MUNICIPAL CORPORATION OF GREATER MUMBAI

GARDEN DEPARTMENT

VOLUME-II

SPECIFICATIONS FOR

HORTICULTURE AND GARDEN WORKS

2013

FOREWORDING NOTE

Ever since establishment of Bombay Municipal Corporation (now Municipal Corporation Of Greater Mumbai) in 1888 by the erstwhile British rulers in India , in the last 125 years of the history of its existence MCGM has catered to every aspect of the citizen of Mumbai that can be conceived of. Look to heritage buildings like Victoria Terminus (Chhatrapati Shivaji Terminus), Office of Municipal Corporation, Dadabai Naoroji Road, Dr. Babasaheb Ambedkar Road, Marine Drive (Netaji Subhash Road), Prince of Wales Museum, Gateway of India, Malabar Hill Reservoir, Nair Hospital, Lokmanya Tilak Hospital, KEM Hospital etc which are the service centers for the citizens. Municipal Services have also been provided in the suburban and extended suburban areas merged in 1950 & 1957 respectively. The obligatory duties are performed well but still there is need to improve in quantity and quality of services to be provided to the citizens.

Ethical governance and righteous work culture will certainly bring positive changes in design and implementation of projects. One may take an example of the first Municipal Head Quarter Building, that was completed in year 1893, in four years, designed by F W Stevens and the execution part was dealt by Project Engineer Shri RaoSaheb Sitaram Khanderrao Vaidya, who executed the project of 77.70m high structure and saved Rs.68,000/- as against estimated cost of Rs. 11.80 Lakhs.

The need is to work with precision and accuracy. There shall be harmony between planning and execution so as to evolve best economics with focused goals.

MCGM is one of the largest local self government in the Asian Continent. In observance of historic traditions of strong civic activism, with the change in time and living conditions to match with the urbanization, MCGM has focused in providing variety of engineering services viz, storm water drain, sewerage, water supply, roads, bridges, solid waste management, environmental services. Beside this, the Corporation is also providing dedicated services in the Health sector by establishing Major and Peripheral hospitals.

To update and modernize the mechanism being used for working on related projects from the stage of conceptualization to execution, the need was realized to revise prevailing “Schedule Of Rates” along with specifications which were in operation with various departments and being prepared individually as per their need and revised at different span of time, resulting into various anomalies. To overcome all these, it was

essential to revise the schedule of rates, not only with simple mechanized revision but incorporating major changes to keep up with the pace of urbanization, civilization, construction techniques / mechanization and voluminous developments by restructuring items in the schedule to cover all requirements. This exercise would provide comfort with designs and field necessities and will assist in effective checks on creation of extra items during execution.

A conscious decision has been taken to prepare Unified Schedule of Rates to keep pace with the changing time; a first step forward in this direction. Since long time, there have been demands made by the stake holders like Municipal Engineers and Contractors to remove non-uniformity, anomalies and discrepancies in various schedules of rates for work contracts of various departments of MCGM. Every department had its own expertise and way of functioning which got reflected in its independent schedule of rates, which however, had no linkage with the fair market rates and schedules of other departments, resulting into extra items and fair rates. In place of earlier 9 Schedule Of Rates, the Unified Schedule of Rates is an effort and seeks to rectify the defects, discrepancies and non uniformities which will provide ease and accuracy of estimation to the Engineers.

In view of the enormous and voluminous nature of work, keeping time frame in perspective and above all, to ensure professionalism, the work of preparation of Unified Schedule of Rates (USR) was awarded to the eminent consultants M/s.Tata Consulting Engineers Ltd. M/s.Tata Consulting Engineers Ltd were directed to conduct a integrated factual market research for major materials from stockists/manufacturers/dealers and to study schedules of rates of Govt bodies like C.P.W.D., P.W.D. etc The new Rate Analysis are based on Factual Market research done by M/s.Tata Consulting Engineers Ltd.

The anomalies in rate are minimized after extensive market research and collection of quotations from reputed large scale stockists/dealers, and also after comparison with rates of CPWD, PWD etc.

The Unified Scheduled of Rates is linked with its comprehensive specifications of basic important activities so as to have clarity in execution. These specifications follow a chronology of general scope of the item, material required, processing of material, construction operation, finishing and mode of measurement. Rigid Standard Operating Procedures (SOPs) and complete control on processes will certainly satisfy quality parameter. The need for checking the quality of construction is quite

apparent and shall be ensured throughout the construction process. To achieve this, the Unified Scheduled of Rates incorporates quality assurance procedures.

All the rates are also linked to their detailed specifications and wherever required, with drawings. Though there are about 12500 items, every item is now given a Unique Code No. which will eliminate the repetition.

It has been our endeavor to include all the necessary modern materials and technologies in Unified Schedule of Rates, for example, the concept of green building, which will go a long way to have control on creation of extra items and fair rates. A salient feature of this Unified Schedule of Rates is 'Starring of items' specified categorically which can be used only at certain works or locations.

Another salient feature is 'Dynamic Rate System' which will be based on study of data base of quantities and bidding prices of awarded contracts on the basis of which necessary corrections can be applied to the Unified Schedule of Rates at specified intervals. The MCGM will be now be in a position to revise the Unified Scheduled of Rates every year, after incumbency period of M/s.Tata Consulting Engineers Ltd of one year, to work with and correct the system as and when necessary.

I am sure that this 'Unified Scheduled of Rates' will be a milestone in civic governance by MCGM. This publication shall be of great help and guidance to the officers engaged in the project work of MCGM.

A.M.C. (Project) **Municipal Commissioner**

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Chapter -1

SITE DRESSING AND LAND MODULATION

1.0 SCOPE OF WORK

1.1 The Scope consists of clearance of the Site of Works and preparation of the same to commence the proposed landscape execution activities. Wherever applicable, this is deemed to include all preliminary works like Dismantling/Demolition, Site Clearance, and General Leveling etc.

1.2 The drawings shall be read in conjunction with the specifications and matters referred to, shown or described in one are not necessarily repeated in the other.

1.3 In the event of any element of specification not available in any of the documents the instructions of the Engineer-in-Charge in writing shall be followed by the Contractor.

1.4 The work shall be carried out in accordance with the drawings and designs as would be issued to the Contractor by the Landscape consultant duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Landscape consultants signature and stamp.

1.5 The work shall be executed and measured as per metric dimensions given in the Schedule of Quantities, drawings etc.

2.0 GENERAL ITEMS

2.1 The more important Codes, Standards and publications applicable to this section are listed hereinafter.

2.2 Setting out the works

- The Contractor shall supply without additional charges the requisite number of persons with the means and material necessary for the purpose of setting out works and checking, weighing and assisting in the measurement or examination at any time and from time to time, of the work or the materials. Failing this, the same may be provided by the client's designated representative In-charge at the expense of the Contractor and the expenses shall be deducted from any money due to the Contractor under the contract or from his security deposit.

- The Contractor shall arrange for a qualified surveyor to set out the works and obtain certification of its accuracy from the surveyor. The Contractor shall then set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and for provision of all necessary instruments, appliances and labour in connection therewith. The Contractor shall submit to the client and the Landscape Architects, margins and the verifications of layout within seven days from the date of getting site layout from Landscape Architects / client.

- Mark the layout on the site. All bench marks, levels should be properly established and preserved for future use.

- Clearly check the surveyed map provided by the client and mark all drainage lines, water pipe lines, electrical lines, etc. client has been asked to remove the electrical lines and electrical poles. It needs to be checked by Contractor to satisfy him / herself from safety point of view before starting of work.

- The checking of any setting out or of any line or level by the Landscape Architects and CLIENT's representative or their representative shall not in any way relieve the Contractor of his responsibilities, for the correctness thereof. The Contractor shall carefully protect and preserve all benchmarks and other things used in setting out of the work.

2.3 Site Clearing / Excavation / Site Grading

- Light irrigation, by flooding the whole site with water. The water should penetrate up to depth of 15-20 cm only so that the weeds can germinate. Remove all grasses, small shrubs/weeds etc. with roots. Excavating the site as marked on the drawing/as instructed at the site, up to any lead and lift.

- Verify the levels and bench-marks from the up-dated surveyed drawing made available by the client. If there are any discrepancies between the site and the survey drawing, the same are to be brought to the client's notice by addressing a letter to the client and copy marked to the Landscape Architects.

- Grading and levelling of site as shown in drawing / specified on site by Landscape Architects. This will include spreading manually or by help of soil unloaded at different working areas in the site so as to obtain basic datum levels and grades.

- Excavated material shall be stacked off in the manner indicated at the site including stacking of excavated material up to any lead and lift. The rate shall only cover the cost of excavation, stacking and/or spreading of the material, if required at the site.

- Clearing the area of unwanted materials including the weeds, stones, masonry pieces etc. and all such matter that may cause damage to growth of the plant materials immediately or in future.

3.0 EARTH WORKS

- Earthworks shall involve the grading of soil for earth mounding, the excavation of trenches and soil for formation levels of pathways and foundations, and the fine grading of earth banks and landscape areas roughly graded by others.

- Excavation shall be carried out to the depth shown on or implied in the drawings or to such greater or lesser depths as the Landscape Architect may direct. The Contractor shall supply and fit all shoring, sheeting, strutting and walling required to maintain the sides of excavations as long as necessary and to remove them as required. The Contractor is to allow for making all necessary adjustments to existing manholes in accordance to bring them to the same level as the required profiled grades. No claim shall be entertained for either bulking or compacting and all other quantities shall be measured net from the drawings.

- The stripping and replacement of the subsoil shall only be done in dry weather and ground conditions unless in exceptional circumstances the Landscape Architect authorizes otherwise. Subsoil in heaps or dumps shall not be sited so as to damage or impede water courses or other drainage so long as they are capable of remaining in operation. Any weeds which may grow on the heaps of subsoil shall be sprayed with an approved selective weed-killer to prevent seeding.

- Notwithstanding the general description for the type of material to be excavated, if original bed rock is encountered during these operations which can only be removed by blasting or compressed air tools this work will be paid for separately as an extra over item for that given for normal excavation. This work shall only be undertaken when authorized in writing by the Landscape Architect.

- During excavation it is expected that the Contractor will take every prudent step or precautions such as tests or borings in order to prove the nature or type of material underneath or the ground bearing capacity in order to protect his workmen, plant or machinery employed in these operations.

- In the event of the Contractor excavating below the proper levels or otherwise in excess of the dimension given, he shall at his own expenses, remove all loose excavated material and replace the soil excavated in error.

- If, in the opinion of the Landscape Architect the bottoms of any excavation or any material to be excavated become unsuitable due to the Contractor's operations, the Contractor shall, at his own expenses, carry out any necessary excavation and make up in a similar manner to the above.

- If, in the opinion of the Landscape Architect the weather conditions are such as to preclude the satisfactory completion of any operation or cause unnecessary nuisance or disturbance to other parties, the Contractor shall, on receiving directions from the Landscape Architect suspend operations on that particular portion of the work until the Landscape Architect considers that weather conditions are satisfactory, or issues a direction to re-commence operations. The absence of such a direction shall in no way constitute the basis of a claim for delay or remedial work to a formation which is unsuitable.

3.1 Major Grading

- Site shall be complete with rough dressing including the base levels by civil contractor before handed over to landscape contractor for execution.

- Role of Landscape contractor involves major grading forming earth mounds / hillocks from imported fill materials where specified, or from the site debris and soil generated by excavations. The soil shall be graded using suitable earth moving machinery to the contoured earth forms indicated on the drawings. Soil, when in a dry enough state for easy working, shall be distributed to the correct areas and laid in layers not exceeding 100mm thick and compacted by at least 2 passes of the earth moving machine in each direction for each 100mm layer.

- Earth slopes are to be formed from the compacted mounds to the gradients and levels shown on the drawings, accounting for the topsoil depths to be included after subsoil formation is complete. If insufficient fill is available to complete the levels shown, additional suitable subsoil is to be imported to make up the required quantities.

Importation of additional fill shall only be carried out with written permission of the Landscape Architect.

- Earthworks levels are to be carried out to the contours shown on the drawings to a maximum tolerance of 150mm measured vertically, and to a maximum gradient of 1:2. All subsoil levels are to account for the later additional of specified depths of topsoil.

- The Contractor shall be responsible for protection of completed subsoil mounds and shall take preventative measures to control erosion and siltation restore or replace any portion of the earthwork areas which erodes, slumps, silts or is otherwise damaged by the out-washing of soil.

3.1.1 Excavation for Formation Levels and Trenches

- For footpath areas or other paving areas, excavate subsoil to create a smooth formation for taking the sub-base for the paved area, to levels shown on the drawings accounting for the depth of the paving build up.

- Firmly compact sub-grade with a smooth wheeled vibratory roller to achieve an even level. Finished sub-grade is to be protected until the path sub-base or other construction such as pool sub-base is laid. If sub-grade is too dry to be compacted, water shall be added until suitable texture is achieved. If sub-grade is too wet, the material shall be left to dry out until workable.

- A completed sub-grade/formation on which there is standing water, soft spots or slurry shall be deemed to be unsuitable and shall be rectified at the Contractor's expense including making up of additional material as required to bring the formation to line and level again.

- Where soft or wet ground is encountered prior to preparation of the sub-grade and this soft or wet ground cannot satisfactorily be compacted, the Contractor shall submit a written request for this to be inspected and the area to be dug out and replaced with suitable material shall be evaluated by the Landscape Architect and directed accordingly.

- Surplus material resulting from excavations for path formation or drainage trenches shall be taken off site at Contractor's own expense unless otherwise directed by the Landscape Architect in writing.

- Excavation of drainage or formation trenches shall be carried out after the major grading has been completed and approved. Trenches shall be cut to lines and gradients shown on the drawings. Planking and strutting shall be carried out as required to make the sides of the trenches safe. The Contractor will be responsible for ensuring that drainage trenches are kept free from mud and water and side slippage.

3.2 Fine Grading and Shaping

- Slight unevenness, ups and downs and shallow depressions shall be removed by fine dressing the surface to the formation levels of the adjoining land, as directed by Landscape consultant and adding suitable quantities of Good earth, brought from approved source, if necessary.

- Fine grading shall be carried out using small sized earth moving equipment or by hand, and shall involve final modeling of the earth contours produced by the major grading exercise. The shaping will follow the contours shown on the plans in general terms, but the final forms will be developed by eye to create smoothly flowing and pleasing contours.

