of selected, approved fill material in compacted lifts to support structural foundations by transmitting the applied load to undisturbed natural soils of suitable bearing capacity. The zone of influence of a structure is defined as starting at a distance of 1 meter outside a footing end, and sloping outward and downward at a 1:1 to undisturbed material.

1.6.6 Embankments

The placement of imported or approved on site fill material in lifts to form stable slopes as shown in the Drawings. Embankment construction includes slopes and subsurface drainage, also as shown in the Drawings.

1.6.7 Common Fill

All site fills not classified as structural, or trench fills, and generally employing approved on-site material.

1.6.8 Drainrock

A layer of graded, compacted crushed gravel to be placed under all large hydraulic structures for support and transmittal of water away from the structures to drains or outlets.

1.6.9 Pipe Bedding

A layer of sand or sandy soil placed and compacted to form a support surface into which pipe is laid.

1.6.10 Pipe Zone Backfill

The pipe zone starts at the top of the bedding layer or trench base if no bedding is used, and ends 300mm above the top of the pipe. All pipe zone backfill must be compacted structural fill material.

1.6.11 Trench Backfill

Trench backfill includes all materials placed above the pipe zone up to the top of trench. This material must be structural fill material below structures or roads, but may be common fill in other areas.

1.6.12 Subsurface Drainage

Includes piping, drain rock and related material designed to control and remove groundwater flow from the vicinity of foundations, embankments and other key facilities.

1.6.13 Topsoil

The top one (1) meter of undisturbed earth. Topsoil is the organic residual soil that must be removed in areas where structure, pipelines, roadways or fills are to be placed.

1.6.14 Impervious Material

A layer of compacted material used primarily to prevent water from percolating and saturating the embankment.

1.7 Compaction Tests

1.7.1 Test Reference

Where backfill is required to be compacted to a specified density, tests for compliance may be made by the Contractor using the test procedure specified in "Methods of Test for Moisture-Density Relations of Soils, using a 10-lb. Rammer and 18 in. Drop" (ASTM D1557) or using a 5.5 lb. Rammer and 12 in. Drop (ASTM D698). Field density tests shall be performed in accordance with the test procedure specified in "Method for Test for Density of Soil in Place by the Sand-Cone Method" (ASTM D1556), however, up to 50 percent of the in-place density readings may be made using a properly calibrated nuclear density meter as specified in "Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)" (ASTM 2922-81).

1.7.2 Test Locations and Frequencies

The location and frequency of field compaction tests shall be at the discretion of Engineer. The Contractor shall give the Engineer advance notice of the need to perform compaction tests on a compacted lift, and allow sufficient time to perform the necessary tests before attempting to place any new fill material. Should the Contractor place fill over an untested layer, that layer shall be considered as sub-standard and subject to the provisions given below for sub-standard compaction.

1.7.3 Test Failure

Any layer or portion thereof that does not meet minimum density requirements, as determined by the Engineer, shall be reworked and recompacted until it meets the specified density requirements. The costs of performing the additional density tests necessitated thereby shall be borne by the Contractor. In the event that adequate compaction of a lift cannot be obtained after a reasonable amount of time, even after recompaction and retesting, the lift shall be removed and replaced with suitable material.

1.7.4 Adverse Weather Condition

If weather conditions beyond the Contractor's control create a need to retest a lift already in place and accepted, then such testing will be at the expense of the Owner. This shall not apply in cases where the Contractor has been pre-warned by the Engineer to protect a fill against anticipated adverse conditions and he has failed to properly institute adequate protective measures.

1.8 Lines and Grades

1.8.1 Requirements

All excavations and engineered fills shall be constructed to the lines, grades and dimensions shown on the drawings or as directed by the Engineer.

1.8.2 Modifications

The Engineer may modify lines, grades or dimensions at any time prior to or during construction and the Contractor shall not be entitled to any adjustment in his Unit Prices or to any costs as a result of such changes other than those cost changes derived from modified quantities.

1.10.4 Adverse Conditions

The Engineer reserves the right to suspend or limit earthwork operations during periods of extended adverse weather conditions, and the Contractor shall have no basis for claiming such as reason for delays or extra payments. It is expressly understood that the job site is located in an area subject to yearly periods of heavy tropical rainfall. the Contractor shall schedule his earthwork taking into account of this wet season.

1.11 General Measurement and Provisions

Measurement of payment of any class of earthwork specified herein shall be based on the in-situ volume in cubic meter as measured from a survey made prior to any excavation or fill work and the lines and grades shown on the drawings or established on the site as directed by the Engineer.

Payment shall be made at the Unit Prices entered in the Schedule of Prices, which shall include the following whichever are applicable:

- a. The cost of all labor, equipment and materials involved in excavation, including drilling, blasting, ripping or excavating by other means and in construction of fills and slope protection.
- b. Obtaining all necessary permits and licenses for the use of explosives or any other materials and equipment.
- c. Trimming of excavated surfaces by machine or by hand.
- d. Any sheeting and bracing necessary to support sides of excavations.
- e. Transporting materials to stockpile, spoil, or point of incorporation into permanent works.
- f. Rehandling of materials.
- g. Clearing, preparation and formation of stockpiles of materials suitable for use in embankment construction or as backfill.
- h. All necessary drainage works to keep excavation free of standing water.
- i. Clearing, preparation and formation of spoil areas for unsuitable or surplus materials, including trimming and leveling to lines and grades, and surface drainage.
- j. The costs of obtaining off-site spoil disposal areas and the costs of transporting excess materials thereto.
- k. The cost of material tests or retests above those provided by the Engineer.

2.0 EXECUTION

2.1 Topsoil Stripping and Stockpiling

2.1.1 Definition