DIVISION 2

SITE WORK

BUILDING WORK

DIVISION 2

SITE WORK

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SECTION 02060

DEMOLITIONS AND SITE CLEARANCE

PART 1: GENERAL

1.01 SECTION INCLUDES

A. Demolition for designated structures and removal of materials form site.

B. Demolition and removal of foundations and slabs-on-grade.

C. Disconnecting and removal of utilities.

D. Removal of underground tanks and piping.

E. Removal of all other services and existing buildings as mentioned in drawings.

F. Clearing of all trees, shrubs and other vegetation.

1.02 RELATED SECTIONS

A. Section 01500-Construction Facilities and Temporary Controls: Barriers, fence and landscape protection and dust controls.

B. Section 01600-Materials and Equipment.

1.03 SUBMITTALS

A. Submit under provisions of section 01340.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of barricades, fences and temporary work.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff control and disposal.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

E. Test soils around buried tanks for contamination.

1.05 SCHEDULING

A. Describe demolition removal procedures and schedule

1.06 MATERIALS ARISING

1st. All materials arising from the demolitions shall become the property of the Contractor unless otherwise specified, and shall be cleared from the site as the work proceeds to an approved Government tip.

B. Materials arising from the demolitions shall not be burnt on site.

1.07 SAFETY

A. Members of the public shall be kept at a safe distance during demolition operations by the erection of barriers, screens, etc..., and outside working hours, by watching.

B. All persons employed on the site shall be provided with protective clothing and equipment suitable for the type of work being undertaken.

C. The Contractor shall at all times comply with the requirements of the police and fire departments, and of safety officers acting on behalf of the Engineer.

PART 2: PRODUCTS

Not used.

PART 3: EXECUTION

3.01 PREPARATION

A. Provide, erect, and maintain temporary barriers & security devices.

B. Mark location of utilities.

3.02 DEMOLITION REQUIREMENTS

A. Conduct operations with minimum interference to public or private accesses.

B. Sprinkle Work with water to minimize dust. Provide hoses and water connections for this purpose.

3.03 GENERAL SITE CLEARANCE

A. The areas indicated on the Drawings shall be cleared of all trees, shrubs and other vegetation, buildings and other obstructions, hard surfacings and rubbish. Other parts of the Site shall be cleared to the extent indicated on the Drawings or instructed by the Engineer.

B. Trees outside the clearance area shall not be cut down without the prior written consent of the Engineer.

C. Trees, shrubs, walls, buildings, instrumentation and other items which are to be preserved as indicated on the Drawings or instructed by the Engineer shall be protected from injury or damage arising from the operations of the Contractor, his sub-contractors and other persons under his control and from any other injury or damage which is the responsibility of the contractor under the Contract.

D. Where underground structures, manholes, wells and similar items are discovered, their presence shall be reported immediately to the Engineer and they shall not be further disturbed until the Engineer has given his instructions for their disposal.

E. Where underground structures, manholes, wells and similar items are demolished, and removed from the areas which are to be occupied by Permanent Works, any holes or depressions resulting from such removal shall be filled with material similar to that in the surrounding ground and compacted to a density equal to that of the surrounding ground unless other treatment is shown on the Drawings or instructed by the Engineer.

F. The Contractor shall remove or divert pipelines, drains and services as shown on the Drawings or instructed by the Engineer. Each diversion shall be complete before the original drain or service is cut and shall be connected into the original line with the least possible interruption to its operation.

G. Drains and services which are to be removed shall be cut and stopped off at points shown on the drawings or instructed by the Engineer in a manner acceptable to the Engineer. Such cutting and stopping off shall only be carried out upon receipt of a written notification from the Engineer.

3.04 DEMOLITION

A. Disconnect and remove utilities within demolition areas.

B. Remove foundation walls and footings.

C. Remove concrete slabs on grade.

D. Empty buried tanks located within demolition area. Remove buried tanks, components, and piping from site.

E. Remove demolished materials from site.

F. Do not burn or bury materials on site. Leave site in clean condition.

G. Debris shall not be allowed to build up on the floors, against walls or other parts of the building so as to overload them.

H. Isolated walls shall not be left unshored unless they are structurally stable against wind and other forces likely to affect them.

I. Support shall be provided for members of framed structures before cutting them and where the structure's stability may be affected by the demolition of a member, temporary bracing, guys, etc, shall be provided to restrain the remainder.

J. Independently supported platforms shall be provided to avoid working from that part of the structure being demolished.

End of Section

SECTION 02213

ROCK EXCAVATION

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required and perform excavation and disposal of rock.

1.02 RELATED WORK

A Earth excavation and backfilling is included in Section 02220.

B Section 02221 - Trenching.

1.03 DEFINITIONS

A Rock excavation shall mean the removal of bedrock (ledge) which, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, or barring and boulders, which in the opinion of the Engineer, require blasting for removal. Rock excavation shall be made to the widths and depths directed by the Engineer in the field.

1.04 PRECONSTRUCTION SURVEY

A A pre-construction survey shall be conducted on and reported for all major structures within the influence range of any blasting operations or within a minimum of 75 meter whichever is greater, from any blast site. The survey shall consist of a visual inspection and recording by notes and photographs of cracks or other structural damage previously sustained, and shall be conducted by a qualified technician furnished by the Contractor's Insurance Underwriter. A copy of all notes and photographs shall be submitted to the Employer prior to the beginning of blasting operations. The records so obtained shall be retained in the Contractor's file for at least one year after completion of the Contract. In the event of damage claims, a report shall be prepared by the Contractor on the particular structures as requested by the Engineer from those notes and photographs and submitted to the Employer.

PART 2: PRODUCTS

(Not Used)

PART 3: EXECUTION

3.01 GENERAL

A When rock is encountered, it shall be uncovered, but not excavated, until measurements are made by the Engineer.

3.02 ROCK REMOVAL BY A MECHANICAL METHOD

A Excavate and remove rock by the mechanical method.

B Drill holes and utilize expansive tools to fracture rock.

C Cut away rock at bottom of excavation to form level bearing.

D Remove shaled layers to provide sound and unsheltered base for footings.

E In utility trenches, excavate to 150 mm below invert elevation of pipe and 600 mm wider than pipe diameter.

F Remove excavated materials from site.

G Correct unauthorized rock removal with lean concrete fill in accordance with Section 03300.

3.03 DISPOSAL AND REPLACEMENT OF ROCK

A Excavated rock material exceeding 6-in diameter shall be not used for backfilling unless otherwise approved. Rock material disposed by wasting shall be replaced by available surplus suitable excavation. Approved borrow to supply any deficiency of backfill shall be provided at no additional cost.

B The small fragments of rock approved for use as trench backfill shall not be placed until the pipe has at least 0.6 meters of cover. Thin layers of fragments shall be alternated with fill to eliminate voids and prevent settlement. Backfilling is further specified in Section 02220.

End of Section

SECTION 02220

EXCAVATION AND BACKFILL

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals necessary to perform all clearing, grubbing and preparation of site; removal and disposal of all debris; demolition as specified, excavation and trenching; backfill, fill and grading as required to complete the work as indicated on the drawings and specified herein. The work shall include, but not necessarily be limited to: site clearing and grubbing, excavation for structures, footings, pipelines, manholes, electrical work, and paving; all backfilling and filling; grading; disposal of materials; and all related work such as groundwater control, temporary support system, sheeting and bracing.

1.02 RELATED WORK

A Other sections directly related to work covered in this Section includes the following:

1. Section 01035 - Control of Work.
2. Section 02221 - Trenching, Backfilling and Compaction.
3. Section 02575 - Pavement Work.
4. Section 03300 - Concrete

1.03 SUBMITTALS

A Submit to the Engineer, as provided in the Submittals Section, proposed methods of construction including excavation supports, excavation, filling, compaction and backfilling for the various portions of the work.

B The submittals required herein should be coordinated with submittals required under other Sections. The preconstruction meeting will be held to discuss the submittals required under these Sections.

C Submit at least two weeks prior to use the results of laboratory grain size analyses and compaction tests for each type of material to be utilized as fill or backfill. The use of a material will not be allowed before laboratory test results have been received by the Engineer and the material has been judged as acceptable by the Engineer.

1.04 QUALITY ASSURANCE

A Adhere to the applicable requirements of all ordinances, codes and regulations of authorities having jurisdiction over safety for excavations.

B Testing and Monitoring: In-place soil compaction tests shall be performed by a testing laboratory employed by and at the expense of the Contractor as specified in the Quality Control Section.

C Methods of Testing: The following tests will be required.

1. Gradation tests shall be in accordance with ASTM D422 and ASTM D2217. One test for each fill type per 200 m^3 of fill will be required for each location where backfill is in progress, plus one additional gradation test each week from each source.