- The Fine Grading will provide the detailed earth contouring prior to cultivation of soil. Soil cultivation and the application of topsoil mixes shall not take place until the Fine Grading is completed.

4.0 SOILS: MATERIALS AND PREPARATION

4.1 Soils

4.1.1 Subsoil

- Subsoil shall be a free draining soil, generally from horizon over 300mm below the original surface to be used as fill materials, either excavated from areas of the site, or imported.

- The Contractor shall:
  I. Furnish the source of top soil to Client.
  II. Study the soil report provided with the tender document, providing soil details such as pH, alkalinity, total soluble salts, porosity, sodium content and organic matter.
  III. Use the restored soil at site for landscape purpose, manure mixture, Neemcake, weedicide shall be added if required.
  IV. Not consider any external soil source unless the existing soil conserved from site is lacking in quality and/or quantity.

4.1.2 Topsoil Mixes

- The components of the Topsoil Mixes shall be as follows:

- Topsoil shall be a free draining organic soil from horizons less that 300mm from the original surface, of a workable crumbly and lump free loamy character and shall contain no grass or weed growth of any kind or other foreign material or stones exceeding 25mm in diameter. Total stone content shall be no greater than 15% by volume. A 1 litre sample with back up soil test data is required before installation, or mixing.

- TOPSOIL SPECIFICATION: The following criteria shall be tested at an approved laboratory before use on site.

  - pH: 5.5 - 7.8
  - Electrical conductivity: 1:2.5 (w/v)
  - Soil-water extracts not exceeding 1500 micromho/cm (1500 micro-Siemens/ cm)
  - Soil texture:

Sand (0.05 - 2.00mm): Max. 75% Min. 20%

Silt (0.002 - 0.05mm): Max. 60% Min. 5%

Clay (less than 0.002mm): Max. 30% Min. 5%

- Soil Conditioner shall be dried treated sludge, organic compost or other fibrous approved organic matter suitable for mixing with topsoil to make a friable growing medium for plants, resistant to rapid decay, free of soluble salts below 900ppm, pH 6-7, free of large lumps or debris.

- Organic Compost shall be organic vegetable compost produced by a thorough horticultural or industrial composting process or Farm Yard Manure (Cow Dung Manure). Compost is to have a clean, un-decomposed smell free from any rotting substances, debris, refuse, clay or visible fungus. A sample is to be submitted for approval before usage. All composts are to be sterilised before being packed for transport and odorous materials used on site will be rejected. Any vermin resulting from use of organic composts will have to be controlled by the Contractor within 12 hours of any infestation.

- Sand shall be a clean, coarse grained and angular material sourced from a river bed with a minimum 1mm diameter section. It shall be well graded, free from soluble salts ranging in size so that 80-100% passes the 3mm sieve and 0-50% passes the 2mm sieve, with 0% passing through a 1mm sieve.

- Lightweight Aggregate shall be an approved low density inert material such as expanded shale or clay or volcanic scoria or other porous aggregate capable of being compacted within the soil zone to 90% compaction without being crushed, free from dust and debris, pH 6-6.5, free of soluble salts. A 2 litres sample shall be submitted and tested as part of the soil mix for physical and chemical performance. Materials are to be approved in writing before installation.

- Soil Mixes

- The following soil mixes are to be used for different areas and for different types of planting. Minor changes to the proportions shown for particular species may be required, as specified by the Landscape Architect from time to time.

i. Soil Mix A: for use in natural ground level areas shall comprise the components listed below, which shall be mechanically cultivated to the correct proportions, prior to placement on site or backfilling. Soil Mix A shall comprise the following proportions by volume:

Topsoil: 50%

Sand: 20%

Soil Conditioner: 15%

Organic Compost: 15%

ii. Soil Mix B: for use in podium area shall be prepared under controlled mixing conditions such as a concrete floor to ensure even mixing. Soil Mix B shall comprise the following

proportions by volume:

Topsoil: 30-50%

Sand: 10-30%

Conditioner: 0-20% (as required)

Lightweight Aggregate: 0-20% (as required)

Organic Compost: 20%

iii. Soil Mix C: for use in planter boxes. Soil Mix C shall comprise the following proportions by volume:

Topsoil: 40%

Sand: 30%

Charcoal: 20%

Organic Compost: 20%

4.1.3 Soil Preparation and Application of Soil Mixes

- All subsoil areas to be topsoiled shall be cleaned free of rubbish, weeds, all stones exceeding 50mm in diameter and builders debris shall be removed from site. Any areas which are contaminated by petrol, soil or other toxic substances shall be excavated to 300mm below the contamination and have the excavated material removed form site. The excavated areas shall be back filled with imported topsoil as specified. These operations shall take place immediately before topsoiling (with soil mixes) commences.

- Where directed by the Landscape Architect, the ground shall be decompacted by ripping to a depth of 300mm. All obstructions to cultivation or deleterious material brought to the surface shall be removed from the site and any voids left by this operation shall be backfilled with imported subsoil as specified.

- Subsoil shall be formed to the finished levels and contours after settlement and with overall even compaction.

- No topsoil or soil mixes shall be spread or cultivation carried out until the subsoil operations have been approved by the Landscape Architect.

- Topsoil or soil mixes shall be spread on the designated areas to the depth shown on the drawings. The loose depth of the topsoil shall be sufficient to allow the area to conform to the levels shown on drawings after natural settlement has taken place. Soil Mixes shall not be compressed or rolled to achieve levels. Conversely if levels drop below specified levels, additional soil mixes are to be added to achieve levels.

- Soil Mixes are to be carefully spread by machine or hand in a moist condition. Very wet or dry soil mixes must not be used. Heavy compaction of soil mixes is to be prevented and compacted soil will be rejected. Soil Mixes are to be spread to the following minimum depths in open ground areas:

  i. Lawn / Turf areas: 300mm

  ii. Shrub areas: 450mm deep

  iii. Tree pits: 1000 x 1000 x 1000mm

  Unless directed otherwise or as shown on the drawings

- The prepared topsoil mix shall be compacted to 80% of maximum density to the depth shown on the drawings in 150mm layers. When planter is filled, water topsoil mix thoroughly to ensure proper and uniform compaction. After 2 weeks, fill with additional topsoil mixture and compact to level and before pavers are laid indicated on drawings.

- When in the opinion of the Landscape Architect site conditions are unsuitable for working, soiling operations shall cease and shall only be resumed when authorized by him.

- Contractor shall be responsible for soil protection and shall take preventative measures to control erosion and siltation of all areas and shall restore or replace any portion of the site which erodes, silts up or is otherwise damaged by out-washing of soil.

4.1.4 Fertilizers

- Chemical fertilizers shall be approved granular slow release compound fertilizers. They shall be stored in waterproof sealed bags under shelter away from water and direct sunlight. Samples of the same to be submitted by contractor before use at site.

- Organic fertilizers shall be organic products such as organic liquid fertilizer, pellets or granules manufactured primarily from organic materials. These products are to be from accredited sources and technical data indicating sources or origin and manufacturing process must be submitted before use. Animal by products must be sterilized before being packed for transport and odorous materials used on site will be rejected. Any vermin resulting from use of organic fertilizers will have to be controlled by the Contractor within 12 hours of any infestation. A sample shall be submitted for review by the Landscape Architect before use on site.

4.1.5 Mulches

- Mulches shall be approved friable composted organic materials. Coco-Peat will not be allowed on its own unless mixed in a proportion of 50-50 with another mulching material free from soluble salts or toxic materials and resistant to rapid decay. Mulches shall have a pH of between 5.5 - 7.0. Samples to be submitted and approved before use.

- Mulches are to be applied in a minimum 50mm layer over the entire surface of shrub and ground cover areas.

- Mulches is to be re-applied to all planting areas every 3 months after initial installation until the end of the maintenance period or until complete surface cover by vegetation is achieved.

- Initial mulching is to take place within 2 days of installation of planting.

5.0 SUBSOIL DRAINAGE

5.1 Subsoil, Field Drains and Trench Drains

- Before beginning installation of drain lines establish invert elevation of city storm drains at points where tree drains will tie in and prepare schematic layout for approval of Landscape Architect before digging trench.

- Surplus material resulting from excavations shall be carted to other fill areas within the site. If no additional fill sites are available the Contractor shall remove all surplus material from site and deposit it in a Local Authority approved tip.

- The Contractor shall survey the gradient levels of all trench bases to ensure that all falls are continuous from the highest point down to the outlet point at the sump. These findings shall be submitted to the Landscape Architect for verification before any further work is undertaken, either pipe laying or backfilling.

- All trenches when completed and approved shall be lined with approved filter membrane laid over the base of the trench and up the sides with sufficient membrane to wrap over the top of the gravel backfilling with a minimum overlap of 300mm.

- The base of each drainage trench shall have a layer not less than 30mm and not more than 50mm depth of fine stone chippings 8-12mm diameter or coarse sand laid to accurate falls for bedding the perforated pipes.

- The drainage pipes to the sizes shown on the drawings shall be prefabricated subsoil drainage system or similar approved type. PVC pipes with drilled holes will not be permitted. Drainage pipes shall be laid to the lines to the falls shown on the drawings and accurately boned in to correct gradients before backfilling.

- All pipe junctions shall be as supplied by the selected manufacturer and shall be fitted to the manufacturer's instructions to provide smooth flow and to fit the correct pipe sizes. Where changes in pipe diameters occur the correct junctions shall be used to match the changed pipe diameters.

- Connect drainage system to percolation pits.

- Where subsoil drainage pipes pass under paths or structure the pipe shall be of non perforated pipe joined at either end to the perforated pipe, and be surrounded by 100mm of concrete haunching.

- Trenches shall be backfilled to within 100mm of the finished level with clean coarse grained sand or crushed stone chippings 8-12mm diameter free of any fine particles. The gravel backfill shall be lightly compacted in 100mm depth layers.

- All drains shall be tested on completion to ensure a satisfactory water flow. Any pipes that do not flow are to be taken up and re-laid at the Contractor's expense.

- After testing has been approved, remaining depth of the trench shall be filled with a layer of coarse grained sand up to the finished soil level (after final settlement). Where the top layer is specified as such, clean graded gravel 20-40mm stone chippings free from fine particles shall be placed up to the finished surface mix, free from clay lumps or any item likely to inhibit drainage.

5.2 Sub-surface drainage Layers for podium planters

- Drainage mat shall be 30mm thick mat or cell. Lay drainage mat over base of podium ensuring individual sections are close butted. Lay filter fabric over drainage mat and return 300mm up walls. Overlap filter fabric by 300mm along seams and bond with filter fabric cement. Spread 50mm sand blinding layer, over filter fabric.

- Filter fabric shall be of approved make, as specified in this document. This shall be laid over the drainage mat and turned up the sides of the planter boxes 300mm.

- Filter fabric cement shall be an approved non-solvent bonding agent that will join filter fabric together. Submit manufacturer's technical data and sample for review.

- Sand shall be coarse washed river sand. It shall be free from soluble salts ranging in size so that 80-100% passes the 3mm sieve and 0.50% passes the 2mm sieve with 0% passing through a 1mm sieve.

Chapter -2

SOFTSCAPE WORKS

1.0 SCOPE

The scope of services covers all horticultural operations and services including, labour, equipment, services and transport for all plant materials, Good earth, top soil conservation, manures, pesticides etc. completing the entire work within the scheduled time, maintaining the entire Softscaping work for one year after virtual completion of the work.

The Contractor shall refer to Specifications provided in this document for relating to formation levels, sub-bases, concrete footings, foundations and all associated works. The specifications are to be read along with necessary specifications from other consultants.

Vendors' shop drawings shall be submitted for all such items where the Contractor will procure and install items from/by a reputed vendor. Execution of all such items shall be done after such drawings are approved by the Employer/ Employer's representative.

Contractor shall prepare and issue all required working drawings and get them approved by Employer/ Employer's representative with required number of revisions till the details provided do not satisfy the Employer/ Employer's representative.

The scope includes maintenance of all above for -- Years from the date of end Defects Liability Period (DLP). DLP shall be of one year after completion of Landscape Execution. The Contractor will maintain the entire landscape development area free of cost for a period of one year after completion of all above works as certified by the Employer/ Employer's Representative's in consultation with the Landscape Architect

2.0 SPECIAL CONDITION

The Contractor will have to provide the following items at no extra cost to Employer:

a. The Contractor will supply and install 3.0 metres high barricades for safeguarding landscape development area and works, as indicated in the drawing. He may also install the barricades in the landscape development area according to his own understanding if he feels that any part of the landscape area is bound to be damaged for any reason, after taking prior permission from the Employer/ Employer's Representative.

b. The Contractor will supply, install and maintain at his own cost, the most modern, automated watering system for the landscape, which will take care of the requirement for particular plants, save water and does not waste water, including any requirements specified by the Landscape Architect appointed by contractor. He will give full details of the layout, size of the pipe, size of the sprinklers, bubblers, etc and their warranty period. All equipment must conform to international standards and / or

Indian Standards if available. The design of the irrigation system has to be approved by Employer/ Employer's representative.

c. All equipment required for development shall be made available by Contractor, and its maintenance shall be his responsibility. This includes Tagara, Phawdas, Hose Pipes, Ground Roller, Manual and/or Electric lawn Mowers, Sprinklers, etc.

d. Contractor will ensure that all plants remain free of diseases, pests, etc during development and maintenance periods. The contractor shall, without any additional charge renew any dead or defective plant material and shall fully maintain including watering, de-weeding etc. of the whole landscape as mentioned above.

e. The Contractor shall maintain Nursery at his own cost at designated locations as shown in the drawing or at a suitable location within the plot as directed by Employer/ Employer's Representative. The Nursery will be fenced with gates for protection from cattle. The area of Nursery will be approximately 5000sqm. The item would include construction and maintenance of Green Houses if required.

f. Contractor shall follow pre construction and during construction soil erosion control measures as per the NBC Part 10, section 1, Chapter 4 – Protection of Landscape during Construction.

g. The contractor in co-ordination with the Employer as applicable shall ensure conservation and storage of top soil: Topsoil shall be stripped to a depth of 200 mm from areas proposed to be occupied by buildings, roads, paved areas and external services. It shall be stockpiled to a height of 400 mm in designated areas and shall be re-applied to site during plantation of the proposed vegetation. Topsoil shall be separated from sub-soil debris and stones larger than 50 mm diameter. The stored topsoil may be used as finished grade for planting areas. It is the landscape contractor's responsibility to conserve top soil that is not disturbed by the civil contractor.

h. The Contractor shall:

I. Furnish the source of top soil to Employer/ Employer's Representative.

II. Study the soil report provided with the tender document, providing soil details such as pH, alkalinity, total soluble salts, porosity, sodium content and organic matter. Ref. Soil Test Report

III. Use the restored soil at site for landscape purpose, manure mixture, Neemcake, weedicide shall be added if required.

