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 REQUIRMENTS

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.

2.2 Placement and Removal

Sheeting, shoring and bracing shall be placed to avoid the formation of voids outside of the excavation, but if voids are formed, they shall be immediately filled with compacted sand. The Contractor shall leave sheeting, shoring and bracing, in place to be embedded in the backfill if directed to do so by the Engineer. The Engineer may direct that sheeting and bracing be cut off at any specified elevation and left in place. The Contractor will be paid for sheeting left in place in accordance with the specifications. All sheeting not left in place shall be removed cautiously in the presence of the Engineer to prevent damage to the construction or nearby structures. Any voids formed by removal of sheeting shall be filled with structural fill or as directed by the Engineer. Wood sheeting shall not be withdrawn if driven below the spring line of a pipe, and any wood sheeting shall be cut off no lower than one foot above the top of any pipe.

2.3 Responsibility

Failure by the Engineer to direct that sheeting, shoring or bracing shall be left in place, will not relieve the Contractor of his responsibility for any damage caused by removal of sheeting, whether due to his negligence or not. The Contractor is fully responsible for providing a safe working condition for his and other employees working on the site.

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

SECTION 02400
EARTHWORKS

1.0 GENERAL

1.1 Scope of Work

The Contractor shall perform all earthwork required for the proposed construction and ancillary facilities as specified and shown on the Contract Documents or as directed by the Engineer to result in a complete and functional facility.

Work in this section includes all surface and trench excavation for all structures and site utilities, bedding and backfilling of structures, roadways, and pipelines, construction of embankments, slope protection and stabilization and final site grading. Also included are the ancillary earthwork operations required for successful completion of the work, such as structural fill construction, protection of excavated surfaces during construction, runoff erosion control, construction dewatering, dust control, etc. Excavation of rock ripping, drilling or blasting is also part of the project earthwork requirements where necessary.

1.2 Earthwork Classifications

Earthwork is specified and shall be measured and paid for under the following classifications:

(a) Topsoil Stripping and Stockpiling
(b) Excavation - Common
(c) Excavation - Rock
(d) Trench Excavation - Common
(e) Trench Excavation - Rock
(f) Additional Excavation

2.2 Placement and Removal

Sheeting, shoring and bracing shall be placed to avoid the formation of voids outside of the excavation, but if voids are formed, they shall be immediately filled with compacted sand. The Contractor shall leave sheeting, shoring and bracing, in place to be embedded in the backfill if directed to do so by the Engineer. The Engineer may direct that sheeting and bracing be cut off at any specified elevation and left in place. The Contractor will be paid for sheeting left in place in accordance with the specifications. All sheeting not left in place shall be removed cautiously in the presence of the Engineer to prevent damage to the construction or nearby structures. Any voids formed by removal of sheeting shall be filled with structural fill or as directed by the Engineer. Wood sheeting shall not be withdrawn if driven below the spring line of a pipe, and any wood sheeting shall be cut off no lower than one foot above the top of any pipe.

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Failure by the Engineer to direct that sheeting, shoring or bracing shall be left in place, will not relieve the Contractor of his responsibility for any damage caused by removal of sheeting, whether due to his negligence or not. The Contractor is fully responsible for providing a safe working condition for his and other employees working on the site.

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(d) Trench Excavation - Common
(e) Trench Excavation - Rock
(f) Additional Excavation

(g) Embankment Construction
(h) Structural Fill
(i) Pipe Bedding and Trench Backfill
(j) Common Fill and Site Grading
(k) Sub-surface Drainage
(l) Slope and Bank Protection

1.3 Description of Work

Work in this section shall consist of all surface and trench excavation for lagoons, dams, structures, pipelines, and roads including topsoil removal, common excavation, rock excavation and slope preparation. Work specified herein also includes all common fill, structural fill, backfill, embankment construction, pipe bedding, trench backfill, and final grading, and rock excavation by ripping or blasting. This section includes provisions covering slope protection, slope drainage, foundation drainage and temporary protection of excavated surfaces during construction.

The work specified in this section shall include all labor, equipment, fuel, materials, borrow areas, stockpiling areas and spoil disposal areas required to meet the project requirements as delineated in the Contract Documents and as directed by the Engineer.