2. Moisture-density (Proctor) tests for common fill and select common fill shall be in accordance with ASTM D698 and for structural fill in accordance with ASTM D1557. Two initial tests will be required for each type of fill or backfill material from each source proposed, then one test for every 200 m^3 of fill for each location where backfill is in progress.

3. For area fills, an in-place field density test for each 100 m^3 of material placed. For pipelines, in-place field density at average intervals of 100 meters along the trench for each lift of fill. The tests shall be carried out according to ASTM D1556 with the following additions:

   a. the sand shall pass a 0.6 mm sieve and be retained on a 0.3 mm sieve.

   b. in no case shall the test hole be less than 150 mm deep and in the case of structural fill it must fully penetrate the layer being tested.

   c. the diameter of the test hole shall not be less than 100 mm.

D Provide the Engineer with a 25 kg sample of all on-site and off-site material proposed and the source of the material.

E Tolerances:

1. Construct finished soil and backfill surfaces to plus or minus 12 mm of the elevations indicated.

2. Maintain the moisture content of fill material as it is being placed within plus or minus two percent of the optimum moisture content of the material as determined by the laboratory tests specified herein.

F Reviews and Acceptance: No earthwork material will be accepted on the jobsite unless indicated in writing by the Engineer.

I Materials which are placed and compacted to less than the specified density shall alternatively be:

1. Recompacted as required to achieve the specified density.

2. Removed and replaced with properly placed and acceptable compacted material.

G Materials placed and/or compacted which do not conform to project specifications for the area shall be removed and replaced with suitable material when directed by the Engineer at no additional cost to the Employer.

K The Contractor shall be responsible for making prompt and continuous evaluations of monitoring data and excavation support system performance and, whenever necessary, taking immediate steps to correct any deficiencies in the capacities or stiffnesses of individual members or to provide other corrective measures which may be required to prevent damage or excessive movements.

1.05 JOB CONDITIONS

A Site investigation information has been collected and summarized in the Contract Documents. This site investigation report lists other information regarding subsurface conditions and the availability of such information.

B The Engineer does not make any express or implied guarantees regarding the accuracy of site investigation information which is made available to the Contractor for his information, to be used at his own risk.

1.06 PROTECTION

A Open Cuts

1. Trench sides may be sloped or battered only in those areas where the increased trench width will not interfere with existing surface features or the limits of permanent rights-of-way. Trench sides shall be of sufficient slope to prevent caving or sliding. Slopes shall not extend lower than the limits indicated on the Drawings. Use of sloped or battered trench sides is subject to acceptance of the Engineer.

PART 2: PRODUCTS

(NOT USED)

PART 3: EXECUTION

3.01 PREPARATION

A Ground surfaces within the construction areas of the working site shall be cleared of all brush, debris, and surface vegetation. Stumps and roots larger than 50 mm in diameter shall be completely grubbed and removed. Matted roots shall be removed regardless of size. Surface vegetation shall be removed complete with roots to a depth of not less than 100 mm below the ground surface.

3.02 EXCAVATION BELOW GRADE

A If the Contractor excavates below grade through error or for his own convenience, or fails to properly control groundwater in the trench, or disturbs the subgrade before groundwater control is sufficiently complete, or otherwise fails or neglects to conduct the excavation work so that the surface of the subgrade is in proper condition for construction, remove all unsuitable materials and replace them with Class 20 concrete or structural fill compacted to at least 95 percent of maximum dry density as determined by ASTM D1557, or other acceptable material at his own expense so that the condition of the subgrade is acceptable to the Engineer before any Work is placed thereon.

B If, in the opinion of the Engineer, the material, in its undisturbed natural condition, at or below the normal grade of the excavation as indicated on the drawings is unsuitable for foundations, it shall be removed to such depth and width as directed and be replaced with structural fill or other suitable material as directed by the Engineer. Removal and replacement of unsuitable material when directed by the Engineer will be paid for under the Provisional Sum.

3.03 STRUCTURE EXCAVATION

A Excavation shall be made to the grades indicated on the drawings and to such widths as will give suitable room for construction of the structures, for bracing and supporting, for control of groundwater and drainage. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer.

B Excavation shall be in the dry and shall be accomplished by methods which preserve the undisturbed state of subgrade soils.

C Excavation equipment shall be satisfactory for carrying out the work in accordance with the specifications. In no case shall the earth be ploughed, scraped, or dug with machinery so near to the finished subgrade as to result in excavation of or disturbance of, material below grade. In order to minimize disturbance to the bearing soils, the final 500 mm of depth to grade shall be excavated with smooth edge buckets or by hand shovel.

D When excavation for foundations has reached prescribed depth, the Engineer shall be notified and he will observe the subgrade conditions. If materials and conditions are not satisfactory to the Engineer, the Engineer will require remedial work.

3.04 BEDDING FOR EXTRA STRUCTURES EXCAVATION

A Incase the depth of foundation excavation was more than required foundation level the additional depth shall be filled with class 15 blinding concrete to the required level, on contractor's expenses.

3.05 MISCELLANEOUS EXCAVATION

A Perform all the remaining miscellaneous excavation. Make all excavations necessary to permit the placing of loam and plants, for constructing roadways and any other miscellaneous earth excavation required under this Contract.

3.06 BACKFILLING - COMMON FILL

A Common fill may be used adjacent to structures beyond the limits of structural fill, as embankment fill, as indicated on the drawings, or in other areas as designated by the Engineer. Material conforming to the requirements of common fill shall be placed "in-the-dry" in layers having a maximum thickness of 300 mm measured before compaction unless otherwise specified.

B Common fill shall be compacted to at least 95 percent of maximum density as determined by ASTM Compaction Tests, Designation D698. Common fill material in place shall be compacted with compaction devices acceptable to the Engineer.

C Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained the specified 28 day compressive strength.

D Common fill shall not be placed until all organic materials, including peat and loam, and loose inorganic silt material have been completely removed from the area to be filled. Test pits may be used to determine the depth of this material.

E Material placed in fill areas shall be placed to the lines and grades indicated on the drawings making due allowance for settlement of the material and for the placing of loam thereon.

F The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the drawings and no soft spots or uncompacted areas will be allowed in the Work.

G No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.07 BACKFILLING - STRUCTURAL FILL

A Structural fill shall be placed in layers having a maximum thickness measured before compaction of 200 mm in open area and 150 mm in confined areas including locations where conduit and piping join structures. Each layer of fill below structures shall be compacted to at least 95 percent of maximum dry density determined by the ASTM D1557, by methods acceptable to the Engineer.

B Structural fill shall be placed against structures which retain water and shall be compacted to at least 92 percent of maximum dry density determined by ASTM D1557, by methods acceptable to the Engineer. The limits of structural fill adjacent to structures shall extend one meter beyond the limits of the structure.

C Compaction of structural fill in open areas shall consists of heavy vibratory roller, or any method acceptable to the Engineer. Compaction of structural fill in confined areas and adjacent to structures shall be accomplished by hand operated vibratory equipment or mechanical tampers acceptable by the Engineer. As a minimum, compaction of structural fill shall consist of four (4) coverage's of the acceptable equipment.

D Temporary bracing shall be provided as required during filling and backfilling of all structures to protect partially complete structures against all construction equipment loads, hydraulic pressures, and earth pressures.

3.08 DISPOSAL OF MATERIALS

A Excavated material shall not be removed from the site of the work or disposed of except as directed or acceptable to the Engineer. Any excavated material not required for use in the work or not suitable for use as fill in the work shall be hauled to designated disposed areas. Removal and disposal of this material shall be the responsibility of the Contractor. The Employer may specify public and private properties to receive fill but at no time will excess material be placed on private property without the consent of the Engineer. In order to avoid unauthorized disposal; arrange that each driver employed

for the disposal of such materials is given written instructions as to the acceptable place where each load is to be tipped. Retain copies of such instructions, together with a list of approved places to be used, for inspection at any time by the Engineer. The Employer shall be indemnified against any claims arising from unauthorized disposal of such materials.

B Should conditions make it impractical or unsafe to stack material adjacent to the excavation, haul and store the material to a location provided by the Contractor. When required, schedule and use the material in backfilling the excavation. No additional compensation will be made for rehandling material.

3.09 GRADING

A Grading shall be performed at all places that are indicated on the drawings, to the lines, grades, and elevations shown and otherwise as directed by the Engineer and shall be performed in such manner that the requirements for formation of embankments can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B If at the time of grading it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in acceptable areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.

C The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the drawings or in order to obtain satisfactory construction.

D Stones or rock fragments larger than 75 mm in their greatest dimensions will not be permitted in the top 150 mm of the finished subgrade of all fill, except as otherwise specified.