IV. Not consider any external soil source unless the existing soil conserved from site is lacking in quality and/or quantity.

Soil Analysis for Top Soil fertility determination

To determine the fertility of top soil for conservation, soil investigation shall be carried out by an NABL accredited laboratory.

Adequate number of test samples of soil from a depth of 10-200mm below ground level shall be collected from at least 5 representative locations from site, preserved and transported (as per standard procedures specified by the laboratory) carefully to the laboratory for carrying out necessary tests.

All relevant Indian Standards for sampling and conducting laboratory tests shall be followed.

This soil samples shall be analyzed to determine soil type, texture, total organic content, pH, extractable nutrients such as nitrogen, phosphorus, potassium, salinity, cation exchange capacity, % base saturation and extractable heavy metals.

The soil analysis report from the laboratory shall also include a statement on the fertility and suitability of the soil for plant growth based on the analysis, in addition to the test results.

Top Soil conservation

Topsoil shall be removed for conservation to a depth of 200 mm (not more than 400 mm) and shall be separated from subsoil debris and stones larger than 50 mm diameter.

It shall be stockpiled to a height of 400 mm in designated areas. The stockpiled topsoil shall be protected from erosion during storage by installing earthern berms/solid walls, temporary seeding (using native grass), covering with mulch or plastic, etc.

The topsoil shall be protected with sand bags/solid walled enclosures (2 feet high) on all sides for containment.

Appropriate drainage channels shall be dug around the storage area to prevent flooding of the top soil storage area.

The top soil shall be reapplied to site during plantation of the proposed vegetation as finished grade for planting areas.

Seeding will take place immediately after respreading topsoil and decompacting, unless timing is inappropriate (for e.g., not in mid-summer).

i. The contractor to identify erosion prone areas on site and protect them from construction activities throughout the construction period. Prevent / mitigate the disturbances caused to site due to construction activity.

j. The contractor shall execute a sedimentation and erosion control plan that conforms to the best management practices highlighted in the National Building Codes of India

(NBC) Part 10, section 1, Chapter 4 – Protection of Landscape during Construction. This standard describes two types of measures that can be used to control sedimentation and erosion. Stabilization measures include temporary seeding, permanent seeding and mulching. Structural control measures include earth dikes, silt fence, sediment trap, and sediment basin. All of these measures are intended to stabilize the soil to prevent erosion.

k. The erosion and sedimentation control plan must be approved by Employer/ Employer's Representative and the erosion sedimentation control plan must be maintained throughout the execution period.

l. The contractor shall execute measures of protection and preservation of existing landscape on site during entire construction time.

m. Design, execute and maintain a temporary storm water management layout for the duration of construction activity. The storm water management layout should conform to National Building Codes of India (NBC) Part 10, section 1, chapter 4 – Protection of Landscape during Construction.

n. Contractor should take measures to prevent entry of any soluble/ insoluble construction waste to enter the water table/ water ways/ ravines on site.

3.0 GENERAL SPECIFICATIONS

a. Holding Nursery

i. A piece of land has been secured within the site for use as a holding nursery as indicated on the Contract Drawing. (Ref. Dwg. No)

ii. As a holding nursery the Contractor shall provide all necessary plant and equipment to store his plant material, machinery and equipment for the duration of the contract, including the two-year maintenance period.

iii. The Contractor shall be required to install and establish all equipment that may be required to run a major landscape contract and ensure plant materials remains in a healthy and fit condition. The list of requirements includes, but is not limited to:

- Provision of a 3,000 high tensioned chain link fence (with at least 2 no. lockable gates) around the extent of the holding nursery)
- Grading and laying of crusher together with associated storm water drainage to take vehicular loading
- Provision of all site utilities including water, telephone, electricity
- Provision of any shade structures that may be required to maintain the plants in a healthy condition prior to planting out
- Provision of any irrigation systems, pumps, sprinklers that may be required to maintain the plants in a healthy condition prior to planting out

- Provision of a site office to include at least one conference/meeting room capable of comfortably accommodating 15 persons

iv. The Contractor may wish to use the holding nursery for the purpose of propagation of plant stock for the contract. This is not a mandatory requirement since it is assumed that plant stock will need to be outsourced in order to meet the programme target dates. The decision to use the holding nursery as a propagation area rests entirely with the Contractor having taken into account the programme constraints, the nature of the site location (relatively remote) and his own commercial considerations.

b. Provision of Site Utilities

i. The Contractor is to allow for the provision at his own cost of all site utilities for the duration of the contract including but not limited to water, electricity and telephone.

c. Landscape Development Technique

i. The contractor will not be allowed to use different techniques or quality criteria or materials unless his alternative system has been confirmed in writing by the Employer/Employers representative.

ii. No cost increases for alternative specifications will be entertained unless formally submitted in writing as an improvement in the quality of a product and accepted in writing, following Employer/Employer's Representative approval, by the Employer/Employers representative.

d. Quality of Workmanship and Materials

i. All materials and workmanship shall be of the high standards and quality demanded by this specification. Sub-standard work and materials identified by the Employer/Employer's representative will be rejected and will be required to be rebuilt or replaced at the Contractor's costs.

ii. All plant material shall be of the genus, species and variety specified and substitutions will not be permitted unless authorized in writing by the Employer/Employer's representative. The sizes and plant description set out in the section headed Plant Material.

iii. All trees and shrubs supplied for the contract shall be free of pest, disease, discolouration and damage. Plants shall be well branched with vigorous shoots. The root system of each plant shall contain a good proportion of fibrous roots.

iv. All materials are to be approved by the Employer/Employer's representative prior to use on site. Materials shall be obtained from approved sources/manufacturers and/or suppliers. All guarantees and warranties shall be copied and submitted to the Employer/Employer's representative prior to requests for approval.

v. Where particular products are specified, the Main contractor's specialists subcontractors if he wishes to use similar products from other manufacturers must seek prior confirmation from the Employer/Employer's representative.

e. Site Responsibilities

i. From the commencement of the works until the Certificate of virtual Completion has been issued by the Employer/Employer's representative, the Main contractors specialists subcontractors shall, in respect of all areas of soft landscape works, adjacent areas and parts of the site used by him, be responsible as follows:

- For adequate protection to grassed areas, planted areas and trees and for making good Softscape works on removal of any protective measures at completion.
- For any damage to existing works and features and any necessary rectification work required to obtain approval from Employer/Employer's Representative.
- For keeping all paved surfaces used by him in a clean and tidy condition.
- For periodic removal of all surplus excavations and waste matter produced by his operations to a Local Authority registered tip off site, to be found by the Main contractors specialists subcontractors.
- For keeping all Softscape areas in a weed-free and tidy condition and adequately watered.

ii. The Main contractor's specialist subcontractors shall make appropriate allowance for these requirements in his rates.

iii. The Main contractor's specialist subcontractors shall, within 24 hours of notification and as directed by the Employer/Employer's representative, undertake at his own expense any remedial works arising from the stated requirements.

iv. Tree conservation:

- All trees to be conserved shall be protected with a 3-4 foot high enclosure constructed using brick/fencing (with an access gate for tree maintenance) at a distance indicated in the table below depending on the diameter of the tree trunk.

TRUNK DIAMETER (measured at 4.5 feet above natural grade)	DISTANCE FROM TRUNK ON ALL SIDES
Up to 6 inches	Past dripline
6-9 inches	5 feet
10-14 inches	10 feet

15-19 inches	12 feet
over 19 inches	15 feet

- This tree enclosure shall be erected before demolition, grading, or construction begins and remain until final inspection of the project. A 'Warning" sign of size 8.5"x 11" shall be prominently displayed on each protective enclosure to state the following:
- The following activities are prohibited within and in the vicinity of the tree protection zone throughout the entire duration of the construction project:
- Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, or other miscellaneous excavations
- soil disturbance or grade change
- drainage changes
- storage of material, topsoil, vehicles, or equipment
- Activity including but not limited to compaction, grading, construction etc.
- dumping of any material including but not limited to paint, petroleum products, concrete, mortar, dirty water, waste
- use of the tree trunks as a backstop, support or anchorage as
- a temporary power pole, signpost or other similar function
- The following activities are permitted or required within the Tree Protective Zone with approval from Landscape Architect:
- Mulching with wood chips (unpainted/untreated) or approved material to a four to six inch depth, leaving the trunk clear of mulch to prevent inadvertent soil compaction and moisture loss.
- Irrigation, Aeration, fertilization indicated by Landscape Architect for the healthy growth/maintenance of the tree
- if tree is adjacent to or in the immediate proximity to a grade slope of 8% or more, e rosion control measures shall be installed outside the Tree Protection Zone to prevent siltation and/or erosion within the zone

f. Plant Protection

i. All plant material is to be carefully protected and if necessary wrapped in the nursery during lifting, awaiting transportation, during transportation, unloading and during storage on site.

ii. Any evidence of unsatisfactory protection to roots, stems, branches and leaves will result in plants being rejected.

iii. Unprotected plants must not be transported during very hot weather, and all plants must be kept moist during transportation and storage. No plant material shall be left on site unplanted for more than two days.

g. Work by Machine or Hand

i. All operations herein described shall be carried out by suitable approved machines or by hand.

ii. Any work around the base of existing trees, in confined spaces or which is impractical to carry out by machine for any reason shall executed by hand and the contractor shall include for this in his rates.

h. Notice of Intentions

i. The contractor shall give forty-eight hours written notice to the Employer/Employer's representative of his intention to commence any of the following operations:

- Setting out,
- Planting,
- Topsoiling,
- Turfing,
- Sprigging,
- Maintenance visits

i. Heavy Machinery

i. Heavy machinery, which would excessively consolidate the sub-soil, shall not be used during any operations nor shall heavy machinery be taken over areas prepared for planting or grassing.

j. Substitutions

i. If the Main contractor's specialist subcontractor is unable to supply a particular species of plant he is to notify the Employer/Employer's representative in advance of his intention to make a substitution. No substitution will be allowed without prior written agreement of the Employer/Employer's representative.

ii. Notices of substitutions are to be made sufficiently for in advance of installation to ensure that the substituted material conforms to specifications. Substitutions

requested by the Main contractor's specialist subcontractor after work has started on site will not be entertained.

k. Setting Out

i. The Contractor shall be responsible for accurately setting out all the works prior to the commencement of the works and shall rectify errors in setting out at his own expense.

ii. Any discrepancy in site area between that shown on the drawings by Landscape Architect appointed by contractor and the actual area on the ground shall be notified to the Employer/ Employer's representative.

iii. The Contractor shall supply all necessary materials, equipment and labour to enable the Landscape Architect to check the setting out, levels and dimensions on the site along with the Employer/ Employer's representative.

l. Tools and Equipment

i. The Contractor shall use proper tools and equipment for the carrying out of the works and is to ensure that the work force is fully and properly equipped with the correct equipment and experience for the job at hand.

m. Failures of Plants (Pre-practical completion)

i. Any trees, shrubs, grass or other plants (other than those found to be missing or not in accordance with the Contract Documents as a result of theft or malicious damage and which shall be replaced), which are dead, dying, missing or found not to be have been in accordance with the Contract Documents at practical completion of the Works shall be replaced by the Contractor entirely at his own cost unless the Contract Administrator shall otherwise instruct.

ii. The Contract Administrator shall certify the dates when in his opinion the Contractor's obligations under this clause have been discharged.

n. Plants Defects Liability and Post Practical Completion Care by Contractor

i. Any grass which is found to be defective within 24 months, any shrubs, ordinary nursery stock trees or other plants found to be defective within 24 months and any semi-mature, advanced or extra large nursery stock trees found to be defective within 24 months of the date of virtual completion due to materials or workmanship not in accordance with the Contract Documents shall be replaced by the Contractor entirely at his own cost unless the Contract Administrator shall otherwise instruct.

ii. The Contract Administrator shall certify the dates when in his opinion the Contractor's obligations under this clause have been discharged.

iii. Malicious Damage or Theft (Before Practical Completion): All loss or damage arising from any theft or malicious damage prior to practical completion shall be made good by the Contractor at his own expense.

o. Submittals

i. The Contractor shall submit for review drawings by Landscape Architect appointed by contractor completely dimensioned, indicating any pattern layouts, special installation procedure, cutting, fitting, sinking and adjacent equipment materials for coordination.

ii. The Contractor shall submit samples of all materials and samples of workmanship for approval by Employer/Employer's representative.

iii. The Contractor shall be responsible for producing and submitting for comment and approval to the Employer/Employer's representative the shop drawings and samples of all elements indicated in this section. All should be based on the drawings provided by Landscape Architect appointed by contractor. All submissions should be reviewed, approved and endorsed by the Contractor.

p. Handling, Storage And Delivery

i. The Contractor shall:

- Coordinate delivery with suppliers, to minimize handling.
- Handle and store equipment and materials in such a manner that no damage will be done to the materials or the work of other trades.
- Store packaged materials, undamaged in their original wrappings, or containers with manufacturer's labels and seals intact.
- Stack equipment and materials on wooden platforms at least 150mm clear of the ground and protect with weatherproof covers.
- Damaged equipment, material or works will be rejected by the Employer/Employer's representative whether built-in or not.
- For equipment, materials and work, covering shall be of suitable material containing nothing that may injure or stain the materials.

q. Protection of Work

i. The Contractor shall protect all equipment, materials and completed work from damage until final completion of the work.

ii. The Contractor shall remove and replace damaged work at no extra cost.

r. Reference Standards

i. The Contractor shall comply with all relevant Indian Standards, ASTM, British Standard Code of Practice, Draft BS or DIN Standard applicable to elements indicated in this section, the recommendations and requirements of such documents shall be considered a minimum standard of such work described and must be complied with.

ii. Nothing shall relieve the Contractor of his responsibility for providing a higher standard than the relevant Code or Standard where it is required to comply with other sections of the Specification.