Materials excavated from the site may, under certain circumstances, be reused for backfill on the project. All materials proposed by the Contractor for reuse shall be approved by the Engineer based upon tests performed by acceptable testing agencies as specified herein and as dictated by standard practice.

The Contractor shall prepare and submit a program for stockpiling of both on-site and imported materials on the site or at other locations. The program shall identify those on-site areas required for stockpiling of materials and the Engineer will endeavor to make such locations available to the Contractor at no additional cost, except that the Contractor shall bear the cost of constructing all necessary temporary facilities such as access roads, drainage ditches, etc.

The Owner assumes no liability whatsoever if adequate on-site locations are not available, and must review and accept the Contractor's stockpiling program.

1.4 Submittals

The Contractor shall prepare the following submittals whenever applicable which for ease of understanding are listed below:

1.4.1 Submittals with Bid

The Contractor shall present with his bid a general program or schedule for civil works construction. The Contractor's bid shall be considered unresponsive without this program. The program shall address the scheduling of the various earthworks work elements and related equipment and manpower needs. The schedule submitted shall indicate the Contractor's ability to meet the project deadlines.

1.4.2 Submittals Prior to Construction

The Contractor shall submit to the Engineer the following information no less than thirty (30) days before earthwork operations begin:

(1) Detailed plans and schedules for all proposed excavation methods and sequences, including necessary site drainage and safety provisions.

(2) The sources, equipment and procedures proposed to obtain all necessary borrow material of the required quality, size and grading as specified herein for each class of backfill.

(3) Detailed plans and schedules for construction of each of the major structural fills and embankments to the lines, grades and tolerances required for the project and as shown on the Drawings.

(4) The Contractor shall also submit, together with excavation plans, detailed plans of proposed spoil areas and temporary stockpile areas to be approved by the Engineer. Volumes, material types, heights, grades and temporary and permanent drainage works shall be included in this submittal.

1.4.3 Submittals During Construction

(1) The Contractor shall notify the Owner in writing at least five (5) days in advance of any significant excavation, to enable him to verify all necessary elevations and cross-sections of the original ground surface. The Contractor shall clear any and all vegetation that may interfere with the quantity survey, in advance, and at his own expense.

(2) The Contractor shall submit to the Owner the results of all materials and compaction tests performed by or for him within a period of five (5) days, whether such tests are required by the specifications or not.

(3) The contractor shall submit monthly progress reports on project earthworks, to include estimated volumes (monthly and cumulative) of all classes of excavation and fill, together with accurate drawings of said work completed to date. Monthly reports shall be submitted ten (10) days after the end of the month reported on.

1.4.4 Approvals

The review and acceptance by the Owner through his Engineer of the Contractor's submittals on earthwork procedures, equipment and sequences shall not be interpreted as approval of said procedures, equipment and sequences, and shall not relieve him of full responsibility for the complete, proper and safe execution of the work.

1.5 Standard Specification References

ASTM D422	Standard Method for Particle-Size Analysis of Soils
ASTM D423	Standard Test Method for Liquid Limit of Soils
ASTM D424	Standard Test Method for Plastic Limit and Plasticity Index of Soils
ASTM D1140	Standard Test Method for Amount of Material in Soils Finer than the No. 200 (70mm) Sieve
ASTM D1556	Standard Test method for Density of Soil in Place by the Sand-Cone Method

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.

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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.

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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

This work consists of stripping of topsoil to a depth 0.30 meters below the existing ground areas, hauling said topsoil to a designated local stock fill site, and protecting topsoil prior to its reuse under landscaping and final grading.

2.1.2 Technical Requirements

The Contractor shall employ sufficient care and supervision and shall use proper equipment to insure that top-soil stripped does not go below the required depth unless otherwise necessary and directed by the Engineer. Topsoil shall be stockpiled in a separate area from other soil material, and shall be protected by heavy plastic if left in place during wet weather. Topsoil may be reused for landscaping and final grading purposes but first be approved by the Owner. Under no circumstances shall topsoil be reused below structures, piping or roadways. Any topsoil remaining after all work is complete is the property of the Owner and shall be disposed of by the Contractor as directed.