E The surface of graded areas shall be to smooth true lines, strictly conforming to grades indicated on the drawings.

End of Section

SECTION 02221

TRENCHING, BACKFILLING AND COMPACTION

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals necessary to perform all trenching for pipelines including filling, backfilling, disposal of surplus material and restoration of trench surfaces and easements.

B Excavation shall extend to the width and depth shown on the Drawings or as specified.

C The Contractor shall furnish and place if required all sheeting, bracing and supports and remove from the excavation all materials which the Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects, acceptable. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.

D Prior to the start of work the Contractor is required to submit his/her proposed method of backfilling and compaction to the Engineer for review, in accordance with section 01340.

1.02 RELATED WORK

A Rock excavation is included in Section 02213.

B Granular fill materials is included in Section 02220.

C Granular materials included in Section 02230.

D Submittal requirements are included in Section 01340.

PART 2: PRODUCTS

(Not used)

PART 3: EXECUTION

3.01 TRENCH EXCAVATION

A Trenches shall be excavated to the depth indicated on the Drawings and in widths sufficient for laying the pipe, bracing and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Trench width shall be practical minimum.

B Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by screened gravel fill as required by the Engineer at the Contractor's expense.

C Clay and organic silt soils are particularly susceptible to disturbance due to construction operations. When excavation is to end in such soils, the Contractor shall use a smooth-edge bucket to excavate the last one foot of depth.

D Where pipe is to be laid in screened gravel bedding, the trench may be excavated by machinery to the normal depth of the pipe provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

E Where pipe is to be laid directly on the trench bottom, final excavation at the bottom of the trench shall be performed manually, providing a flat-bottom true to grade upon undisturbed material. Bell holes shall be made as required.

3.02 DISPOSAL OF MATERIALS

A Excavated material shall be stacked without excessive surcharge on the trench bank. Inconvenience to traffic shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified below.

B It is expressly understood that no excavated material shall be removed from the site of the work or disposed of by the Contractor except as directed by the Engineer. When removal of surplus materials has been approved by the Engineer, the Contractor shall dispose of such surplus material in approved areas designated by the Contractor.

C Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored at a location provided by the Contractor. When required, it shall be re-handled and used in backfilling the trench.

3.03 EXCAVATION BELOW GRADE AND REFILL

A Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.

B If the Contractor excavates below grade through error or for his/her own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he/she may be directed by the Engineer to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his/her own expense.

3.04 BACKFILLING

A As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. Bedding gravel, as specified for the type of pipe installed, shall be placed up to 0.3 meter over the pipe.

B Backfilling over pipe or ducts shall begin not less than three days after placing concrete encasement, concrete reaction blocks, or arches.

C Where culvert or pipe is to be installed in fill of any type, fill shall be placed and compacted to the total depth required (rough grade elevation) and then re-excavated for culvert or pipe installation.

D As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously.

E To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material or screened gravel has been placed and compacted to a level 0.3 meter over the pipe.

F Backfill shall be brought up evenly on all sides. Each layer of backfill material shall be thoroughly compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping, to 92 percent compaction as determined by ASTM D698. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to compact the fill throughout the full width of the trench.

G Where other methods are not practicable, compaction shall be by use of hand or pneumatic ramming with tools weighing at least 10 kg. The material being spread and compacted in layers not over 0.15 meter thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.

H Backfill around structures shall be selected common fill material, may be compacted by puddling where approved by the Engineer. All backfill shall be compacted, especially under and over pipes connected to the structures.

I Subject to the approval of the Engineer, fragments of ledge and boulders smaller than 0.15 meter may be used in trench backfill providing that the quantity in the opinion of the Engineer, is not excessive. Rock fragments shall not be placed until the pipe has at least 0.6 meter of earth cover. Small stones and rocks shall be placed in thin layers alternating with earth to insure that all voids are completely filled. Fill shall not be dropped into the trench in a manner to endanger the pipe.

J Bituminous paving shall not be placed in backfilling unless specifically permitted, in which case it shall be broken up as directed.

K All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

3.05 RESTORING TRENCH SURFACE

A Where the trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, the Contractor shall thoroughly consolidate the backfill and shall maintain the surface as the work progresses. If settlement takes place, he/she shall immediately deposit additional fill to restore the level of the ground.

B In and adjacent to streets, the top 0.3 meter layer of trench backfill shall consist of compacted bank-run gravel. Should the Contractor wish to use material excavated from the trench as gravel subbase for pavement replacement, the Contractor shall at his/her own expense have samples of the material tested by an independent testing laboratory at intervals not to exceed 150 feet, in order to establish its compliance with the specifications. Only material which has been tested by the Contractor and approved by the Engineer shall be allowed to be incorporated into the work.

C The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved road shall be restored by the Contractor to a condition at least equal to that existing before work began.

End of Section

SECTION 02230

GRANULAR MATERIALS

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals necessary to obtain materials for filling and backfilling, grading and miscellaneous sitework, for the uses shown on the Drawings and as specified herein.

1.02 RELATED WORK

A Rock Excavation is included in Section 02213.

B Structural Excavation, Backfilling and Compaction are included in Section 02220.

C Trenching, Backfilling and Compaction are included in Section 02221.

D Paving is included in Section 02575.

1.03 SUBMITTALS

A Submit in accordance with Section 01340 complete product data for materials specified in this Section.

1.04 REFERENCE STANDARDS

A American Society for Testing and Materials (ASTM)

1. ASTM C33 - Standard Specification for Concrete Aggregates.

2. ASTM D476 - Standard Specification for Titanium

3. ASTM D698 - Standard Test Method for Moisture-Density Relations of Soils and Soil - Aggregate Mixtures, Using 5.5 - lb (2.49-kg) Rammer and 12 - in (305-mm) Drop.

B Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A Laboratory Testing

1. At least seven days prior to the placement of any backfill or fill materials, deliver a representative sample of the proposed materials weighing at least 20 kg to the

soils testing laboratory or if one has not been appointed, to the resident project representative.

2. Engage the soils testing laboratory to perform:

   a. Grain size analyses of the samples to determine their suitability for use as backfill or fill material in conformance to the materials requirements specified hereinafter.

   b. The appropriate Proctor analyses to determine the maximum dry densities required for compaction testing as specified elsewhere in the Contract Documents.

3. Test results and determinations of suitability shall be delivered to the resident project representative no later than three days prior to the placement of backfill or fill materials.

PART 2: PRODUCTS

2.01 MATERIALS

A Backfill and Fill materials shall be suitable excavated materials, natural or processed mineral soils obtained from off-site sources, or graded crushed stone or gravel. Backfill and Fill materials shall be free of all organic material, trash or other objectionable materials which may be compressible or which cannot be properly compacted. Soft, wet, plastic soils which may be expansive, clay soils having a natural, in-place water content in excess of 30 percent, soils containing more than 5 percent (by weight) fibrous organic materials, and soils having a plasticity index greater than 30 shall be considered unsuitable for use as backfill and fill. Backfill and fill materials shall have a maximum of 1 percent expansion when testing is performed on a sample remolded to 95 percent of maximum dry density (per ASTM D698) at 2 percent below optimum moisture content under a 100 lbs/sq ft surcharge.

B. Structural Fill shall be class A1.a conform to AASHTO-M-145, clean and free from loam, rubbish, wood, trash or other objectionable materials which cannot be properly compacted. Structural fill shall be graded within the following limits:

Sieve Size	Percent Passing
10 mm	100
4.75 mm	95 - 100
2.36 mm	80 - 100
1.00 mm	50 - 85
0.60 mm	25 - 60
0.30 mm	10 - 30
0.15 mm	2 - 10

C Select Fill shall conform to the requirements of common fill except that the material shall not contain any materials larger than 50 mm in largest dimension.

D Common Fill shall not contain granite blocks, broken concrete, masonry rubble, asphalt pavement, or any material larger than 0.15 meter in any dimension. Common Fill shall have a plasticity index of less than 15 and shall conform to the following gradation limits:

Sieve Size	Percent Passing
0.60 mm	75
0.075 mm	20

E Crushed stone shall consist of hard, durable rock particles (crushed limestone will not be allowed) of proper size and gradation, and shall be free from sand, loam, clay, excess fines, and deleterious materials. Crushed stone shall be capable of being spread to easily fill voids and shall be capable of being compacted with little effort. The crushed stone shall be graded within the following limits:

Sieve Size	Percent Passing
16 mm	100
13 mm	40 - 100
10 mm	15 - 45
2.00 mm	0 - 5

F Pea Gravel shall be screened, uniformly rounded stone, free from sand, loam, clay, excess fines and other deleterious materials. Pea Gravel shall conform to the following gradation limits:

Sieve Size	Percent Passing
13 mm	100
10 mm	90
4.75 mm	30
2.36 mm	10
1.00 mm	5

G Materials for gravel base course shall consist of 150mm maximum size gravel, sandy gravel, or gravelly sand free of organic material, loam, wood, trash, and other objectionable material, and shall be well graded within the following limits:

Sieve Size	Percent Passing
50 mm	100
13 mm	50 - 85
4.75 mm	40 - 75
0.425 mm	10 - 35
0.075 mm	0 - 10

H Sand for concrete, grout, and masonry shall conform to ASTM C33 for fine aggregate. General purpose sand shall be Select Common Fill.