4.0 PLANT MATERIALS AND PLANTING OPERATIONS

The following plant descriptions cover the different categories of plant material to be used on the site.

These descriptions and their accompanying drawings requirements must be studied carefully and adhered to.

Plants that do not reach the specified dimension or quality, characteristics in this section or in the sizes and descriptions set out in the Bill of Quantities will be rejected and will have to be replaced at the Contractor's cost.

Trees and palms and large feature plants that are growing in open ground are to be prepared for transplanting at least 2 months before moving, either to containers in the nursery or direct to the site.

Preparation of in-ground trees and palms shall be by root pruning to the stated rootball dimensions.

Trenching around the outer edge of the rootball using pruning and a sharp spade shall be done in four separate stages trenching in quarters, with one quarter of the tree roots being cut and backfilled each week, the next quarter the following week, with all of the ball being cut in one month.

If roots over 25mm are encountered these are to be cleanly cut with large secateurs or pruning saw.

The trench which shall be at least 200mm wide shall be dug to the full specified depth of the rootball and undercut at the end of the root-pruning exercise to sever base roots.

The whole trench shall by this time be backfilled with sand. The tree is then to be allowed to settle for one month before final wrapping with protection and lifting. The rootball is to be well watered during this period.

For trees and palms that are to be containerised or root wrapped, the lifting and placing in containers or being wrapped is to be done immediately after the root trenching operation is complete.

Plants to be transported or moved are to be thoroughly wrapped and protected prior to transporting.

Rootballs are to be wrapped and tied with Gunny sack or hessian sacking if not containerised.

Exposed trunks are to be wrapped in rice straw including the lower parts of the branch system.

The upper branch system, especially if well furnished with leaves and twigs during transportation is to be completely wrapped in Lightweight netting or cloth tied and palms are to be laid at an angle to prevent damage from overhead structures and from buffeting and shall be covered by canvas as protection from wind.

Damaged trees will automatically be rejected on arrival at site.

All trees and palms are to be purchased, stored and grown on in suitable nursery conditions within one month of the contract and made ready for direction by the Landscape Architect appointed by Contractor.

Failure to procure within this time and to reveal the source of supply and location will result in the Employer/Employer's representative sourcing the plant materials for the Contractor, and the cost of this sourcing operation will be deducted from the Contractor's payments.

All dimensions shown with tolerances (that is 120 - 150mm) refer to maximum and minimum dimensions that will be accepted. Measurement of all plants of one species shall, as a minimum, average between the upper and lower figures (that is in the above case 135mm).

All trees and palms specified for containerising or root wrapping after root pruning operations are to be well furnished with leaves over the crown of the tree. Thinning of leaves to reduce transpiration to give a 50% cover is permissible providing due notification is given that thinning is required to ensure that the trees can be inspected before thinning work is done. Bare crowned trees will not be permitted.

Leave cover: Any trees or palms which shed their leaves within 2 weeks of transplanting are to be replaced by the Contractor at no extra charge.

4.1. Trees

a. Instant Trees

These are semi-mature trees especially prepared in advance for transplanting.

Root pruning to cleanly cut roots to the diameter of the rootball shall be carried out 3 months in advance of transplanting.

Trees shall be 300 - 450mm (12" - 18") circumference of stem when measured 1.0m (3') from ground level and shall have a clear stem of minimum 1.8 metres.

The head shall be well balanced and contain at least four main branches 500-1000mm long giving an overall height of 3 - 4m after pruning.

All saw cuts are to be painted with an approved insecticide/fungicide solution.

b. Extra Heavy Standard Trees (EHS)

These are large size nursery grown trees pruned during growth to produce a tight well rounded head and a straight stem clear of leaves or twigs.

Trees shall be 140 - 180mm circumference of stem when measured 1m above ground level and shall have a clear straight stem of minimum 2m.

The head shall be well balanced and rounded and contain at least four main branches, and a well developed secondary branch system giving an overall height of 4.5 - 4.8mm at the time of planting.

Trees shall have a defined central leader. Pruning at the time of removal from the nursery will not be permitted.

In dry weather conditions trees are to be sprayed with approved Anti-transpirant.

Rootball dimensions: diameter 750mm x 600 deep minimum. Branching/leaf spread shall be of 2.2 - 2.4m diameter.

c. Heavy Standard Trees

These are large size nursery grown trees pruned during growth to produce a tight well rounded head, and a straight stem clear of leafs or twigs.

Trees shall be 120 - 150mm (5” - 6”) circumference of stem when measured 1.0m (3’) from ground level and shall have a clear straight stem of minimum 1.8 metres.

The head shall be well balanced and rounded and contain at least four main branches with a well developed secondary branch system and a central leader, giving an overall height of 3.5 - 4.0cm (10’ - 13’) at the time of planting.

Pruning at the time of removal from the nursery will not be permitted.

In dry weather conditions, trees are to be sprayed with approved Anti-transpirant.

Rootball dimensions: diameter 600mm (2’) x 450mm (1’6”) deep minimum. Branching/leaf spread to be of 1.8 - 2.0m diameter.

d. Standard Trees

These are medium size nursery grown trees pruned during growth to produce a tight well rounded head, and a straight stem clear of leaves or twigs.

Trees shall be 100 - 120mm circumference stem when measured 0.9m from ground level and shall have a clear straight stem of minimum 1.5mm.

The head shall be well balanced and rounded and contain at least four main branches with a well developed secondary branch system and a defined central leader that has not been pruned, giving an overall height of 2.5 -3.0m at the time of planting.

Pruning at the time of removal from the nursery will not be permitted.

In dry weather conditions, trees are to be sprayed with approved Anti-transpirant.

Rootball dimensions: diameter 500mm (1.6") x 300mm (1') deep minimum. Branching/leaf spread shall be of 1.5 - 1.8m diameter.

e. Standard Feathered Whips

These are medium sized nursery grown trees having a single straight stem and unbroken leader giving an overall height of 2.5 - 3m.

The stem shall be fully furnished with evenly spread and balanced lateral branches down to ground level and shall be 80 - 100 mm circumference of stem when measured 1m from ground level.

The tree shall have a strongly developed fibrous root system and shall be container grown. Leaves or branches shall not be cut off before planting.

Rootball dimensions 450 x 300mm minimum. Branching/leaf spread shall be of 1.5 - 1.8m diameter.

f. Ships/Saplings

These are young tree grown from seed or cuttings which are trimmed or pruned, furnished with branches down to ground level.

Trees shall have a single straight stem and unbroken leader between 900 - 1500mm overall height.

Stem thickness will vary between species, but a strong stem which does not bend over is required.

The tree shall have a strongly developed fibrous root system and shall be container grown. Leaves shall not be cut before planting.

Container dimensions: 250mm diameter x 250mm deep minimum.

4.2. Palms

All palms shall be single stem. Single Stem Palms shall have clear straight trunks of heights as stated in the Bill of Quantities as measured from the root collar to the base of the lowest leaf sheath. The stem girth shall be of dimension normally found for palms for the stem height and species specified.

Acceptable tolerances to variations in stem height shall be +200mm or -200mm from the height specified in the Bills of Quantities.

The heads of palms shall be well balanced with at least 7 leaves and a healthy growing apical shoot all free from pest and disease.

a. Rootball dimensions shall be in proportion to stem heights as follows:

Stem height	Rootball diameter	Depth
1m	400mm	400mm
2m	750mm	600mm
3m	900mm	600mm
4m	1200mm	750mm

4.3. Shrubs, Herbaceous Plants and Ground Covers

a. Shrubs

These are woody perennials of generally multi stemmed and bushy habit ranging from 3 - 4.5m down to 500mm height.

Shrubs shall have no less than three main stems and shall be well balanced and bushy, with strongly developed fibrous root systems, and shall be pruned in advance as required to achieve the specified height tolerances.

Branches shall break from the base of the plant just above the root collar, and shall be well furnished with leaves right down to ground level.

All plants are to be container grown in containers of suitable dimensions for the species.

b. Herbaceous Plants

These are non-woody perennials usually of a clump forming habit.

Plants shall have a well developed main stem or stems with good symmetry, a healthy root system, free from pest or disease.

Clumps of herbaceous plants shall include rhizomes, corns, tubers or roots and soil undisturbed by lifting with evidence of growing shoots emerging above soil level.

All herbaceous plants are to be grown in containers unless specified as being produced by alternative method.

c. Groundcover plants

These are low growing, 500mm or less, or prostrate shrubs or herbaceous plants whose habit is to totally cover the soil.

All groundcover species shall be evenly balanced to allow equal growth in all directions.

Plants shall have fully developed roots and leaves.

Rooted cuttings will not be accepted. All plants to be container grown.

Rooted shoots of certain spreading ground cover plants shall be used only where specified, planted as 'sprigs' as opposed to established plants in soil.

Plants shall be rooted shoots and shall have at least one and evidence of vigorous root growth.

Recent cuttings with no root development shall not be acceptable.

d. Climbers

Climbers are plants whose growth habit is to climb upwards by means of twinning stems, tendrils or clinging roots.

Plants shall be grown to reach the recommended size using stocks no less than one year old, and no more than five years old at the time of the start of the contract.

Plants shall have at least two leader shoots up to the recommended height and a vigorous root system.

All plants to be container grown.

4.4. Hedging Plants

Hedging Plants shall be shrubs such as Lawsonia, Ixoras, etc as per design requirements of Landscape Architect appointed by contractor as suited to regular clipping, previously prepared to establish a uniform height and complete foliage cover to the stem from ground level upwards.

Plants shall be a minimum overall height of 500mm with a minimum of 4 branches arising from ground level and a strongly developed fibrous root system.

Branches shall be well clothed in leaves down to ground level.

All plants to be container grown in suitably sized containers.

Hedging plants shall be prepared by root and branch pruning to achieve the 'box' shape shown, at least 3 months before transplanting.

4.5. Container Grown Plants

Container grown plants shall mean trees and shrubs which have been grown in containers sufficiently large to hold the developing root system from seed or cutting and shall be filled with suitable nutrient rich, free draining compost as per design requirements of Landscape Architect appointed by contractor.

Container grown stock shall be well watered prior to dispatch from the nursery and shall remain in the container until planted on site, whereupon the container shall be carefully removed to avoid soil disturbance.

Empty containers are to be removed from site.

4.6. Cultivation of Plant Beds

Cultivation of the completed soil mix beds shall take place only when the seeding or planting operations can begin immediately after cultivation. No cultivation shall be undertaken in weather or ground conditions in which operations may destroy soil structure or where soil mix has not been approved by the Landscape Architect.

Cultivation shall be by approved mechanical or manual means to a depth of 250mm for Ground Cover and 450mm for Shrubs to provide an even, weed free texture.

After cultivation, stone picking from the surface of soil areas shall be carried out such that all stones and lumps exceeding 50mm in diameter are collected. All stones, weeds and rubbish brought up shall be removed from the site to a tip to be found by the Contractor.

Ground cover, rooted shoot and herbaceous beds are to have 25mm solid conditioner spread over the entire area and well forked in to the top 250mm of soil during cultivation. This operation is separate from the mulching specified.

5.0 PLANTING TECHNIQUES AND ACCESSORIES

All plants shall be planted to accommodate the spreading root system of the plant to the same soil depth as in the nursery and shall be well watered before removing them from containers. Plants are to be positioned upright and the soil firmed around the roots.

Planting shall be carried out in accordance with the schedule of plants and drawings supplied by Landscape Architect appointed by contractor. The number of each

species and variety shall be evenly distributed over the area as indicated on the drawings by Landscape Architect appointed by contractor.

For large areas the outer rows are to be set out first to ensure the correct shape to the bed is established. The remaining plants are then to be evenly distributed to cover the planting area. The Landscape Architect is to be notified in advance if there are too many or too few plants to fill the area required and an assessment of setting out adjustments will be directed accordingly.

Setting out of plants is to be completed and approved by Landscape Architect appointed by contractor before planting into the soil bed can commence.

5.1. Small Shrubs, Herbaceous, Ground Cover and Root Planting in Beds

Small shrubs, ground cover and herbaceous plants shall be planted in pockets formed by a trowel or spade.

The pocket shall be deep enough and wide enough to accommodate the root of the plant.

The sides and base of the pocket shall be loosened and the plant roots lightly loosened from the rootball.

The plant shall be placed upright in the pocket and firmed into the ground by backfilling and treading or hand pressure.

The topsoil in areas to receive rooted shoots shall be brought to a fine layer 75mm deep by approved mechanical means or hand raking.

Approved slow release fertiliser shall be applied evenly over the area at a rate of 40gms per square metre and shall be lightly raked into the surface.

Rooted shoots shall be firmly bedded into the soil at 75mm centres with each shoot spread on the topsoil surface, separated from adjacent shoots.

The area shall be top-dressed with finely sifted topsoil/compost mix as approved by the Landscape Architect appointed by Contractor to lightly cover the rooted shoots after laying.

The ground shall then be firmed by lightly treading or hand pressure around the roots, taking care not to damage the shoots, to ensure good contact with the soil.

Watering shall take place immediately after planting, using a fine spray.

The firmed up area is to be tightly cultivated after completion of this operation to leave an even layer before mulching.

5.2. Shrub Pits

Shrub pits for large and medium shrubs, feature plants and climbers shall be excavated to 150mm wider on either side than the root spread, and to a depth of 150mm deeper than the root depth and shall not be less than 300mm x 300mm x 450mm deep.

The bottom 150mm of the pit is to be forked loose prior to backfilling.

Backfill material shall be topsoil Mix A for backfilling purposes. (Ref. Section 8-Part 1: 4.1.3 Soil Mixes)

The Contractor shall note that for planting into turf areas, where topsoil has not been spread topsoil mix will be required for backfilling purposes.

Climber pits shall be 150 - 200mm away from the supporting structure with the roots spread away from the wall or adjacent supporting structure.

The climbing plants shall be trained through the wire mesh with leading shoots directed upwards and tied.

Pits for shrubs and feature plants in planters shall be excavated to 150mm wider on either side than the root spread and to a total depth of the rootball.

The bottom of the pit shall be lightly formed, prior to planting taking care not to damage the terrain layer below.

After planting shrubs the area is to be watered immediately to bed the shrubs in.