2.2 Area Excavation - Common

2.2.1 Description

a. The work described herein consists of all common excavation; hauling and stockpiling required preparing the site for construction of structures, roads, embankments, excepting rock excavation and trench excavation.

b. Excavation work includes all construction drainage, dewatering, sheeting and bracing and sediment control work required to complete the work as shown on the drawings, as specified herein, and as directed by the Engineer and all other area excavation by whatever means shall be classified as common. Common excavation includes excavation by ripping.

c. The work includes all incidental excavation related to temporary site facilities such as site access roads, office buildings, camp sites, construction plants, etc. which are not part of the permanent work. Disposal of excess or rejected unsatisfactory soils from the excavation is included in the work.

2.2.2 Technical Requirements

a. This category of excavation includes, but is not restricted to, earth, gravel, hard and compact material such as cemented gravel, and soft or disintegrated rock of such hardness and texture that it can be removed without blasting, by using a bulldozer developing 425 bhp of continuous power, with or without ripping. This criterion shall also apply (except for trench excavation) irrespective of the type or capacity of plant actually used for the excavation, or whether use of a 425 bhp bulldozer is practical or convenient. Trimming of slopes shall be included. If necessary, excavations shall be sheeted and braced.

b. The Contractor shall at all times during construction maintain a proper ditching, pumping and dewatering and shall keep all excavations as dry as possible.

c. Excavation for structures shall progress in uniform horizontal layers, with extreme caution exercised as the face of the excavation approaches the line and grade of the foundation base shown in the drawing. The Contractor shall notify the Engineer promptly of any rock encountered or when the excavation is within 500mm of the final cut surface or foundation elevation. Excavation equipment shall be of a size and type suitable for carrying out the work as specified. During final excavation to subgrade level, the Contractor shall take whatever precautions are necessary to prevent disturbance and remolding of the subgrade. In load bearing soil (i.e., soil

under structures, pipelines and roadways), final excavation to subgrade shall be by hand or by using light weight machines with smooth edge buckets. Load bearing soil which has been softened and disturbed by mixture with water due to the Contractor's actions shall be removed to solid ground and replaced with structural or lean concrete at his expense.

d. Should the subgrade be properly reached on the final stage of excavation and found to be unsatisfactory for the support of the structures, then such material shall be over-excavated and properly replaced with structural fill. The Contractor shall be paid for such excavation and fill in accordance with the Unit Prices for those items as discussed.

e. After the required excavation under buildings has been completed, the exposed surface shall be scarified to a depth of 150mm, brought to optimum moisture content, and rolled to achieve a compaction of 95 percent of maximum density as measured by the Modified Proctor Test (ASTM D1557).

f. Excavations for all hydraulic structures shall proceed to the base of the drain-rock layer, after which the top 150mm of soil shall be scarified and brought to optimum moisture content, following which it shall be compacted to 95 percent of maximum density as measured by the Modified Proctor Test (ASTM D1557).

g. Excavations in roadways or in areas to be paved with concrete shall be extended to the bottom of the aggregate base, if such base is called for; otherwise it shall extend to the bottom of the pavement. After the required excavation has been completed, the exposed surface shall be scarified to a depth of 150mm, brought to optimum moisture content, and rolled with heavy compaction equipment to 95 percent of maximum density as measured by the Modified Proctor Test (ASTM D1557).

2.3 Area Excavation - Rock (Only Where Applicable)

2.3.1 Scope of Work

The work described herein consists of rock excavation by blasting including all solid rock in place which cannot be removed until loosened by blasting, barring or wedging and all boulders or detached pieces of solid rock which cannot be removed. Solid rock under this definition, as distinguished from soft or disintegrated rock as defined earlier which the Contractor chooses to blast before removal, is defined as sound rock of such hardness and texture that it cannot be loosened or ripped by a bulldozer capable of developing 425 bhp of continuous power equipped with a single shank ripper. Determination of the delineation line between rock excavation and common excavation shall be made by the Engineer.

2.3.2 Technical Requirements

(a) Material which in the opinion of the Contractor can be removed only by blasting, shall be exposed. No blasting shall be carried out without the approval in writing of the Engineer.