I Lean Concrete shall be ready-mix, cast-in-place concrete conforming to the requirements of Section 03300.

PART 3: EXECUTION

[NOT USED]

End of Section

SECTION 02517

STONE PAVERS

PART 1: GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install limestone floor, stairtread and riser finish using mortar bed application as selected and shown on drawings and specified herein.

B. Tile and control (expansion) joint pattern shall be as shown and as accepted.

1.02 RELATED WORK NOT INCLUDED

A Section 03350 - Concrete Finishes.

B Section 03300 - Concrete.

C Section 02220 - Excavation and Backfilling.

1.03 REFERENCES

A. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

B. ASTM C33 - Concrete Aggregates.

C. ASTM C144 - Aggregate for Masonry Mortar.

D. ASTM C150 - Portland Cement.

E. ASTM C270 - Mortar For Unit Masonry.

1.04 SUBMITTALS FOR REVIEW

A. Section 01340 - Submittals: Procedures for submittals.

B. Product Data: Provide characteristics of paver unit, dimensions, special shapes, and setting materials.

C. Shop Drawings: Indicate layout of pavers, dimensions of paved areas, elevations, and affected adjacent construction.

D. Samples: Submit two samples of each paver size, illustrating style, size, color range and surface texture of units being provided.

1.05 SUBMITTALS FOR INFORMATION

A. Section 01340 - Submittals: Procedures for submittals.

B. Manufacturer's Installation Instructions: Indicate substrate requirements, and installation methods.

1.06 MOCK-UP

A. Provide paver mockup, 2 m long by 1.5 m wide, which includes setting bed, pavers, joints, and edging.

B. Locate where directed.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain cementitious materials and substrate surface to a minimum of 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of work.

B. At end of working day or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2: PRODUCTS

2.01 NATURAL STONE SLABS AND FITTINGS GENERALLY

A. To be first quality stone, each type obtained from one strata, from one quarry and delivered in one shipment.

B. Slabs are to be hard and free from cracks and other defects to surfaces and edges which may impair structural integrity, function or appearance and are to be cut square and true with clean edges and uniform in shape and thickness.

C. Length and width dimensions of individual slabs are to be within ± 1 mm and thickness within 3 mm from those shown on the Drawings.

D. Submit supplier's test results for each type of stone for the following tests, which must meet the following:

Test	Unit	Limit	Standard
Specific Gravity	ton/m^3	not less 2.5	ASTM-C 97
Absorption	wt %	not moor 3	ASTM-C 97
Modules of Rupture	N/mm^2	not less 6.9	ASTM-C 99
Abrasion Resistance	%	not moor 10 %	ASTM-C 241

2.02 STONE SOURCE

1st. Local stone tiles and pavers shall be White color first quality Ajlon/ Jordan Stone, and obtained from quarries having sufficient quantities to complete the works as indicated on the drawings. The color variation shall be within the limits established on the mock-up and approved by the Engineer. Minor natural markings which are characteristic of the material which do not impair strength or appearance will be permitted.

B. Black stone shall be deserved Basalt stone.

2.03 STONE FINISH

1st. The finish for exposed surfaces of tiles and pavers shall be fine mechanical bush hammered, or honed as stated on the drawings and B.O.Q.

B. The finish for exposed surfaces of stone curbs type R and rizer type D shall be sand plast finish.

C. No visible saw marks shall be evident.

2.04 STONE SIZES

A. Generally all stone work shall be cut to size, finished and prepared for installation in the shop,

B. Stone size shall be as defined in Drawings and B.O.Q.

C. Stair Treads and Risers: Match flooring for surface finish and color; free of defects detrimental to appearance or durability, size and Exposed edge as shown on Drawings.

2.05 MORTAR BED & GROUT

A. Portland Cement: ASTM C150 Type 1, white color for marble and granite pavers and grey colour for other types.

B. Sand: ASTM C144 or ASTM C33; sharp, coarse, clean, screened sand, free of organic material.

C. Water: Potable, not detrimental to mix.

D. Admixtures: Plasticizer.

E. Color: Mineral type, non - fading, color.

F. Grout materials shall be factory mixed as specified in section 09600.

2.06 ACCESSORIES

A. Sealant: tow parts polysulphide as specified in Section 07900.

2.07 MIXES

A. Cementitious Bed: Portland cement mix conforming to the following:

Property Value

1. Compressive Strength (28 day) 2000 psi (15 Mpa).

2. Slump (75 to 100 mm).

3. Air Entrainment 5 to 7 percent.

B. Joint Mortar: Portland cement mix conforming to the following:

Property Value

1. Compressive Strength (28 day) 3000 psi (20 Mpa).

2. Slump (25 to 50 mm).

3. Air Entrainment 5 to 7 percent.

4. Color admixture In accordance with manufacturer's instructions.

C. Add admixtures in accordance with manufacturer's instructions.

D. Thoroughly mix ingredients in quantities needed for immediate use.

E. Use within two hours after mixing. Do not re-temper.

2.08 SOURCE QUALITY CONTROL

A. Section 01400 - Quality Control: Shop inspection of stone cutting.

B. Fabrication Tolerances For Stone Units: Within (3 mm) of actual dimensions.

PART 3: EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this section.

B. Verify that concrete substrate has cured at least 28 days, and attained 75 percent design strength.

C. Verify gradients and elevations of substrate are correct.

3.02 INSTALLATION - MORTAR SETTING BED

A. Set paver units in full cementitious mortar bed of minimum (30 mm) thickness, to support pavers over full bearing surface.

B. Place paver units in pattern as shown on drawings, from straight reference edge.

C. Place half units, special shaped units, and curbs at edges and interruptions. Machine saw partial units.

D. Maintain tight joints between marble and granite pavers, and at abutting vertical surfaces and protrusions.

E. Maintain uniform joint width of (8 mm) between volcanic pavers and various width between lime stone pavers as shown on drawings, and at abutting vertical surfaces and protrusions. To accommodate mortar, rake out joints (6 to 9 mm) deep.

F. Fill joints with mortar. Pack and work into voids. Neatly tool surface to flush joint. Wet cure.

G. Form control and expansion joints as detailed with sealant and backing instead of pointing mortar. Form control joints (10 mm) wide. Form expansion joints wide as shown on drawings.

3.03 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom clean paving surfaces. Dispose of excess sand.

3.04 PROTECTION OF FINISHED WORK

A. Do not permit traffic over unprotected paver surface.

End of Section

SECTION 02518

CONCRETE TILE AND PAVERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install Precast concrete tiles, and curbing using mortar bed application for Precast concrete tiles as selected and shown on drawings and as specified herein.

1.02 RELATED WORK NOT INCLUDED

A. Section 03350 - Concrete Finishes

B. Section 03300 - Concrete

C. Plumbing and Manholes Work Sections.

D. Section 02220 - Excavation and backfilling.

1.03 REFERENCES

A. ASTM C936 - Solid Concrete Interlocking Paving Units.

1.04 SUBMITTALS FOR REVIEW

A. Section 01340 - Submittals: Procedures for submittals.

B. Product Data: Provide characteristics of paver unit, detectable warning pavers, dimensions, and special shapes.

C. Samples: Submit two samples of each paver size, illustrating style, size, color range and surface texture of units being provided.

1.05 SUBMITTALS FOR INFORMATION

A. Section 01340 - Submittals: Procedures for submittals.

B. Manufacturer's Installation Instructions: Indicate substrate requirements, and installation methods.

PART 2 PRODUCTS

2.01 MATERIALS

A. Precast concrete tiles: shall be constructed of grade 25 Precast concrete laid on 30mm thick mortar, to the sizes and colors shown on drawings and as following:

1. size: 400 x 400 x 40 mm thick.

2. finish: fair face.

3. Absorption not moor than 8% when tasted with BS 4131.

B Cement used in the manufacture of concrete paving blocks shall, unless stated otherwise, be ordinary Portland cement which complies with the requirements of ASTM - C150 - type I "Ordinary Portland Cement".

1. Cement Content should not be less than 400 kg/m3. concrete.

C Aggregates used are crushed limestone complying with ASTM C33, free from earth, clay, loam and soft clay.