Once the water has percolated away and left the surface relatively dry the soil area is to be lightly forked to loosen the surface and leave an even soil layer.

5.3. Tree Pits

Tree pits shall be excavated to the dimensions and the location shown on the drawing by Landscape Architect appointed by Contractor.

Tree pits shall be dug a minimum of 3 weeks period prior to back filling.

The bottom of the pit shall be forked to loosen the soil. In case the soil is clayey, a layer of broken bricks and stones shall be spread on the bottom of the hole and this layer shall be covered with dried leaves or straw.

No tree pit shall be less than 300mm wider on either side than the root spread, and to a depth of 150mm deeper than the root depth, and shall not be less than 1m x 1m x 1m.

The trees shall be planted to the same depth in the nursery or as in their containers.

In case the site is infested with white ants the sides of the pits shall be brushed with a mixture of BHC (10% concentration) and water in a proportion of 200 gms of BHC mixed in 5 litres of water. BHC is the common name for the insecticide.

5.4. Backfilling of Pits (trees, shrubs and climbers)

Before backfilling, imported topsoil and sand is to be thoroughly mixed with soil conditioner and organic fertiliser as specified for Topsoil Mix A. (Ref. Section 8-Part 1: 4.1.3 Soil Mixes)

The tree pit shall be backfilled with the Soil Mix A to a depth which will allow soil, after settlement to match surrounding ground level.

The filled pit shall be watered and allowed to settle. After settlement soil levels shall be topped up as required.

The centre of the backfilled tree pit shall be excavated large enough to allow placing of the rootball, and to allow even compaction all round during backfilling.

After careful removal of the container or wrapping, the rootball of trees shall be placed carefully in the pit, and soil replaced gradually into the pit.

The soil is to be consolidated during backfilling in layers to ensure that the plant is firmly held in the ground and that voids are not left around the roots.

Care shall be taken during planting to avoid damage to the root system, branches or leaves.

After careful removal of the container or wrapping, the rootball of the roots of shrubs and climbers shall be placed carefully and the soil replaced gradually in the pit.

The soil is to be consolidated during backfilling in layers to ensure that the plant is firmly held in the ground and that voids are not left around the roots.

Care should be taken during planting to avoid damage to the root system, branches or leaves.

5.5. Staking and Supports

Stakes shall always be used when planting instant trees, standards and single stem palms and for tall shrubs when directed by the Landscape Architect appointed by Contractor.

Stakes shall be in sawn timber of an approved type and be carried out according to the size of plant to be supported. The types of approved staking methods are:

a. Tripod or Quadropod staking for large trees or palms (extra heavy standard and above)

Three or four stakes each 50 x 50mm section shall be positioned equidistantly around the tree and firmly driven into the ground at angles of between 30 - 40 degrees.

The inner ends of the stakes shall extend beyond the tree stem by not more than 150mm and shall not be higher than 300mm below the lowest branch.

The tree stem shall be wrapped in hessian or gunny sacking at the point where the tree stakes are to be fastened in order to prevent bark damage.

The stakes shall be neatly and firmly fastened to the tree stem using rubber hose or cord; String are not be used.

The stakes are to be adjusted and the position of the protective wrapping is to be altered up or down every month.

The hessian wrapping is to be sprayed with an approved horticultural pesticide.

b. Multiple guying - for large trees or palms (heavy standard and above)

A minimum of three wire guys are to be used per tree.

Each guy wire is to be fastened by a loop around the lowest branches of the tree at the junction with the main trunk or branches of the tree at the junction with the main trunk or stem.

Loops are to have protective rubber or plastic hose to prevent chafing and are to be fastened back to the guy wire by means of U-clamps or bolts.

Guy wires are to be fastened at ground level to short stakes firmly driven at an angle into the ground.

Stakes shall be minimum length of 600mm and are to be driven deep enough to resist movement.

A notch is to be made near the top of each stake for the fastening of the guy wire.

Stakes shall be positioned equidistantly and equally around the tree and shall be at least 300mm beyond the extent to the tree pit.

Distance away from the tree shall be gauged on site to provide firm and secure guying.

Each guy wire is to have one turnbuckle located near the fastening to the stake.

Guy wires are to be kept in a proper tension and adjusted to maintain the tree in a vertical position without guy wires being rigid.

c. Double Staking - for trees and palms (heavy standard and smaller)

Two stakes each 50mm x 50mm cross section shall be driven into the ground in a vertical position on either side of and outside the rootball of the tree so as to form a straight line outside the rootball of the tree so as to form a straight line with the stem at the centre.

Stakes shall be driven in to penetrate the bottom of the tree pit and be deep enough to resist lateral movement when tested.

Stakes shall not extend beyond the lowest branch of the tree and if necessary are to be sawn off at the top.

Fastening or securing of the tree may be carried out by using either:

i. Cross bar

A wooden cross bar of same section as the stakes is fastened in a horizontal position to the outside of the stakes by nails or tying securely at a level below the lowest branch.

The tree is fastened to the cross bar with a single adjustable tie of an approved rubberised or plastic type with a spacer and shall be fastened to prevent any chafing or abrasion of the bark.

No nails or fixings are to be driven into the tree trunk.

ii. Wire/Hose loops

Two separate wire or rope loops are made about the stem just below the lowest branch with each being fastened back to one of the vertical stakes.

Each loop is to have a protective outer covering or sheath of rubber hose to prevent chafing or abrasion of the bark.

The wire or rope is to be fastened to the stakes in a manner that allows adjustment of the tension to be made easily.

Tension on each wire is to be equal to maintain the tree in a vertical position.

Where directed by the Landscape Architect appointed by Contractor the tree may be secured with a second set of loops at a lower level.

d. Single Staking - for trees and palms of sapling size only

A single stake of cross section 50mm x 50mm is driven vertically into the ground 150mm - 250mm away from the tree.

The stake is driven down beyond the base of the tree pit and shall be firm when tested.

The top of the stake shall be 100mm below the lowest branch.

Two ties of an approved rubberised or plastic type are to be used.

The top tie is to be located 100mm below the top of the stake; the lower tie 300mm from the base.

Ties are to have spacers to maintain the 150mm - 250mm distance between the stake and the tree.

Ties are to be fastened to avoid rubbing, chafing or abrasion of the bark.

e. <u>'Dead Man' Guying - for large sized trees standard and above</u>

This method of supporting trees is for use in areas where other conventional methods of support are not feasible due to space constraints.

Prior to backfilling two pairs of preservative treated hardwood planks minimum 100mm x 50mm cross section are laid across the top of the rootball at right angles so that the trunk or stem is enclosed in a square edge of the rootball as possible but kept approximately 100mm in from the edge.

Two pairs of galvanised or stainless steel cables are then led over at right angles to the timber planks and the ends firmly fastened into the ground at the base of the rootball or preferably fastened into structure nearby.

Twin buckles at the midpoint of each cable are installed to tighten the cables to a suitable degree. Cables should be tightened only to hold the rootball firm.

Over tightening may cause the rootball to settle deeper into the ground than desired.

Wherever dead-men guying is specified without a drawing the contractor is to notify the Employer/Employer's representative.

f. <u>Climber wires</u>

Wires for training climbing plants against walls shall be approved lightweight PVC mesh, fixed at 600mm intervals to screw eyes supplied under the sub contract.

Maximum mesh coverage shall be 180mm high x 240mm wide.

The climbing plants shall be trained through the wire mesh with the shoots directed upwards and tied.

5.6. Turfing

a. Close Turfing

Close Turf shall be a live grass sod or mat at least 300mm square with a well developed root system growing in a minimum of 25mm soil bed, free from stones or extraneous roots, cut mechanically or by hand to give an extra thickness and texture.

A sample of one square metre of Turf shall be submitted to the Employer/Employer's representative for approval before Turf is brought in for use on site.

The source of the material shall be stated by the Contractor.

Turf shall be free from weeds, fungus, pest or disease and contamination or pollutants.

Turf sods shall be kept moist and in shade and shall be planted within 24 hours after lifting.

In exceptionally dry weather, the turf must be kept well watered at the nursery or turf farm in order to keep full green leave structure.

Dry, brown or wilting grass turf will be rejected and growth or recovery on site will not be permitted.

i. Close Turfing: Ground Preparation

Rake the topsoil mix area to a smooth and uniform grade free of any slight mounds or depressions to achieve a uniformly flat surface.

Re-grade any depressions or humps that may occur until a satisfactory grade is achieved.

The area to be turfed is to be brought to a fine tilth by approved mechanical means or by hand raking.

Any stones over 25mm in diameter shall be removed from the site of turfing.

Watering of the area shall be carried out to produce a moist condition of the soil and to consolidate the soil.

If consolidation occurs to produce any areas with topsoil depths less than 100mm these areas shall have extra topsoil spread to produce finished levels.

Fertiliser shall be applied to all areas to be turfed prior to turfing at the rate of 40gm per square meter, evenly spread over the whole area and lightly worked into the soil.

ii. Close Turfing: Operations

Close turf sods shall be laid onto the surface of the prepared ground with leaf turfs upwards, butt jointed as closely as possible to achieve a uniform cover.

The turf shall be laid off planks working over turves previously laid.

The whole area is then to be top dressed with finely sifted topsoil mix to give an evenly smooth surface. The finished close turfing shall be lightly compacted by treading or with a wooden beater to ensure even coverage and compaction.

Watering shall take place over the area that has been turfed immediately after planting. Watering shall be undertaken by use of a fine spray to avoid disturbance of soil particles.

Turfing shall be only accepted as complete after the growth of an even grass cover is evident. Any areas not covered by green healthy grass to the satisfaction of the Employer/Employer's representative within 28 days after turfing shall be re-laid as specified at the Contractor's own expense.

For the period of 28 days after turfing the vegetative cover shall:

I. Evenly cover at least 90% of the areas with leaves and spreading shoots of specified grass variety

II. be free of perennial weeds or disease

III. be healthy and vigorous and showing a strongly developed root system

Should there be any settlement due to lack of even compaction this will be corrected by application of topdressing of finely sifted soil to maximum depth of 25mm.

If the depression is greater than 25mm the grass in the affected area shall be lifted, the depression filled with sifted topsoil, lightly compacted and the affected area re-turfed as specified. These operations shall be done as often as necessary to produce an even and smooth surface free from bumps and hollows.

All turfing operations shall be carried out from wooden planks or plywood boards, with the workers moving away from completed turfed areas, raking any compressed soil or footprints before laying of sods.

All access onto soil areas shall be on wooden boards or plywood sheets. Areas compacted by working are to be re-cultivated and re-laid.

iii. Maintenance of Close Turfing Before Completion

The following operations are to be carried out as often as required to achieve the specified quality of turf:

I. Cutting before Completion shall be carried out as necessary to keep the grass to a maximum height of 30mm.

II. Watering shall be carried out as often as necessary before Completion to allow a satisfactory green sward to develop over the whole close turfed area.

III. One fertiliser application per month is to be carried out for before Completion.

IV. Topdressing as specified as often as required to establish smooth even grades and levels free of hollows.

V. If compaction or consolidation takes place or hard passing or baking of the soil occurs, the soil areas are to be well watered first and lightly loosened by mechanical means such as spiking, slitting or hollow tinning using approved equipment.

VI. Completed close turfed areas are to be kept in a weed free insect free, fungus free and tidy condition until Completion (that is start of maintenance period).

iv. Sourcing of Turf Types

Close turfing materials are to be obtained from a bona-fide horticultural source or private landowner.

No turf is to be removed from unauthorised locations, roadside, riverbanks or private property without permission of the owner.

The Contractor is to inform source of all turf delivered to the Employer/Employer's representative before any turf is laid at site.

b. <u>Fine Turf</u>

Fine Turf shall consist of fine bladed rhizomatous grass such as Bermuda grass or cultivar specified by Landscape Architects appointed by the Contractor.

Fine Turf shall be a live grass sod or mat at least 300mm square with a well developed root system growing in a minimum of 25mm soil bed, free from stones or extraneous roots, cut mechanically or by hand to give an even thickness and texture.

A sample of one square metre of Fine Turf or both types shall be submitted to the Employer/Employer's representative for approval before fine Turf is brought in for use on site.

The source of the material shall be stated by the Contractor.

Fine Turf shall be free from weeds, fungus, pest or disease and contaminants or pollutants.

Fine Turf sods shall be kept moist and in shade and shall be planted within 24 hours after lifting.

i. Fine Turfing Operations

Subsoil mix shall be hand raked to provide an even and fine tilth to an even and accurate level matching kerb edge levels.

Any lumps or stones over 25mm in diameter brought up in this operation shall be removed from site.

Soil areas shall be lightly sprinkled with water to moisten surface in dry weather before laying turf.

Pre-Turfing fertiliser shall be applied to all areas to be turfed prior to turfing at the rate of 40gm per square metre evenly spread over the whole area and lightly worked into the soil.

The turves shall be laid on the prepared soil bed and firmed into position in consecutive rows with broken joints, closely butted and to the correct levels.

The turf shall be laid off planks working over turves previously laid.

Where necessary, the turves shall be lightly and evenly firmed with wooden beaters, the bottom of the beaters being frequently scraped clean of accumulated soil and mud.

A dressing of finely sifted topsoil/sand/compost mix shall be applied and well brushed into the joints to give an overall even surface.

Watering shall take place over the area that has been turfed immediately after planting. Watering shall be undertaken by use of a fine spray to avoid disturbance of soil particles.

Fine turfing shall only be accepted as complete when new growth has caused turves to knit together and adhere by rooting to the soil bed.

Any areas not covered by green healthy grass to the satisfaction of the Landscape Architect within 28 days after fine turfing shall be re-laid as specified at the Contractor’s own expense.

If shrinkage occurs or the joints open, finely sifted topsoil/ sand/ compost mix shall be brushed into the gaps and shall be watered in.

Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by lifting turves and by re-spreading fine soil mix to correct levels and relaying turves as specified.

The finished level of the Fine Turf shall be 25mm above adjoining paved surfaces or other hard edges after allowing for final settlement.

Turf edges and margins shall be laid with whole turves and uneven edges trimmed to give an even line.

ii. Maintenance of Fine Turfing before Completion

Watering shall be carried out as often as necessary before completion to allow a satisfactory green sward to develop over the whole fine turfed area.