(b) Before blasting proceeds, the top surface of the rock shall be surveyed by the Contractor, and the survey results to be agreed to by the Engineer. Lines shown on the Geotechnical Drawings in the Information for Bidders Volume of the Specifications delineating sound rock and weathered rock are approximate only and shall not be used for measurement purposes.

2.4 Trench Excavation - Common

2.4.1 General

The work described herein consists of excavation of any material, except rock material as defined in this section, within small or restricted areas where the width of excavation is less than or equal to the pipe diameter plus 0.6 meters, and the depth to width ratio is equal to or greater than 1.0. Where a pipe is to be installed in a location that is to be subject to area excavation or fills, trench excavation is to be measured from the finished ground surface (for areas in cuts) or from 500mm above the top of the pipe (for areas in fills). The work includes loading, hauling, disposal of excess material, sheeting and bracing not left in place and dewatering of the trench. Where more than one pipe is to be laid in a trench, the trench width shall be calculated providing 250mm clearances between the outside wall of the outer pipes and the walls of the trench.

2.4.2 Execution

a. This category of excavation includes, but is not restricted to earth, gravel, hard and compact materials such as cemented gravel, and soft or disintegrated rock of such hardness and texture that could be removed without blasting, by using a backhoe developing 150 bhp of continuous power without ripping. This criterion shall apply irrespective of the type or capacity of backhoe actually used for the excavation.

b. All excavations shall be sheeted and braced to meet the requirements of the specification where necessary.

c. The Contractor shall at all times during construction maintain proper ditching, pumping and dewatering to meet the requirements of the specifications and shall keep all excavations as dry as possible.

d. Trench excavation for pipes and ducts shall proceed to the lines and grades shown on the drawings. The bottom 200mm measured up from the pipe invert elevation shall be excavated by hand rather than by machine, and shall be carefully brought to the proper slopes. The base of the trench shall be carefully worked to remove any rocks or stones that might contact the pipe.

e. The Contractor shall over-excavate by hand beneath the pipe to a depth of 150mm and replace the excavated material with gravel bedding material as specified. The gravel bedding material shall be compacted to 95 percent of maximum density at optimum moisture content as measured by the Standard Proctor Test (ASTM D 698). Such over-excavation and replacement with gravel bedding may be omitted if directed and approved by the Engineer.

f. Where pipes or ducts are to be laid in fills, the fill shall be constructed to a depth of at least 500mm above the top of the pipe or duct before the pipe trench is excavated into the fill. Payment shall be based on this depth of trench.

g. The trench bottom shall receive a final smoothing using a string line or laser instrument, such that each pipe when first laid will be in continuous contact with the ground along the extreme bottom of the pipe. Rounding out of the trench bottom is not required. Bell holes may be hand excavated at the Contractor's expense.

h. When directed by the Engineer, pipe and duct trenches may be over-excavated beyond a depth of 150mm. Such over-excavation shall be to the depth ordered. The trench shall be refilled to the grade of the bottom of the pipe with gravel material and compacted to 95 percent of maximum density at optimum moisture content as measured by the Standard Proctor Test (ASTM D 698). Such over-excavation and replacement with pipe trench, bedding material shall be paid for under the appropriate Unit Price bid items.

1.8.3 Construction Surveys

The Contractor shall be responsible for properly setting out all the structures and slopes, in accordance with these specifications. All extra work and over-excavation caused by the Contractor's negligence in setting out shall be at his expense, and shall be corrected immediately.

1.8.4 Over-Excavation

The Contractor shall use care, and the most appropriate methods of excavation, to avoid carrying excavation beyond the lines and grades shown on the drawings, or of loosening of material or the breaking of rock outside of the excavation limits. If for any reason, excavation or disturbance is carried beyond the lines and grades shown in the drawings, the Contractor shall, at his own expense, remove the excess material and take the necessary measure to restore the required lines and grades with approved fill material or concrete. Should the Contractor wish to excavate beyond the limits given in the drawings, he may only do so after obtaining prior permission from the Engineer. Such excavation and any backfilling with approved materials shall be at the Contractor's expense.