D Sand for Concrete shall be capable of passing through a 5 mm BS test sieve and it shall be so graded that when mixed with coarse aggregates and cement it shall produce concrete of the maximum density.

The fine aggregates shall not contain more than 25% by weight of soluble calcium carbonate in either the fraction restraint on, or the fraction passing a 600 micron BS sieve.

E Water for Mixing Concrete shall be potable and free from all sediments and dissolved or suspended matter which may be harmful to the manufacture of concrete as specified.

F Admixtures shall be permitted to be used in the concrete only with the full approval from the Engineer.

G Sand for Setting Bed: Clean river or bank sand containing maximum of 30 percent particle size of No. 10 (2 mm) sieve.

H Sand for Joints: Clean fine sand of 2 mm sieve size.

2.02 CONCRETE CURBS AND EDGINGS

A Curbs and Edgings are to be constructed of grade 25 cast in situ and Precast concrete as required; to the sizes shown on drawings.

B In situ concrete to comply with the requirements of grade 25 cast-in-situ concrete as per section 03300 of specifications.

C Precast concrete shall be manufactured by hydraulic pressing (pressure employed not less than 70 kg/100 mm2).

D Finishes: curbs and edges shall be of sound appearance with clean plain faces, free form segregation, honeycombing, pits, broken corners and other defects.

E Tolerances: the following tolerances shall be allowed:

Length	Width	Height
± 6 mm	± 2 mm	± 3 mm

PART 3: EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

3.02 PREPARATION

A. Treat soil with herbicide to retard plant growth.

3.03 CONCRETE TILE - INSTALLATION

A. Set concrete tile in full cementitious mortar bed of minimum (30 mm) thickness, to support tiles over full bearing surface.

B. Maintain uniform joint width of (8 mm) between concrete tiles as shown on drawings, and at abutting vertical surfaces and protrusions. To accommodate mortar, rake out joints (6 to 9 mm) deep.

C. Fill joints with mortar. Pack and work into voids. Neatly tool surface to flush joint. Wet cure.

D. Form control and expansion joints as detailed with sealant and backing instead of pointing mortar. Form control joints (10 mm) wide. Form expansion joints wide as shown on drawings.

3.04 CURB LAYING

A Elements shall be set out to lines and grades as shown.. Under no circumstances shall levels be set by direct measurement.

B The foundation shall be excavated to the grades and sections shown and fully compacted and rolled to a smooth surface. Concrete shall not be placed until the foundation has been approved.

C Level shall be defined at intervals along the line of not more than 5.0 meter in the case of straight curbs and 3.0 meter in the case of curved curbs by temporarily setting marker curbs on beds of sand. Curbs shall be set true to level between the marker curbs. The allowable tolerance both in line and level will be ± 2 mm in 3.0 meter.

D Elements shall be laid either directly on a wet concrete base or on 20 mm thickness of 1:3 cement: sand mortar bedding on a previously laid concrete base. The base shall be constructed of class B concrete conforming to the requirements of Section 03300.

E After elements have been laid, continuous concrete backing shall be poured. The backing concrete shall be of class B strength conforming to the requirements of Section 03300.

F Joints between curbs and paving tiles shall have width of 4 mm if not otherwise instructed by the Engineer and shall be filled with a 1:1 cement sand mortar with one fifth hydrated lime and sufficient water to make the mixture plastic and easily smooth and finished.

G A grooving tool shall be used to produce a smooth semi-circular groove not more than 3 mm deep in all joints.

3.05 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom cleans paving surfaces. Dispose of excess sand.

End of Section

SECTION 02910

PLANT PREPARATION

PART 1 : GENERAL

1.01 SCOPE OF WORKS

A This section covers the supply, delivery, construction, testing and maintenance of all materials and equipment required for the preparation of soil and top soil for planting areas.

B The Contractor will be required to carry out all works so that the installation is complete in every detail and left in full working order and to the Employers satisfaction.

C. It will be the Contractors responsibility to programme, co-ordinate and manage the various utility works and integrate these into his own construction programme.

D. This specification shall be read in conjunction with the General Conditions of Contract, the "Particular Clauses" and any supplementary specifications, schedules and drawings issued with it and enumerated in the invitation to tender. In the event of a discrepancy between this specification and its related documents and any drawings, the drawings shall be followed and the Employers representative informed.

1.02 REFERENCES

A The work shall conform to the codes and standards of the following Agencies as further cited herein:

1. American Society for Testing and Materials (ASTM) Standards.
2. C 136-81 Sieve or Screen Analysis of fine and coarse Aggregates.
3. D 442-63 (1972) Particle - Size Analysis of soils.
4. D 2507-69 Standard method of test for peats, mosses, humus etc.
5. D 2974-71 Standard method of test for moisture, ash and organic matter of organic materials.
6. Official Methods of analysis (11th Edition and supply, 1st October 1970).

1.03 CONTRACTORS OBLIGATIONS

A The contractor shall take all necessary precautions to avoid causing unwarranted damage to roads, land, properties, trees and other features and during the period of contract, shall deal promptly with any complaints by Employers, occupiers and other responsible authorities as they occur.

B The contractor shall notify the Employer in writing immediately following any damage or injury ansing out of the execution of the works.

C. The contractor shall coordinate work of this section with other sections so as to avoid damaging surfacing, and to match with the work of other sections.

1.04 SUBMITTALS

A The contractor shall submit to the Employer full details of the materials and equipment he proposes to use in the works, and these submissions shall include comprehensive information regarding their manufacturer and country of origin.

B. Before materials or equipment for the permanent works are delivered to the site, the Contractor shall obtain approval to this submittal from the Employer.

C When requested by the Employer the Contractor shall submit samples of the proposed materials for approval as part of the submittal procedures, and may be retained by the Employer until the completion of the contract.

D Samples of materials shall be delivered to the Employer free of charge for his approval before the work is commenced and shall be truly representative in all respects of the proposed materials to be supplied.

E All materials shall be subject to test from time to time as the Employer may direct and any material that falls below the standard of the accepted materials shall be immediately removed from the Works at the Contractors expense.

PART 2 : MATERIALS

2.01 PLANTING TOPSOIL MIX COMPONENTS

A Agricultural Soil shall conform to the following physical and chemical characteristics:

Agricultural soil to be from an agricultural source outside the limits of the project selected by the contractor and in compliance with the requirements specified herein soil shall have the same relative composition and structure, a friable sandy loam character and be free of roots, clods and stones larger than 25mm in greatest dimension, pockets of coarse sand, noxious weeds sticks, brush and other litter. It is not be infested with plant disease organisms, nematodes or other undesirable

insects and shall be free from all chemicals harmful to plant and animal life.

Agriculture Soil to meet the following requirements as proved by soil analysis:

1. Sanitary as measured by the saturation extract method not be exceed 2.0 millions per centimeter.
2. The sodium absorption ratio (SAR) to be not greater than 5.0.
3. The PH values to be between 5.5 and 7.5.
4. The boron concentration in saturation extract not be exceed 1.0 weight.
5. The silt plus clay content shall not exceed 16 percent by weight.
6. A minimum 90 percent by weigh to pass a 2mm round hole sieve.
7. The permeability rate not to be less that 13 mm per hour when tested in accordance with ASTM D 2434 or other approved methods.

B Sand: Sweet Sand for soil mix shall be obtained from approved sources, it will conform to the following physical and chemical characteristics:

1. Physical Characteristics:

a)	Material passing a No. 10 sieve	100%
b)	Material passing a No. 35 sieve	90-100%
c)	Material passing a No. 140 sieve	0-10%
d)	Material passing a No. 270 sieve	0-3%

C Organic Matter: Shall conform to the following physical and chemical characteristics:

Soil organic matter shall be composed bark or coconut-fibre thoroughly rotted and bagged compost or approved equal. Organic amendments shall come from an environmental friendly and sustainable resource. The organic matter shall be sterile and free of foreign matter. It shall have the following characteristics:

1. Physical Characteristics:

a)	Material passing 9.51mm (3/8")	sieve 100%
b)	Material passing 6.35mm (1/4")	sieve 90-100%
c)	Material passing 2.38mm (No. 3)	sieve 90-100%
d)	Material passing 0.50mm(No. 35)	sieve 90-100%
e)	Bulk Density	300-400 kg/m^3

2. Chemical Characteristics:

a)	Organic matter	Not less than 65%
b)	pH	5.0-6.5
c)	Salinity (Ece x 1000)	0.5-2.0
d)	Total Nitrogen	0.7-2.0
e)	Available phosphorous	100-500 ppm
f)	CEC (meq/100 gms)	80-120 ppm
g)	Boron (by hot water extraction)	Less than 2 ppm
h)	SAR	Less than 2.0

D Gravel drainage material (Pobbels)

Gravel mulch shall be clean, washed aggregate with a size criteria as follows:

Sieve	90Wt. passing square mesh sieve
19mm	100%
13mm	90-100%
10mm	50-80%
6mm	10-45%
No. 4	0-15%

2.02 Soil mix for Aquascaping (for Aquatic Areas only)

A The components for soil mixes shall conform to the physical and chemical specification as mentioned in the section part 2 (A) agricultural soil and sand & B Organic compost. Soil mix shall conform to the following requirements:

1. Salinity (Ece x 100) less than 3.0
2. SAR less than 3.0
3. pH 5.5 to 6.5

B Soil is to be mixed in the quantities or proportions as indicated below:

1.	Agriculture soil	=	30%
2.	Sweet sand	=	10%
3.	Organic compost	=	40%
4.	Peat moss	=	20%

C The Contractor shall submit prior to the start of soil mix operations sample of these trials. The analysis will include specific recommendations for changes in the soil mix. The contractor shall submit such analysis and recommendations to the Employer.