Cutting before completion shall be carried out as necessary to keep the grass to a maximum height of 25mm.

One extra fertiliser application is to be allowed for before completion, to be used if directed by the Landscape Architect appointed by Contractor.

Completed fine turfed areas are to be kept in a weed free inset free, fungus free and tidy condition until completion (that is start of maintenance period).

Edge cutting shall be carried out as required along edges of paths, plant beds or other junctions with other materials. Only sharp edge cutting tools are to be used for this operation.

Over cutting or ragged edges will require the relaying of the turf edge strip as specified (that is 300mm wide).

iii. Specification for Sourcing of Turf Types

Fine Turf is to be specially prepared horticultural turf, re-lawn or turf-carpet, mechanically cut to specified tolerances.

5.7. Watering of all Plants

After planting all plants are to be thoroughly watered to soak the ground all around the rootball.

After watering and the water has percolated away leaving e surface relatively dry the soil is to be lightly cultivated to give an even soil tilth.

5.8. Mulching

After completion of planting and watering and light cultivation operations a 50mm deep layer of approved mulch shall be spread and forked in over all cultivated planting areas.

Around each tree and palm and around the base of each climber, additional mulch is to be applied to a 50mm depth to a diameter of 600mm.

Mulching is to be done within 2 days of completing planting and watering in.

5.9. Fertilising

After a period of settling in of at least one month, all pit planted materials shall be fertilised with an approved slow release fertiliser at the rate of:

Trees : 250gm per tree

Shrubs/climbers : 50gm per plant

Ground Cover/Herbaceous : 100gm per square meter spread

Rooted Shoots : around the base of the plants - 40gm per square meter

All fertilised areas are to be watered immediately after fertiliser application.

5.10. Disease Control

The Contractor shall take all necessary precautions to prevent or eradicate any outbreak of disease or insect attack.

5.11. Planting into Turf Areas

Where planting is to be carried out in areas of turf, the turf shall be carefully cut to the size of the tree or shrub pit, rolled and stored for re-use, being kept moist and in shade.

After planting is complete stored turf shall be re-laid around the base of the plant.

The Contractor shall replace at his own expense, any turf which is damaged during planting operations.

5.12. Protection of Planted Areas

The contractor shall be responsible for protecting all planted areas.

If it is necessary for the Contractor to erect protective fencing, the Contractor shall be responsible for keeping the fencing in position and in good repair until the end of the maintenance period.

Fencing proposals shall be submitted to the Employer/Employer's representative for approval.

Post and string fences shall not be acceptable.

5.13. Maintenance prior to Completion

After planting and prior to the onset of the maintenance period, the Contractor shall be responsible for carrying out all necessary measures to ensure that the plant material thrives and becomes established and that the landscape areas are kept in a clean and tidy condition.

The Contractor shall allow for carrying out the following maintenance operations when necessary prior to the onset maintenance period, all as specified in section 6 of this specification:

- Replacement of dead/missing plants
- Grass cutting around trees
- Watering
- Cultivation and loosening of soil
- Weeding
- Pruning and clipping
- Firming up and adjusting stakes and ties
- Eradication of pest or insect attack
- Topdressing and mulching
- Fertilising

The Contractor shall be responsible for replacing any plants which fail to survive as a result of inadequate maintenance operations, poor workmanship or poor quality of plant material prior to completion.

The Virtual Completion Certificate will not be issued until all plants scheduled on the Drawings and Schedule of Works are installed in a healthy condition in the manner specified.

6.0 MAINTENANCE WORKS

6.1. General

i. The Contractor shall maintain the landscape for a two-year period after the date certified by the Landscape Architect that the work has been satisfactorily completed (issue of Certificate of Completion).

ii. The extent of the landscape to be maintained by the Contractor shall be deemed to cover and include all soft landscape areas within the overall project boundaries as

shown on the drawings including all existing soft landscape not affected by the contract works and retained intact or nearly so through the end of the contract period as well as all the landscape works covered in the contract scope of works. No additional maintenance charges will be allowed unless specifically agreed to by the Landscape Architect in writing.

iii. The Contractor shall ensure that a senior qualified supervisor is made available for organising and running the maintenance programme. The Contractor shall also have available an experience foreman who can supervise the workers on a day-to-day basis. An adequate trained labour force of at least 3 workers must be available for routine work and they must be on site for at least half a working day, 5 days per week during the maintenance period. Additional grass cutting operators will be needed to ensure adequate cutting and cleaning.

iv. The Contractor's Supervisor shall inspect the site once per week during the maintenance period and shall prepare a brief schedule of operations required for the coming week. The format for the schedule of operations will cover each distinct areas of the site such as frontage, rear, courtyard, roof, interior, etc. The schedule shall describe the operations the Contractor intends to carry out in the coming week to cover the items listed in the specification and to ensure that the current weather conditions and growing performances, insect attack, etc is taken into account.

v. A copy of this schedule is to be submitted to the Landscape Architect and Employer every week so that a running record of proposed operations can be checked at the maintenance inspections each month. If in the opinion of the Landscape Architect the maintenance works have not been satisfactorily carried out according to site conditions and the specifications, part of the monthly payment will be withheld until the works have been satisfactorily carried out.

vi. The contractor shall carry out all necessary measures to ensure that all pot plants, trees and shrubs and other plants shall thrive and become established within this period. All landscape areas will be inspected monthly and lists of remedial works issued after each inspection. All items on the remedial lists are to be carried out by the time of the next inspection, ie within one month.

vii. The Contractor shall keep the landscape areas clean and tidy at all times and dispose of all waste materials arising from the cleaning.

6.2. Maintenance of Planted Areas: Trees, Shrubs, Climbers, Herbaceous and Ground Covers

i. The Contractor shall water all trees, palms, shrubs, ground cover, rooted shoots, herbaceous plants and other planting areas as often as necessary to keep the ground moist all around and to the full depth of the roots of the plants to a minimum depth of saturation of:

- 100mm for groundcover
- 300mm for shrubs
- 750mm for trees

ii. Fresh water only shall be used for the Works. Water shall be supplied to the Contractor from agreed points on the site. However, it will be only to necessary for the Contractor to supply his own means of transport from the watering points to the plant beds.

iii. An inspection of watering requirements is to be made by the Contractor at least two times a week in dry weather.

iv. Water shall be supplied using an approved hose or sprinkler so as not to cause compaction or wash-outs of the soil or loosening of plants. The Contractor shall immediately make good any such damage, soil erosion or outwash and plants loosened by erosion are to replanted or if damaged, replaced.

v. All plant beds are to be kept in a weed free condition with a weeding operation once a month. All weeds, stones and rubbish collected from this operation shall be removed from the site to a tip to be found by the Contractor. Herbicides may not be used on this site unless a specific application in writing is made by the Contractor with full back up data on the performance of the chemicals and the particular need for the chemicals use. Approval will in all cases be subject to the Landscape Architect's decision.

vi. After weeding, at least once per month the soil surface is to be lightly broken up between plants using a pronged fork upto maximum depth of 100mm. Contractor shall Take care not to disturb the root systems of plants. After forking the soil loose, the mulch and loosened soil are to be raked to give an even re-distribution of the mulching materials

vii. Firming up and adjusting of stakes/ties shall be carried out monthly to ensure that the trees and shrubs are firmly held in the ground. If required guy ropes or tree pits shall be adjusted, tightened or loosened. If tree ties or ropes are rubbing the bark of the trees, the ties are to be taken off and retied. Any damaged branches are to be carefully pruned and the wounds sealed.

viii. All protective fencing is to be maintained and kept in good condition and in position until the end of the maintenance period.

ix. Trees shall be pruned if dead, rotten or crossed branches are present or to maintain a clear stem up to the specified height using the methods described below. Tree pruning is to be reviewed monthly.

x. All shrubs and ground covers are to be reviewed monthly and pruned as and when required during the Maintenance Period to promote bushy growth and good flowering characteristics. The shrubs shall be checked and all dead wood, broken, damaged or crossed branches shall be cut back, depending on species. Pruning and removal of branches is to be carried out using sharp clean implements to give a clean sloping cut with one flat face. Ragged edges of bark or wood are to be trimmed with a sharp knife.

xi. Pruning for all plants shall be carried out as follows:

- Pruning is to be done with the cut just above and sloping away from an outward facing health bud.

- Removal of branches is to be done by cutting flush with the adjoining stem and in such a way that no part of the stem is damaged or torn.
- Ragged edges of bark are to be trimmed with a sharp knife.
- Any cuts or wounds over 25mm diameter are to be painted with an approved sealant after trimmed.
- All pruning to be cleared up and removed from site after pruning.

xii. All hedges, mat forming herbaceous plants and ground cover plants shall be clipped with shears as often as necessary (at least monthly) to maintain a tidy appearance. Tall hedges are to be cut to forms shown on the drawings. Fertiliser is to be applied to clipped areas around 1-2 weeks after clipping.

xiii. Selective pruning of flowering plants shall be done where special flowering characteristics are required such as for Ixoras, Hibiscus, Allamanda where flowering takes places on twig ends. Heavy clipping must not be used for these species since this will remove future flower buds. Selective pruning by clipping non flowering twigs and leaving flowering twigs is necessary for these plants, and this operation must be done by experienced workers.

xiv. The Contractor shall allow for monthly fertiliser operations during the Maintenance Period. An approved slow release fertiliser shall be applied to each plant at the rate of 50gm per shrub and 200gm per tree, one month after planting and thereafter monthly. After spreading the fertiliser around the base of the plant the granules shall be lightly forked into the soil, and the plant well watered. Herbaceous and ground cover areas shall receive 25mm of approved soil conditioner, evenly spread and mixed with 50gm/m2 of approved slow release fertiliser, evenly spread over entire area and lightly forked into the soil to break up the top layer, and the area well watered on a month by month basis.

xv. The horticultural requirements of different plants or areas may involve variations to those techniques (such as the use of organic liquid fertilisers for sensitive plants) and variations in method will be authorised as required.

xvi. Heavy feeding plants such as Canna, Heliconia and Lantana shall be dressed with a 25mm mulch of approved organic compost or similar approved compost every 2 months, lightly forked in around the base of the plants.

xvii. Additional mulching layer, 25mm deep to be spread and forked in over all planted areas at 3 monthly intervals.

xviii. The Contractor shall make regular weekly checks to ensure that the plant material is insect and pest and fungus free. No pesticides may be used unless approval from the Landscape Architect is given from the Contractor stating the chemical intended for use; concentration, spraying programme and including full technical details of the product.

6.3. Maintenance of Lawn Areas

i. The Contractor shall mow all lawn areas using approved cutting equipment to maintain a close sward to a height of not less than 20mm and not more than 30mm for all grass types.

ii. Mowing shall be carried out generally weekly, except in dry weather and grass shall not be allowed to flower between cuts.

iii. Weekly inspections are to be made to ensure adequate planning of grass cuts to suit growth and weather conditions. All clippings to be gathered up and removed from site.

iv. All grass areas are to be watered by means of sprinklers during dry weather as often as is required to keep the grass green and the soil moist.

v. The Contractor shall provide hoses and sprinklers for use from water points provided. Weekly inspections are to be made to determine the need for water and, in dry weather watering must be done to moisten the soil to a depth of 100mm.

vi. Fertiliser of NPK value 10-15-15 or similar approved be spread at a rate of 40gm/sq m over all grass areas at monthly intervals, using approved spreading equipment to give an overall even spread. Grass areas that have been fertilised shall be watered if no rain falls within 24 hours.

vii. The Contractor shall apply top-dressing of not more than 15mm depth fine sand and granulated compost raked and spread evenly over the lawn areas. The next top-dressing shall be applied only after the grass has grown through to a mowable height.

viii. There shall be at least two applications of topdressing during the maintenance period, to be directed by the Landscape Architect appointed by Contractor.

ix. If depressions or bumps over 25mm deep or high in turf areas during the maintenance period these are to be levelled out by lifting the turf and raising the soil level with sand/compost mix or trimming to level grades, followed by re-turfing.

x. Grass areas are to be kept free of weeds, annual grasses, fungus and insect attack and free of stones or other debris throughout the maintenance period as often as is required.

xi. All chemicals used shall be to the approval of the Employer/Employer's representative. Assessment of these operations is to be prepared on the basis of the weekly maintenance inspection chart.

xii. If compaction or consolidation takes place or hard passing or baking of the soil occurs, the soil areas are to be well watered first and lightly loosened by mechanical means such as spiking, slitting or hollow tinning using equipment approved by the Employer/Employer's representative.

6.4. Replacement Planting

i. If during the course of the Maintenance Period trees or shrubs or other plants die because of a fault by the Contractor, the Contractor shall replace the plant at no cost to the Employer.

ii. All questions related to responsibility for the replacement planting will be subject to site inspection and agreement of the appointment of responsibility.

iii. This will be done very month at the monthly maintenance inspections.

6.5. Final Handover

i. Two weeks before the end of the Maintenance Period a joint inspection shall be held with the Maintenance Agency, Contractor and the Employer/Employer's representative review the requirements for alteration or replacement in order to gain approval for Final Handover.

ii. In order to ensure satisfactory handover procedures, the site meetings held each month between the Contractor and Employer/Employer's Representative will be used to inspect and approve the maintenance works which will be reviewed to ensure adequate work has been done.

iii. At the time of the final inspection, all areas under this contract shall be free of weeds, neatly cultivated and raked, and all plant boxes in good order.

iv. Grass shall be neatly cut and all clippings removed. No bare patches of earth shall be visible in turf or planting areas unless specified (that is rings around tree trunks).

v. If, after this inspection, the Employer/Employer's representative is of the opinion that all work has been performed in accordance with the drawings and specifications, the Employer/Employer's representative will give written letter of acceptance and completion of the project.

vi. If, all or certain portions of the work are not acceptable under the terms and intent of the drawings and specifications, the formal maintenance period for all the work shall be extended at no cost to the Employer/Employer's representative until the defects in the work have been corrected and the work is accepted by the Employer/Employer's representative.

	TERMINOLOGY:	
	Avenue	A wide road or pathway lined with trees on either sides.
	Buffer	The use of landscape to curtail view, sound or dust with plants or earth beams, wall or any such element.
	Climber (Creeper / Vine)	A non-supporting plant, woody or herbaceous, which clings to a wall, trellis or other structures as it grows upward.
	Columnar	A slender, upright plant form.