1.9 Disposal of Excess Material

The Contractor shall remove from the site and dispose all excess excavated material at his own expense. The location of the spoil disposal areas shall meet all legal requirements at no extra costs.

1.10 Construction Dewatering

1.10.1 General

The Contractor shall maintain at all times during construction proper equipment, manpower and facilities to prevent water from entering excavations and to remove any water from excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed.

1.10.2 Objective

Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the sub-grade soils at the proposed bottom of excavation. The Contractor shall prevent floatation of structures or pipelines by maintaining a positive and continuous removal of water. The Contractor shall also take any other precautions necessary to prevent uplift during construction.

1.10.3 Responsibility

The Contractor is responsible for developing the plans and provisions for control of water at the construction site. The Contractor to the Engineer for review shall submit a proposed drainage control program ten (10) days in advance of associated construction activities. The Contractor shall be solely responsible for the adequacy and implementation of the said program. The Contractor shall be fully responsible and liable for all damages, which may result from failure to adequately keep excavations dewatered. Such damages may include over excavation and structural backfilling or placement of lean concrete should the bearing capacity of the undisturbed foundation surfaces be reduced by the action of uncontrolled water. The nature of such corrective measures shall be determined by the Engineer and shall be at the expense of the Contractor. The Engineer shall determine if damages to the bearing capacity of foundation level soils are due to the actions of the Contractor, but may require the use of lean concrete as backfill material irrespective of responsibility. If the use of structural fill or lean concrete is not due to the Contractor's actions, then such materials shall be paid for under the Unit Prices of those items.

2.5 Trench Excavation - Rock (Only Where Applicable)

2.5.1 Scope of Work

The work described herein consists of rock excavation by controlled blasting, or other approved methods in trenches, including removal of large boulders which cannot be removed as specified in Section 02200 paragraph 2.4. Solid rock under this definition is distinguished from soft or disintegrated rock which the Contractor chooses to blast before removal for his own convenience. Determination of the delineation line between rock excavation and trench excavation shall be made by the Engineer.

2.5.2 Technical Requirements

a. Rock excavation by blasting or other approved methods shall meet all of the technical specifications outlines in paragraph 2.3 of this section. Trench support and drainage, and all other requirements for trench excavation specified shall be conformed to.

b. The Engineer shall be notified immediately when rock is encountered in a trench excavation. No blasting shall be allowed until the Engineer issues a written approval on the basis of a blasting plan submitted by the Contractor. The volume of rock shall be determined by survey after the rock surface has been exposed.

c. In all cases where rock is excavated from a pipe trench, the trench shall be over-excavated by a minimum of 200mm, and backfilled with gravel material conforming to Section 02200, paragraph 2.10. In no case shall a pipe barrel or bell be permitted to rest directly on rock.

2.6 Additional Excavation

2.6.1 Scope of Work

The work described herein is any excavation ordered by the Engineer during the course of the work subsequent to completion of specified construction work in a particular area, or in addition to planned excavation work. Such excavation is defined as additional excavation.

2.6.2 Technical Requirements

Additional excavation may consist of excavation described in the different Sub-section 2.2, 2.3, 2.4, 2.5. the differentiation between common and rock excavation shall be made by the Engineer.

2.7 Embankment

2.7.1 Description

This item shall consist of the construction of embankment in accordance with this specification and in conformity with the lines, grades, and dimensions shown on the Plans or established by the Engineer.

1.1.1 Material Requirements

Embankment shall be constructed of suitable materials, in consonance with the following definitions:

PART 2 - Suitable Material – Material which is acceptable in accordance with the contract and which can be compacted in the manner specified in this item. It can be common material, unless under

structural fill shall be used..

Selected Borrow, for topping – soil of such gradation that all particles will pass a sieve with 75 mm. (3 inches) square openings and not more than 15 mass percent will pass the 0.075 mm (No. 200) sieve, as determined by AASHTO T 11. The material shall have a plasticity index of not more than 6 as determined by AASHTO T 90 and a liquid limit of not more than 30 as determined by AASHTO T 89.