D The contractor shall make adjustment to the soil mix as directed by the Employer.

E Fertilizers

Provide fertilizing as indicated below for soil mix.

1. Controlled release ferti1lizer shall be Osmocote as manufactured by Sierra Chemical Company, Strijkviertel 35 II, 3454 PJ De Meem, Netherlands or approved equal and shall be organic resin coated complete fertilizer with an analysis of 16-17-5 + Fe and a release longevity of 12-14 months at 21 degrees C soil temperature.

2. Agriculture Grade Sulphur, S. 99% sulphur content with 100% passing a 16 mesh screen and 50% passing a 100 mesh screen.

2.03 TEST REPORTS

A The proposed source of top soil shall be submitted to the Employer together with the complete soil analysis at least 15 days before its use.

B The Contractor shall provide a full chemical and physical analysis of the top soil by a registered institution in the form of a written report.

C The analysis shall be made for every 100m2 of top soil delivered and shall state that the source complies with the specifications and shall include tests for soil fertility (concentrations in parts per million) and analysis of particle size (by hydrometer and sieve methods).

D The following test information shall be submitted:

1. Manufacturer's certified analysis of standard packaged products.

2. Provide an independent laboratory analysis for all materials and submit for review by the Employer.

3. Manufacturers or vendors certified analysis for fertilizer materials.

4. For the organic matter, a laboratory analysis containing all of the items indicated below by a laboratory approved by the Employer.

   a) pH
   b) Moisture Content
   c) Bulk Density
   d) Organic Matter (by ash)
   e) Particle sizes expressed as percent passing:
      1. 9.51 mm (3/8") sieve
      2. 6.35 mm (1/4") sieve
      3. 2.38 mm (No. 8) sieve
      4. 0.50 mm (No. 35) sieve
         U.S. standard sieves
   f) Total Nitrogen (%)
   g) Organic Nitrogen (%)
   h) Nitrate Nitrogen (%)
   I) Ammonium Nitrogen (%)
   j) Phosphate Phosphorous (ppm)
   k) Calcium (ppm)
   l) Magnesium (ppm)
   m) Dilute Acid Soluble iron (%)
   n) Base Saturation Percentage
   o) Boron (ppm) by hot water extraction
   p) CEC-Cation Exchange Capacity meq/100gm.

Note

Items (c) through (n) are based on dry weight.

5. Organic matter:

   Prior to shipping materials to the project, submit an analysis to the Employer items (a) through (p) from an approved laboratory. Thereafter, submit such an analysis for every 10m3 of material received on the project, or as required by the Employer.

6. For sand and soil mix a laboratory analysis which contains all of the items below prepared by an approved laboratory.

   a) Soil Fertility

      1. Base Saturation (%)
      2. Nitrate Nitrogen (ppm)
      3. Ammonium Nitrogen (ppm)
      4. Phosphate Phosphorous (ppm)
      5. Potassium (ppm)
      6. Magnesium (ppm)
      7. Calcium (ppm)

   b) Agricultural Suitability

      1. Salinity (Ecs)
      2. pH
      3. Calcium (Me/1)
      4. Magnesium (Me/1)
      5. Sodium (Me/1)
      6. Potassium (Me/1)
      7. SAR (Sodium Adsorption Ratio)
      8. Boron (ppm by not water extraction)
      9. Lime content (% equivalent $CaCO_3$)
      10. Percent Organic Matter

7. Agricultural Soil/Sand

   Prior to the beginning of excavating activities submit to the Employer laboratory analysis showing items under soil fertility, agricultural suitability and particle sizes or as required by the Employer.

8. Soil Mix.

   Prior to placement of soil in the landscape submit to the Employer laboratory analysis showing items in soil fertility and agricultural suitability as required.

9. to ensure prompt proceeding of the works, stock piling of material after having been tested an approved is permitted.

PART 3: EXECUTION

3.01 COMMENCEMENT OF WORK

A Excavation and backfill shall be carried out according to the lines and levels necessary for the landscape works according to the tender drawings.

B Commencement of preparation of plants beds is conditional upon completion of almost all construction works including the laying of all necessary pipes and cables and specially the irrigation water supply maln, or an agreed part thereof, with the exception of excavation for drainage, tree pits, and the laying of drains and primary and secondary irrigation which must be carried out simultaneously with the surface preparations.

C The Contractor is to provide services and utilities necessary to the carrying out of the planting, with special attention to the supply of sufficient quantities of water, the quality of which is to approved by the Employer.

D Of all existing pipes and services shall be taken care. The Contractor is responsible for the replacement at his own expense for any damage to them which may cause, and for any consequences which such damage may result in.

E The Contractor shall assure himself that rough grades and all other surface and sub-surface work has been completed to his satisfaction. He shall further assure himself that adequate drainage has been installed.

F The Contractor shall remove all rock, gatch, wood, construction steel, stones, concrete waste and similar foreign material prior to preparing the soil for planting. He shall be satisfied that the sub-grade will meet the required levels necessary to fulfill the final grade requirements.

G When preliminary grading, soil import and preparation, including fertilizing has been completed and the soil may be readily worked, all planting areas shall be scarified and graded to a smooth, even and uniform plane with
no abrupt change of surface soil areas adjacent to the building shall slope away from building and surface drainage shall be directed as indicated on the drawings Grade to within 30mm of the top of curbs and paving.

H The locating of all turf, tree, shrub and ground cover beds and pits shall be scales from the plans and clearly marked in the field by the Contractor. No installation work shall commence until the Employer approves the field layout. The Contractor may choose to use string with woods stakes, red spray paint or lime dust to cutline beds woods stakes will be used to mark the location of individual trees an shrubs.

I Plants Pits

The Contractor shall construct plant pits according to the derails as shown on the drawings.

J Plant Pit Drainage Test

Testing the drainage of plant pits shall be done by filling each pit 10cm deep with water. The Employer shall be notified of any paint pit that does not drain the water in six (6) hours planting shall not proceed until Employer has reviewed drainage test plt results.

K If remedial action is required because of unsatisfactory drainage of painting pits, the Employer will require the Contractor to construct a drainage chimney according to the relevant detail.

L Soakaways shall be constructed by drilling a 30cm diameter hole at the bottom of the plant pit with an auger through the impermeable layer from the bottom of the plant pit. The hole shall be filled with the specified drainage stone and the top of the soakaway covered with the specified soil separator before backfilling.

M The Contractor shall not undertake remedial action until directed by the Employer.

3.02 INSTALLATION OF DRAINAGE GRAVEL AND SOIL SEPARATOR

A Drainage devices shall be carried out to all tree pits, planting areas lawn areas and soakaways as shown on the tender drawings.

B Gravel shall fill the hole in soakaways to a depth of not less than 200cm.

C Soakaways shall be in a dimension of 3x3m.

D Install soil separator.

3.03 TOPSOIL MIXING

A Soil mix shall conform to the following requirements:

1.	Salinity (ECe x 1000)	less than 4.0.
2.	SAR	less than 4.0
3.	pH	6.5 to 7.5
4.	Boron (by saturation extract)	less than 0.7 ppm.

B Soil mix is to be mixed in the quantities or proportion as indicated below according to the procedures outlined:

80%	Sand
10%	Agricultural Soil
5%	Organic Material
5%	Agrilite

C In the event that the pH of soil mix exceeds 7.5 the sand/soil potion of the mix will be amended with suitable additives (soil sulfur, sulfuric acid or other approved amendments) to bring the resultant soil mix into the specified range of 6.5 to 7.5. Such additives will be adced to the sand/soil prior to addition to the organic amendment. After adding such additives

the sand/soil will be leached to bring the salinity, SAR. pH. Boron of the resultant mix within the ranges indicated.