	Contour	The form of the land, existing or proposed; a part of the topography, indicated by map lines at intervals as desired, to understand the landform clearly. The contour line though imaginary, indicates continuous elevation above mean sea level or an assumed datum line.
	Contour Interval	The difference in elevation or the vertical distance measured between consecutive contour lines.
	Egress	A way out or exit.
	Elevation	A contour line or notation of relative altitude, useful in plotting existing or proposed feature.
	Exotic	A plant that is not native to the area in which it is planted.
	Fencing	A barrier of plant or construction material used to set off the boundary of an area and to restrict visual or physical passage in or out of it.
	Foliage	The collective leaves of a plant or plants.
	Geo-textile	Any permeable textile (natural or synthetic) used with foundation, soil, rock, earth or any other geotechnical engineering-related material as an integral part of a human made project, structure or system.
	Grade	The slope or lay of the land as indicated by a related series of elevations.
	Natural Grade	Grade consisting of contours of unmodified natural landform.
	Finished Grade	Grade accomplished after landscape features are installed and completed as shown on plan as proposed contours.
	Gradient	The degree or slope or a pipe invert or road or land surface. The gradient is a measure of the slope height as related to its base. The slope is expressed in terms of percentage or ratio.
	Grading	The cutting and / or filling of earth to establish smooth finish contours for a landscape construction project. Grading facilitates good drainage and

		sculpts land to suit the intent of landscape design.
	Grasses	Plants that characteristically have joint stems, sheaths and narrow blades (leaves).
	Groundcover	The planting material that forms a carpet of low height; these low-growing plants are usually installed as the final part of landscape construction.
	Hard Landscape	Civil work component of landscape architecture such as pavement, walkways, roads, retaining walls, sculpture, street amenities, fountains and other built environment.
	Hard Plant	Plants that can withstand harsh temperature variations, pollution, dust, extreme soil conditions and minimal water requirements and the likes. These plants have ability to remain dormant in such conditions and survive
	Hedge	Number of shrubs or trees (often similar species) planted closely together in a line. A hedge may be pruned to shape or allowed to grow to assume its natural shape.
	Herb	An annual plant with a non-woody or fleshy structure. Certain herbs are highly useful for cooking or of high medicinal value.
	Ingress	A way in, or entrance.
	Invert	The low inside point of a pipe, culvert, or channel.
	Kerb	A concrete or stone edging along a pathway or road often constructed with a channel to guide the flow of storm water and thereby serving dual purpose.
	Mound	A small hill or bank of earth, developed as a characteristic feature in landscape.
	Native	A plant indigenous to a particular locale.
	Screen	A vegetative or constructed hedge or fence used to block wind, undesirable views, noise, glare and the like, as part of in landscape design; also know as ‘screen planting’ and ‘buffer plantation’.
	Sediment	The product of erosion processes; the solid material, both mineral and organic, that is in

		suspension, is being transported or has been moved from its site of origin by air, water, gravity or ice.
	Shrub	A woody plant of low to medium height, deciduous or evergreen, generally having many stems.
	Soft Landscape	The natural elements in landscape design, such as plant materials and the soil itself.
	Spot Elevation	In surveying and contour layout, an existing or proposed elevation noted as a dot on the plan.
	Street / Outdoor Furniture	Items of furnishing in outdoor landscape
	Swale	A linear wide and shallow depression used to temporarily store, route or filter runoff. A swale may be grassed or lined.
	Topsoil	The uppermost layer of the soil.
	Transplanting	Moving a plant from its place of origin to another location.
	Tree	A woody plant, generally taller than 2.00 m, with a well-distinguished trunk or trunks below the leaf crown.
	Deciduous Tree	Tree that sheds all its leaves in autumn or in dry season.
	Evergreen Tree	Tree that remains green for most part of the year and sheds leave slowly throughout the year.
	Tree Grate	A metal grille, installed at the base of a tree otherwise surrounded by pavement that allows the free passage of air, water and nutrients to the tree root, but does not interfere with the foot traffic.
	Tree / Plant Guard	The protection constructed around a tree to deter vandalism and helps to prevent damage. It could be made of metal, bamboo or concrete or the like.

Chapter - 3

HARDSCAPE WORKS AND GARDEN FURNITURES

1.0 SCOPE

The scope of services covers all operations and services including, labour, equipment, services and transport for all materials, etc. completing the entire work within the scheduled time, maintaining the entire hardscaping work for one year after virtual completion of the work.

The Contractor shall refer to Specifications provided in this document for relating to formation levels, sub-bases, concrete footings, foundations and all associated works. The specifications are to be read along with necessary specifications from other consultants.

Vendors' shop drawings shall be submitted for all such items where the Contractor will procure and install items from/by a reputed vendor. Execution of all such items shall be done after such drawings are approved by the Employer/ Employer's representative.

Contractor shall prepare and issue all required working drawings and get them approved by Employer/ Employer's representative with required number of revisions till the details provided do not satisfy the Employer/ Employer's representative.

The scope includes maintenance of all above for -- Years from the date of end Defects Liability Period (DLP). DLP shall be of one year after completion of Landscape Execution. The Contractor will maintain the entire landscape development area free of cost for a period of one year after completion of all above works as certified by the Employer/ Employer's Representative's in consultation with the Landscape Architect

2.0 SPECIAL CONDITION

The Contractor will have to provide the following items at no extra cost to Employer:

The Contractor will supply and install 3.0 metres high barricades for safeguarding landscape development area and works, as indicated in the drawing. He may also install the barricades in the landscape development area according to his own understanding if he feels that any part of the landscape area is bound to be damaged for any reason, after taking prior permission from the Employer/ Employer's Representative.

From the commencement of the works until the Certificate of virtual Completion has been issued by the Employer/Employer's representative, the Main contractors specialists subcontractors shall, in respect of all areas of soft landscape works, adjacent areas and parts of the site used by him, be responsible as follows:

- For any damage to existing works and features and any necessary rectification work required to obtain approval from Employer/Employer's Representative.
- For keeping all paved surfaces used by him in a clean and tidy condition.

- For periodic removal of all surplus excavations and waste matter produced by his operations to a Local Authority registered tip off site, to be found by the Main contractors specialists subcontractors.

a. Work by Machine or Hand

i. All operations herein described shall be carried out by suitable approved machines or by hand.

ii. Any work around the base of existing trees, in confined spaces or which is impractical to carry out by machine for any reason shall executed by hand and the contractor shall include for this in his rates.

b. Substitutions

i. Notices of substitutions are to be made sufficiently for in advance of installation to ensure that the substituted material conforms to specifications. Substitutions requested by the Main contractor's specialist subcontractor after work has started on site will not be entertained.

c. Setting Out

i. The Contractor shall be responsible for accurately setting out all the works prior to the commencement of the works and shall rectify errors in setting out at his own expense.

ii. Any discrepancy in site area between that shown on the drawings by Landscape Architect appointed by contractor and the actual area on the ground shall be notified to the Employer/ Employer's representative.

iii. The Contractor shall supply all necessary materials, equipment and labour to enable the Landscape Architect to check the setting out, levels and dimensions on the site along with the Employer/ Employer's representative.

d. Tools and Equipment

i. The Contractor shall use proper tools and equipment for the carrying out of the works and is to ensure that the work force is fully and properly equipped with the correct equipment and experience for the job at hand.

e. Submittals

i. The Contractor shall submit for review drawings by Landscape Architect appointed by contractor completely dimensioned, indicating any pattern layouts, special installation procedure, cutting, fitting, sinking and adjacent equipment materials for coordination.

ii. The Contractor shall submit samples of all materials and samples of workmanship for approval by Employer/Employer's representative.

iii. The Contractor shall be responsible for producing and submitting for comment and approval to the Employer/Employer's representative the shop drawings and samples of all elements indicated in this section. All should be based on the drawings provided by Landscape Architect appointed by contractor. All submissions should be reviewed, approved and endorsed by the Contractor.

f. Handling, Storage And Delivery

i. The Contractor shall:

- Coordinate delivery with suppliers, to minimize handling.
- Handle and store equipment and materials in such a manner that no damage will be done to the materials or the work of other trades.
- Store packaged materials, undamaged in their original wrappings, or containers with manufacturer's labels and seals intact.
- Stack equipment and materials on wooden platforms at least 150mm clear of the ground and protect with weatherproof covers.
- Damaged equipment, material or works will be rejected by the Employer/Employer's representative whether built-in or not.
- For equipment, materials and work, covering shall be of suitable material containing nothing that may injure or stain the materials.

g. Protection of Work

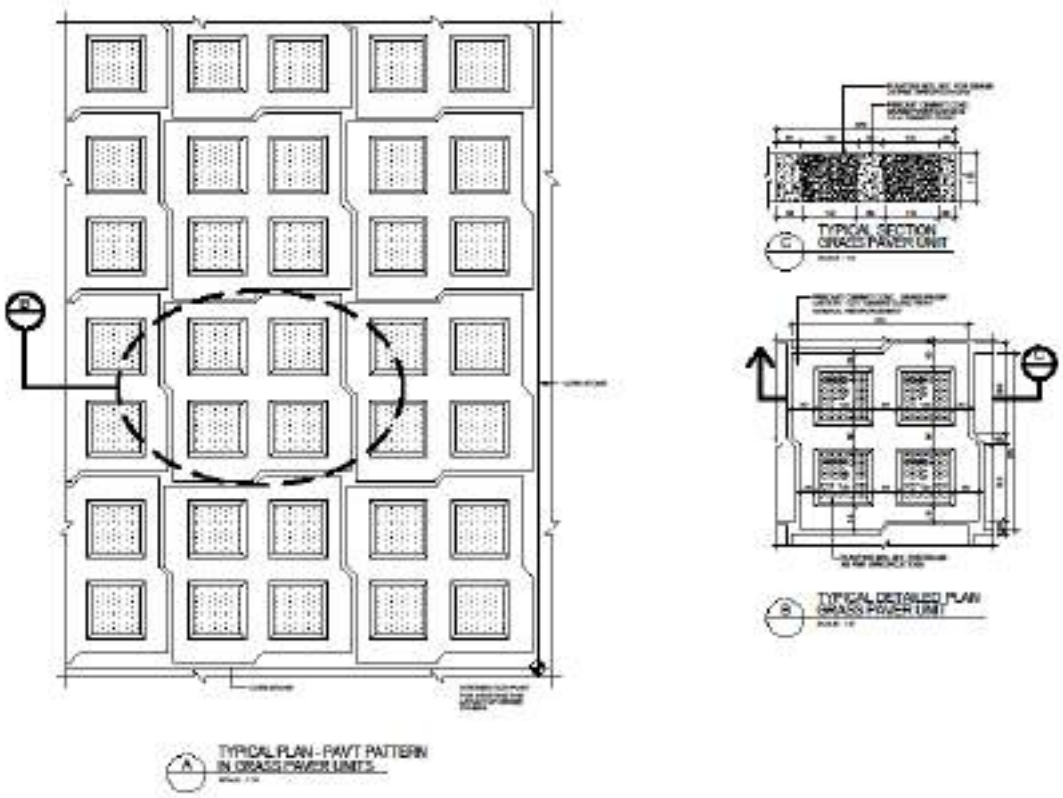
i. The Contractor shall protect all equipment, materials and completed work from damage until final completion of the work.

ii. The Contractor shall remove and replace damaged work at no extra cost.

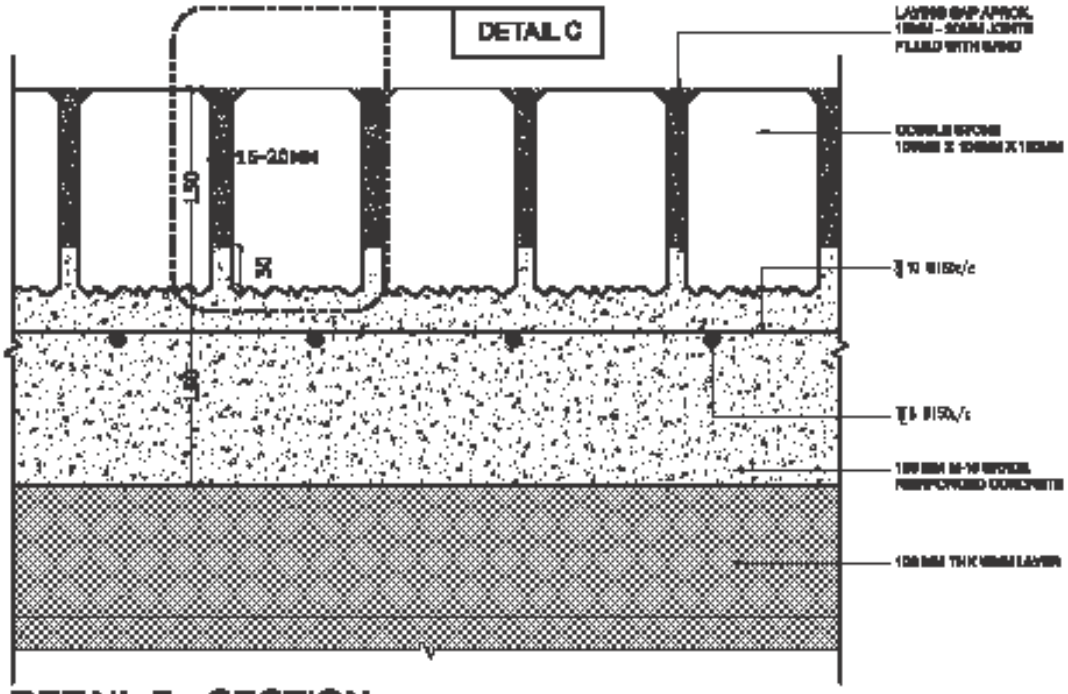
h. Reference Standards

i. The Contractor shall comply with all relevant Indian Standards, ASTM, British Standard Code of Practice, Draft BS or DIN Standard applicable to elements indicated in this section, the recommendations and requirements of such documents shall be considered a minimum standard of such work described and must be complied with.