PART 3 - Unsuitable Material – Material other than suitable material such as:

PART 4 - Materials containing detrimental quantities of organic material, such as grass, roots and sewage.
PART 5 - Highly organic soils such as peat and muck.
PART 6 - Soils with liquid limit exceeding 80 and/or plasticity index exceeding 55.
PART 7 - Soils with a natural water content exceeding 100%.
PART 8 - Soils with very low natural density, 800 kg/m^3 or lower.
PART 9 - Soils that cannot be properly compacted as determined by the Engineer.

1.1.2 Construction Requirement

1.1.2.1 General

Prior to construction of embankment, all necessary clearing and grubbing in that area shall have been performed in conformity with Section 02100 Subsection 2.3, Clearing and Grubbing.

Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed; the construction of dikes within or adjacent to the roadway; the placing and compacting of approve material within roadway areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions within the roadway area.

Embankments and backfills shall contain no muck, peat, sod, roots or other deleterious matter. Rocks, broken concrete or other solid, bulky materials shall not be placed in embankment areas where piling is to be placed or driven.

Where shown on the plans or directed by the Engineer, the surface of the existing ground shall be compacted to a depth of 150 mm (6 inches) and to the specified requirements of this item.

Where provided on the plans and Bill of Quantities the top portions of the roadbed in both cuts and embankments, as indicated, shall consist of selected borrow for topping from excavations.

1.1.2.2 Methods of Construction

When there is evidence of discrepancies on the actual elevations and that shown on the Plans, a preconstruction survey referred to the datum plane used in the approved plan shall be undertaken by the contractor under the control of the Engineer to serve as basis for the computation of the actual volume of the embankment materials.

When embankment is to be placed and compacted on hillsides, or when new embankment is to be constructed against existing embankments, or when embankment is built one-half width at a time, the existing slopes that are steeper than 3:1 when measured at right angles to the roadway shall be continuously benched over those areas as the work is brought up in layers. Benching will be subject to

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complies with the requirements of Subsection 2.7.3.3.

Hauling and leveling equipment shall be so routed and distributed over each layer of the fill in such a manner as to make use of compaction effort afforded thereby and to minimize rutting and uneven compaction.

1.1.2.3 Compaction

Compaction Trials.

Before commencing the formation of embankments, the Contractor shall submit in writing to the Engineer for approval his proposal for the compaction of each type of fill material to be used in the Works. The proposal shall include the relationship between the types of compaction equipment, and the number of passes required and the method of adjusting moisture content. The Contractor shall carry out full of compaction trials on areas not less than 10 m wide and 50 m long as required by the Engineer and using his proposed procedures or such amendments thereto as may be found necessary to satisfy the Engineer that all the specified requirements regarding compaction can be consistently achieved. Compaction trials with the main types of fill material to be sued in the Works shall be completed before work with the corresponding materials will be allowed to commence.
Throughout the periods when compaction of earthwork is in progress, the Contractor shall adhere to the compaction procedures found form compaction trials for each type of material being compacted, each type of compaction equipment employed and each degree of compaction specified.

Earth

The Contractor shall compact the material placed in all embankment layers and the material scarified to the designated depth below subgrade in cut section, until a uniform density of not less than 95 mass percent of the maximum using Standard Proctor Test (ASTM D 698 or AASHTO T 99) Method C, is attained, at a moisture content determined by the Engineer to be suitable for such density.

The Engineer shall during progress of the Work, make density tests of compacted material in accordance with AASHTO T 191, T 205, or other approved field density tests, including the sue of properly calibrated nuclear testing devices. A correction for coarse particles may be made in accordance with AASHTO T 224. If, by such tests, the Engineer determines that the specified density and moisture conditions have not been attained, the Contractor shall perform additional work as may be necessary to attain the specified conditions.

At least one group of three in-situ density tests shall be carried out for each 500 m^2 of each layer of compacted fill.

Rock

Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with approved methods.

Embankment materials classified as rock shall be deposited, spread and leveled the full width of the fill with sufficient earth or other fine material so deposited to fill the interstices to produce a dense compact embankment. In addition, one of the rollers, vibrators, or compactors approved by the Engineer, shall compact the embankment full width.

1.1.2.4 Protection of Roadbed During Construction