D The Contractor shall make adjustments to the soil mix as directed by the Employers approval, the Contractor may begin full soil mixing operations.

E Soil mixing procedure for trees, shrubs, ground cover

1. Mix physical ingredients (sand/soil, sulfur and organic amendment) shall be a uniform mixture according to accepted horticultural practices and approved by the Employer. Mixing method shall take place on an approved hard surfaces area. The organic portion should be moist. The soil mixing operations should not be carried out on excessively windy days. The contractor shall submit a method statement for the mixing method for approval by the Employer.

2. Apply fertilizer ingredients and mix until homogenous in the upper 150mm of the soil prior to planting.

3. Planting soil mix shall not be stored for longer than 2 weeks to avoid activation of the slow release fertilizer.

4. The resultant mix will be moistened to about 5-10%.

5. Moisture content: The soil shall not be worked with the moisture content so great that the excessive compaction will occur nor when it is so dry that a dust will form in the air or that clods will not break replay. Water shall be applied if necessary to provide deal moisture for filling and for planting as herein specified.

F Soil mixing procedure for aquatic plants

1. Mix physical ingredients. Agricultural soil, sweet sand, organic compost, peat moss to a uniform mixture according to accepted horticultural practices and approved by the Employer.

2. Fertilizer shall be Agriform tablet slow release complete fertilizer with an analysis of 20.15.20 + Fe and release iongerily of 6-12 months in tablet form or approved equal.

3. Fertilizer tablet shall be placed in soil bag plant containers along with top soil as described the quantities of tablets any range between 3-4 DCS per container depend on the type of plants.

4. Tropical water liters are heavy feeders and should be fertilized about every 1-2 months during their growing times. Do not fertilize the dormant plant.

End of Section

SECTION 02950

PLANTING

PART 1 : GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required to install plants, trees and ground cover as listed and shown on drawings.

1.02 REFERENCES

A American Joint Committee on horticulture nomenclature standardized plant names (AJCHN).

B American National Standards Institute Z60.1 (ANSI),1980. American Standard for Nursery Stock.

C Florida Department of Agriculture and Consumer Services, USA. Division of Plant Industry Publication Grades and Standards for Nursery Plants - Part 1 and Part 2.

D Sunset Western Garden Book 7th Edition, Lane Publishing Co., Menlo Park, CA, USA.

E Hortus Third, Staff of Bailey Hortorium Macmillan publishing Co. Inc. New York, USA.

F Landscape Plants in the United Arab Emirates, by Teresa Kwei and Tony Esmonde, 1978 published by Teresa Kwei.

G American Society for Testing and Materials (ASTM) Standards:

1. C136-81 Sieve or Screen Analysis of Fine & Coarse Aggregates.
2. D442-63 (1972) Particle - Size Analysis of Soil.
3. D2607-69 Standard Classification of Peats, Mosses, Humus, and related products.
4. D2974-71 Standard Method of test for moisture ash, and organic matter of peat materials.
5. D2976-71 Standard Method of Test of pH of Peat Materials.

H Official methods of analysis (11th edition & supply, 1 October 1970).

I Westcott's Plant Disease Handbook - Latest Edition, Dr. Cynthia Westcott, Van Nostrand - Reinhold Co. New York NY, USA.

1.03 CERTIFICATES

A Submit to the Engineer for approval, information and certificates for all materials proposed for use in the Planting Works. These shall include but not be limited to the following:

1. Certificates confirming the origin, size & age of all plant material

2. Health certificates for all imported plant material

1.04 INSPECTION

A The Contractor shall be responsible for the quality of all items purchased and shall submit an inspection plan for review. The inspection plan shall cover those items intended for shop inspection and the procedures for carrying out such inspections.

1.05 QUALITY ASSURANCE

A Perform work with personnel experienced in the work required of this section under direction of a skilled foreman with minimum five years experience on projects of a similar size and nature.

B When material or plants of the species specified are not available substitution may be made with the written approval of the Engineer or Engineer's Representative. In general substitutions will not be permitted in that all required plants are readily available.

C All trees, shrubs and ground covers shall be inspected at their growing source by the Engineer. Approved, Representative samples of each required plant type shall be tagged by the Engineer at the time of inspection. All plants delivered to the project shall be equal to or better than the approved samples. All travel and subsistence costs for the Engineer inspection trip shall be paid by the Contractor. Notify the Engineer 14 calendar days in advance of the anticipated date and manner of delivery of plants. Plants shall be prepared for shipment in a manner that shall not cause damage to their branches, distort their shape, or impair their future development.

1.06 DELIVERY, STORAGE, AND HANDLING

A Evidence of inadequate protection, carelessness while in transit or improper handling shall be cause for rejection of plants. All plants shall be kept moist and fresh during shipment. Upon arrival, plants will be inspected for proper transit procedures. Plants will be rejected if their roots are dried out, large branches are broken, areas of bark are torn or removed, plants have desiccated, leaves are shredded, plants show evidence of disease, insect eggs, insect infestation, frost damage, damage from browsing or grazing.

B STORAGE: Store packaged materials in a protected area away from construction activities and weather. All plants shall be kept moist, fresh and shall be stored in a protected area on site.

C Acceptance: The Engineer or Engineer's Representative will inspect plant material upon delivery to the site. Upon his acceptance of the plant material

as to the correct species, and acceptable condition, written approval will be given and work may proceed.

D Provide two year warranty from date of substantial completion under provisions of contract.

E Replace all plant materials found not in a healthy growing condition as determined by the Engineer or Engineer's Representative during the warranty period and prior to substantial completion.

F Replacement: plant materials of same size as per the specifications and drawings and shall match in size the same plant species growing in the area. More than one replacement of the same plant may be required during the warranty period if after initial replacement the plant is found to be unacceptable.

1.07 MAINTENANCE SERVICE

A Begin maintenance of plant materials immediately after planting and continue until termination of warranty period.

B Maintenance shall include measures necessary to establish and maintain plants in a vigorous and healthy growing condition. Including the following:

1. Cultivation and weeding plant beds and tree pits. When herbicides are used for weed control apply in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.

2. Watering, sufficient to saturate root system.

3. Pruning, including removal of dead or broken branches, shaping of plants as directed and treatment of prune wounds with an approved material.

4. Disease and insect prevention and control.

1.8 PROTECTION OF OTHER WORK

A All other work installed under other sections of this specification, shall be kept clean and free of soil, and other materials incidental to this work.

PART 2: PRODUCTS

2.01 PLANT MATERIALS GENERAL

A Selection Of Plants: Prior to the Engineer inspection locate and tag the plant material in the plant list. Tag all plants provided that the quantity of the species is less than 50 units. Where more than 50 units of one species are specified, tag 10% of the required number as "Sample plants" and all plants of this species delivered to the job shall match the quality of the sample. Maximum sample required shall be 100 plants.

2.02 PLANT SIZE AND QUALITY:

A. Palms:

1. Palms shall be healthy, vigorous plants from a well cared for active grove.

2. Palms shall be grown in a climatic condition similar to Jordan.

3. Palms shall have clean, clear trunks to heights shown on drawings.

B. Trees and Shrubs:

1. All plants shall be container grown.

2. Plants shall be of sound health, vigorous and free of disease or insect infestation or damage.

3. Plants shall be of a quality equal to standards set forth in ANSI Z60.1.

4. Container grown plants shall be healthy, vigorous, well rooted and established in the containers in which they are grown. They shall have tops which comply with accepted nursery standards and specifications and are of good quality, and meet the requirements stated in the "plant list" plants shall not be root bound or pot bound. The fibrous roots shall have sufficiently developed so that the root mass will retain its shape and hold together when removed from the container.

C. Ground covers

1. Shall be healthy, vigorous, well formed, and free of disease.

2. They shall conform to the applicable nursery standards and specifications.

2.03 HERBICIDE

A Herbicide shall be as approved by the Engineer.

2.04 ACCESSORIES

A. Stakes shall be straight and sound of approved wood. They shall be not less than 50 mm square or 60 mm diameter if round. If insect repellent wood is not used, stakes shall be treated with an approved preservative. Stakes to be approved by Engineer or Engineer's Representative.

B. Guying cable shall be 12 gauge U.S.S. pliable galvanized steel.

C. Hose for protecting trees against abrasion of the cable shall be reinforced two ply single color rubber of suitable length.

D Tree Root Barrier: shall be of cylindrical shape; similar to Universal Barrier by Deep Root product No. UB36-2; panel size 600 mm long x 900 mm deep.

With additional features: dual purpose use, adjustable sizing, safety rounded edges, non-lifting ground locks and with the following technical data:

1.	Thickness	:	2.79 mm
2.	Plastic type	:	Polyethylene; recycled product
3.	Fabrication Process	:	Extruded
4.	Rib type	:	Molded 90° ribs
5.	Assembly method	:	Self locking joiner
6.	Ultra Violet Inhib.	:	Added + by color

E Tree grate cover shall be tow parts cast-iron circular cover, to the sizes shown on drawings.

PART 3: EXECUTION

3.01 PLANTING SEASON

A As approved by the Engineer and generally suitable for the region of Jordan.

B Do not plant during periods of high wind.

3.02 LAYOUT AND STAKING

A All locations, shall be staked out in accordance with the planting plan.

B When staking has been completed, the Engineer or Engineer's Representative shall be requested, in writing to inspect and approve the stake-out. The Engineer or Engineer's Representative shall be given 7 calendar days advance notice for said inspection.

C After inspection and approval of the stake-out work can proceed.

3.03 EXCAVATION

A Excavate all tree pits and shrub/ground cover beds to the depths and sizes indicated on the drawings.

B Remove and dispose of all excavated material.

C The Engineer shall approve all excavations prior to backfilling operation.

3.04 INSTALLATION OF PLANTS

A Planting of Palm Trees

1. Palms shall be planted in prepared pits, size as specified on the contract drawings, back filled and firmed in.

2. Trunk burlap, frond wrapping and dead fronds to be removed after turgidity in fronds is observed or new growth indicates adequate recovery.

3. Palm trees with an installed brown trunk height of 3.0m shall be secured with a triangular wooden frame tightly around trunk burlap. Do not nail frame to trunk. Drive 3 Nos. Wooden stakes 120 apart firmly leaving them 20 cm above ground. Nail wooden brace to stake and triangular wooden frame very securely.

B Planting of Trees, Shrubs and Ground Covers

1. Excavate pit or bed to a sufficient size and depth to easily receive the required plant.

2. Water all plant pits and shrubs/ground cover beds thoroughly prior to planting.

3. Remove plant container.

4. Set plants at the same relationship to finished grade as to the soil level in their containers.

5. Backfill and step-in trees and shrubs. Backfill and tamp by hand ground covers.

6. Thoroughly water all planting pits and beds.

7. Apply, slow release planting tablets in tree pits and shrubs/ground cover below soil bed level at the manufacturer's stated rates.

8. Cut ropes or strings from the tops of all plants.

3.05 PRUNING

A Pruning shall be done after planting operations are completed.

B Do not prune until guidelines for pruning have been established in the field with the Engineer. The Engineer will require that sample trees, shrubs and ground covers be pruned in his presence, such pruning being prototypical for the entire job. Ground cover pruning shall generally be sanitary in nature.

C Plants shall be pruned according to standard horticultural practice to preserve their natural character.

D Remove all dead wood, suckers and broken or badly bruised branches.

E Only clean sharp proper tools shall be used. Do not use pruning shears where loppers are required or loppers where a pruning saw is required.

F Treat all cuts over 2 cm in diameter with an approved tree wound dressing.

3.06 MAINTENANCE

A Begin maintenance of plant materials immediately after planting and continue until completion of warranty/ maintenance period.

B Maintenance shall include all measures and tests at the Contractor's expense necessary to establish and maintain plants in a vigorous and healthy growing condition.

1. Cultivation and weeding plant beds and tree pits: This operation shall be performed at least once a week. When herbicides are used for weed control, they shall be approved in writing by the Engineer and applied in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides. The Contractor shall be responsible for all damage resulting from the use of herbicides.

2. Watering: Maintain an adequate supply of water to ensure root zone moisture. Any areas disturbed by watering shall be repaired by the Contractor immediately. Water shall be applied as required to meet the peak use consumption rate requirements by season, for all plants. Water tank trucks and quick-couple hoses shall be available immediately for watering if the irrigation system is not operating for any reason.

3. Debris and litter shall be removed from all soft and hardscape areas at least once a week.

4. Pruning, including removal of dead or broken branches, shaping of plants as directed and treatment of prune would be with an approved tree wound dressing. Maintenance pruning shall be done twice a year or as directed by the Engineer. Practices and procedures shall be as outlined under Q31: 10 of this section.

5. Disease and insect control. All chemicals must be approved in writing by the Engineer prior to use. A preventative pesticide program shall be prepared and submitted for approval to the Engineer (4) weeks prior to commencement of the warranty/ maintenance period. Disease infestation or other pesticide problems shall be diagnosed by an Agency approved by the Engineer. Their treatment recommendation shall be implemented immediately. However, the agencies recommendation shall not absolve the Contractor of his responsibilities as contained in the drawings and specifications. Additionally, all testing shall be at no cost to the employer. The Contractor shall submit to the Engineer (4) weeks prior to the commencement of the warranty/ maintenance period a complete maintenance program by season which details specific horticultural maintenance work grams i.e. - pruning by plant species, when it shall be pruned and how. Fertilization & insect & disease prevention shall also be detailed and included. The submittal shall be fully developed in Arabic/ English and shall not contain expressions such as "as required".

C Perform maintenance for a period of two years commencing with substantial completion of the planting.

3.07 PLANT SCHEDULE

A. TREES:

1- TILIA ARGENTIA:

Girth 12-14 cms. Height 2.50-3 meters, straight clear trunk up to 2 meters high from soil level & well branched.

2- ACACIA MIMOSA:

1.75 - 2 meters high, well branched.

3- CUPRESSUS SEMPERVIRONS VAR. (SKY ROCKET):

Straight stem 2.5 - 3 meters high.

4- JACARANDA ACUTIFOLIA:

2.5- 3 meters high, Girth 10 - 12 cms, straight clear trunk up to 2 meters.

5- CUPRESSUS SEMPERVIRONS:

Straight stem 2.5 - 3 meters high, straight stem, full healthy tree.

6- CASTANEA SATIVA:

Girth 12 - 14 cms, height 2.5 - 3 meters, straight clear trunk up to 2 meters high from soil level and well branched.

7- CELTIS AUSTRALIS:

Girth 12-14 cms, height 2.5-3 meters, straight clear trunk up to 2 meters high from soil level and well branched.

8- POPULUS NIGRA:

Height 3 - 3.5 meters, Girth 12 - 14 cms.

9- ERYTHRINA CAFFRA:

Height of 2 meters well branched.

10- FRAXINUS ORNUS:

Girth 12-14 cms, height 2.5 - 3 meters straight clear trunk up to 2 meters high from soil level and well branched.

11- PINUS HALAPENSIS:

Height 2 - 2.5 meters, straight stem.

12- ALBIZIA JULLIBRISSIN:

Girth 12-14 cms, height 2.5-3 meters, well branched after two meters of straight clear stem.

B. SHRUBS:

1- BUDDLEIA DAVIDII:

Well branched one meters high.

2- PELARGONIUM DOMESTICUM:

Full, well branched, 30 cms high.

3- EUONYMUS JAPONICA AUREA:

Full, well branched, 50 cms high.

4- LAVANDULA ANGUSTIFOLIA:

Full, 30 cms high, well branched.

5- PITTOSPORUM TOBIRA:

Full, well branched, one meter high.

6- MYRTUS COMMUNIS:

Full, well branched, 1.5 meters high.

7- VIBRINUM TINUS:

Full, well branched, 1.25 - 1.50 meters high.

8- THUJA ORIENTALIS:

Full round, 1.50 meters high.

9- NERIUM OLEANDER NANA:

Full, well branched, 75 cms high.

10- VINCA MAJOR:

3 - 4 branches, 40 cms tall.

11- PLUMBAGO CAPENSIS:

Full, well branched, one meter high.

12- CYTISSUS SPP:

well branched, 80 - 100 cms high.

13- LANTANA CAMARA:

Well branched, 80 - 100 cms high.

14- FORSYTHIA SPP:

Well branched, 1.25 - 1.50 meters high.

C. VINES:

1- VITIS VINIFERA:

Local varieties budded on rootstocks strong, 1 m tall, good root system.

2- BOUGAINVILLEA SPECTABILIS:

Well branched, 1.50 - 1.75 meters high.

3- BIGNONIA RADICANS:

Well branched, 1.50 - 1.75 meters high.

4- HEDRA HELIX:

Well branched, 1.50 - 1.75 cms. high.

5- LONICERA SEMPERVIRONS:

Well branched, 1.50 - 1.75 meters high.

D. GROUND COVERS:

1- CARPOBRUTUS EDULIS:

2 - 3 branches, 40 cms tall.

2- DICHORDRA REPENS:

Healthy, Full coverage of the planted area.

E. GENERAL SPECIFICATIONS:

All plants should have a strong healthy root system, be free from deformations, diseases, insects and physical injuries.

End of Section