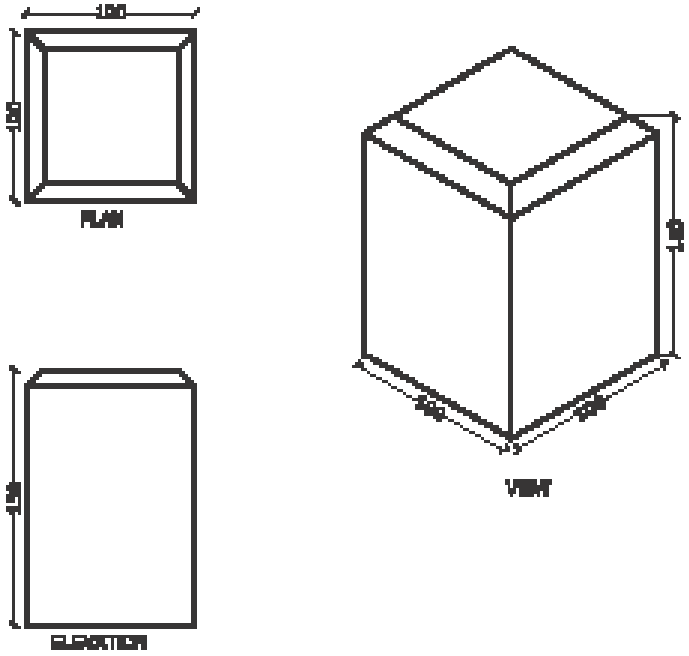
ii. Nothing shall relieve the Contractor of his responsibility for providing a higher standard than the relevant Code or Standard where it is required to comply with other sections of the Specification.


TYPICAL PLAN - PAVT PATTERN IN GRASS PAVER UNITS
TYPICAL SECTION GRASS PAVER UNIT
TYPICAL DETAILED PLAN GRASS PAVER UNIT

Sketch 1



DETAIL B - SECTION
SCALE 1:5

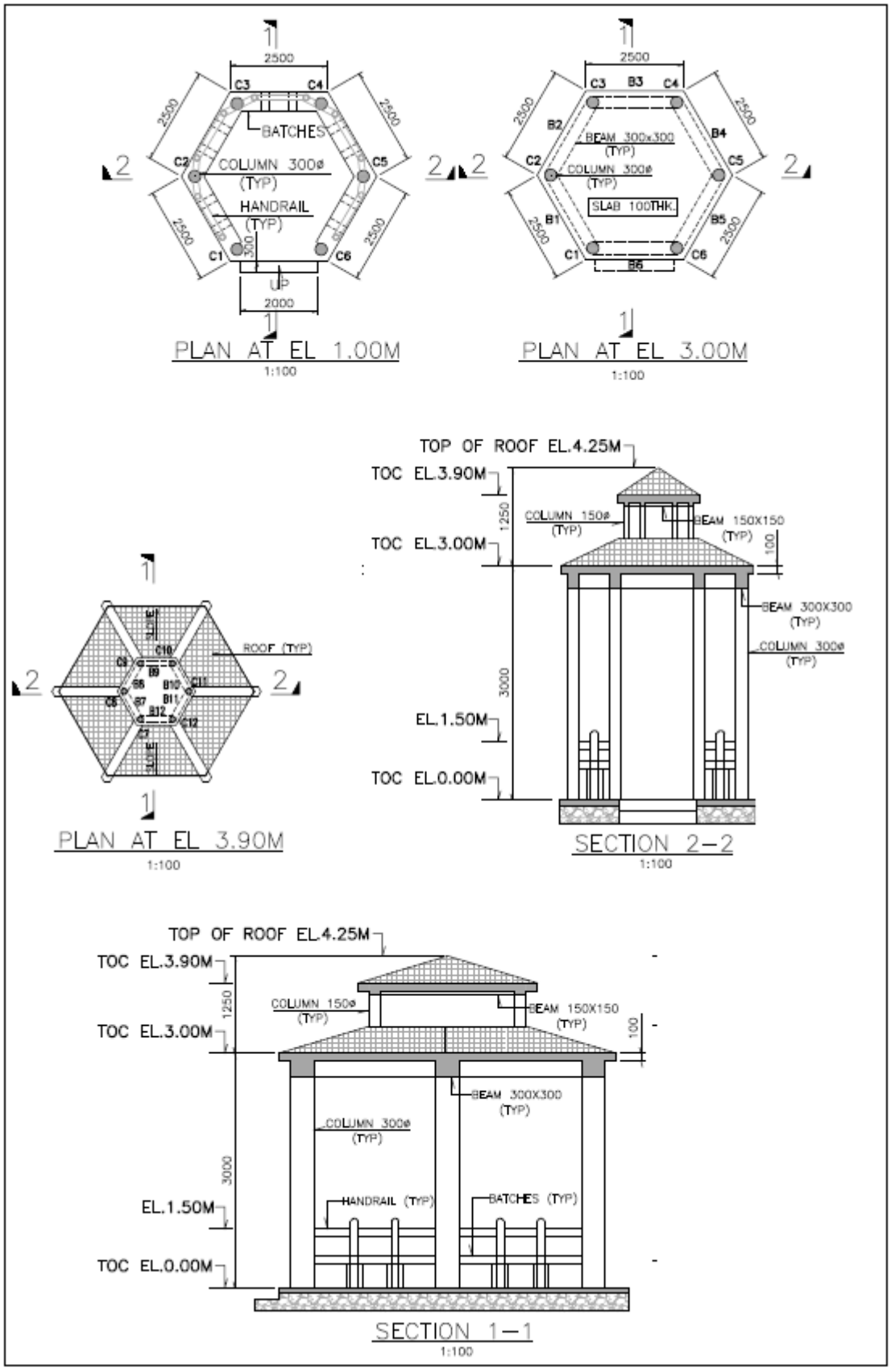


DETAIL C - EMBEDDED COBBLE
SCALE 1:5

Sketch 2

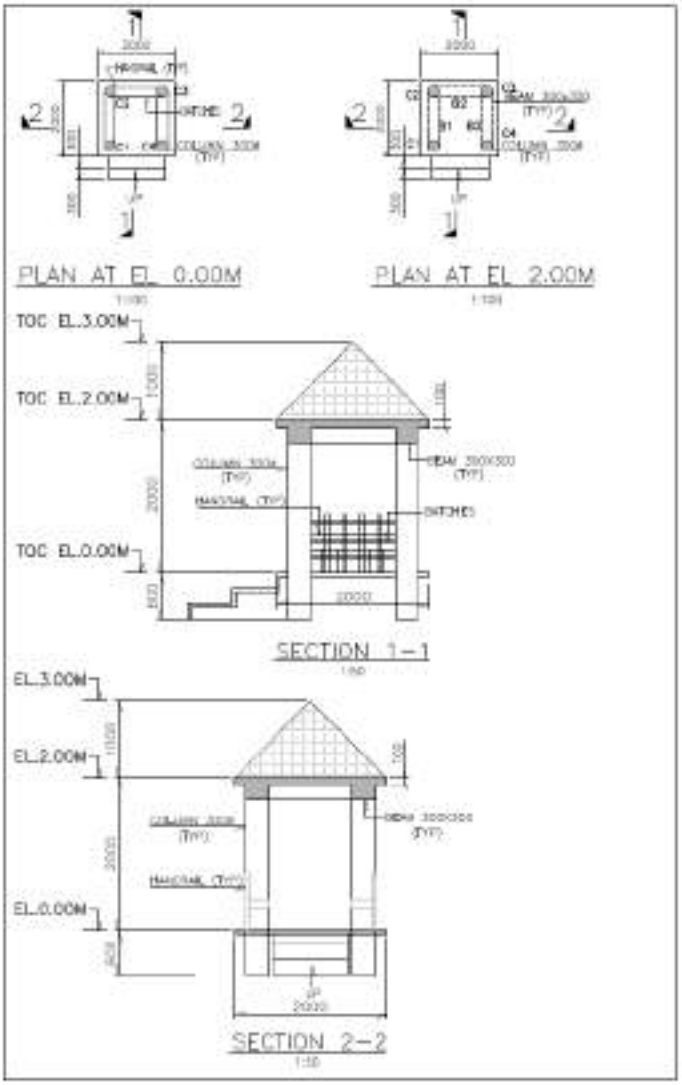
Sketch 3

Note: The architectural design shown in sketch 3 is conceptual and may change cultural representation, colour, texture, shape and size as per the Architect or Engineer-in-charge's design for a particular project.


2500
C3
C4
BATCHES
COLUMN 300ø (TYP)
HANDRAIL (TYP)
C2
C5
C1
C6
300
2000
PLAN AT EL 1.00M
1:100
B3
B2
B4
BEAM 300x300 (TYP)
SLAB 100THK.
B1
B5
B6
PLAN AT EL 3.00M
1:100
ROOF (TYP)
PLAN AT EL 3.90M
1:100
TOP OF ROOF EL.4.25M
TOC EL.3.90M
TOC EL.3.00M
EL.1.50M
TOC EL.0.00M
1250
3000
100
COLUMN 150ø (TYP)
BEAM 150X150 (TYP)
BEAM 300X300 (TYP)
COLUMN 300ø (TYP)
SECTION 2-2
1:100
HANDRAIL (TYP)
BATCHES (TYP)
SECTION 1-1
1:100

Sketch 3

Note: The architectural design shown in sketch 4 is conceptual and may change cultural representation, colour, texture, shape and size as per the Architect or Engineer-in-charge's design for a particular project.



Sketch 4

Sketch 5

Sketch 6

Sketch 7

Sketch 8

Sketch 9

Sketch 10

Sketch 11

Sketch 12

Sketch 13

Sketch 14

Sketch 15

Sketch 16

Sketch 17

Sketch 18

Sketch 19

Sketch 20

Sketch 21

Sketch 22

Sketch 23

Sketch 24

Sketch 25

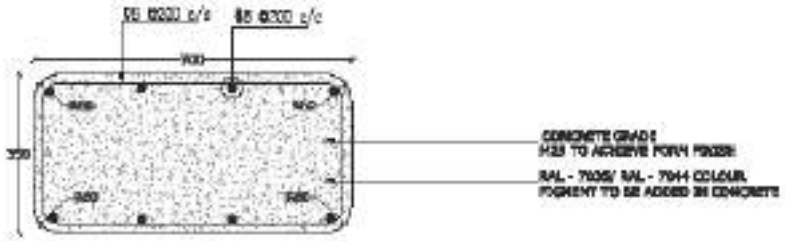
Sketch 26

Sketch 27

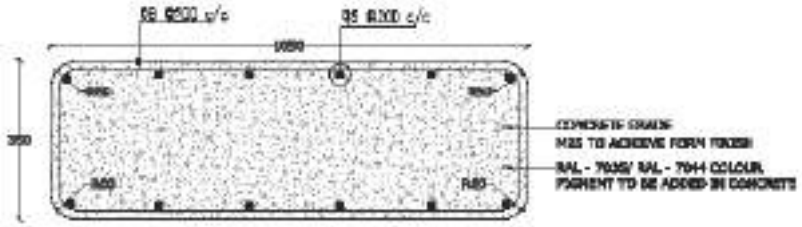
Sketch 28

3.0 RCC Bench

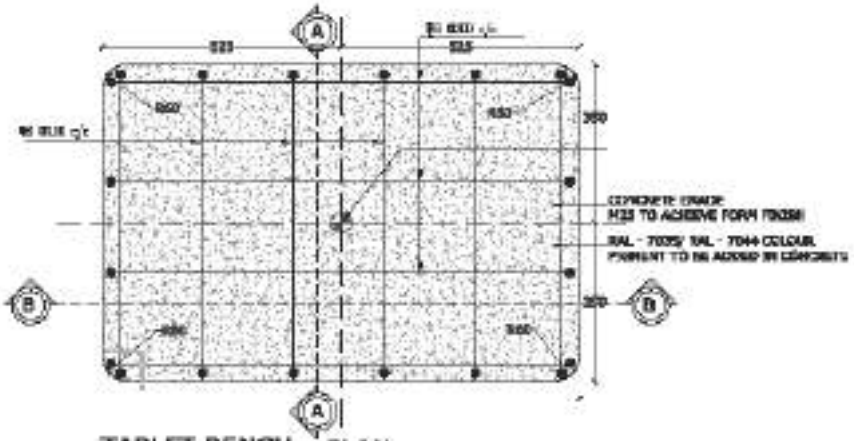
For specifications of reinforced cement concrete refer specifications for Concrete Works from Common and Building Works Vol.II of USOR 2013.



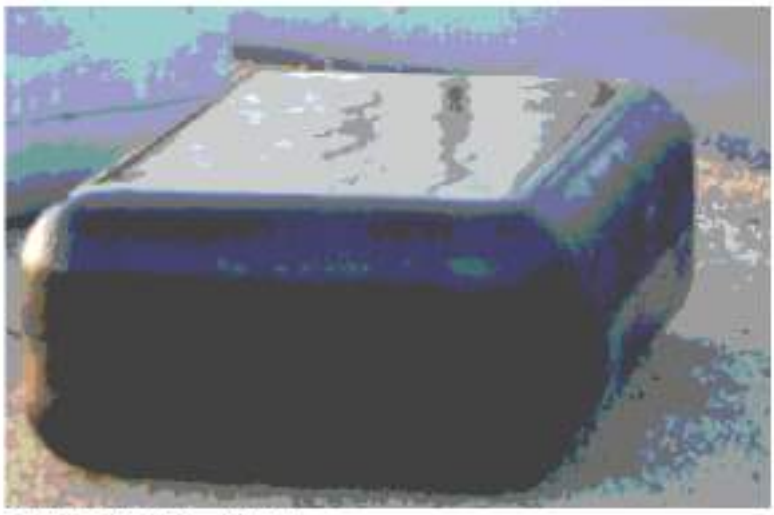
TABLET BENCH - SECTION AA



TABLET BENCH - SECTION BB



TABLET BENCH - PLAN



TABLET BENCH - VIEW

Sketch 29

4.0 STAMPED CONCRETE

This type of concrete flooring has an advantage that this flooring can be broadcasted to a new concrete and stamped to a required design. Wide varieties available of Stamped Concrete Flooring make it an ideal choice for all the diverse surfacing needs. Stamped concrete floorings is widely constructed at pathways, patios, swimming pool decks, parking decks and garden walk-ways. Neoflor Ultra Stampfloor is to be done in dry atmosphere at ambient temperature.

• Place the concrete (in civil contractor's scope) of appropriate grade and thickness depending upon traffic expected. After the concrete has been placed, floated and appropriate levels given (in the scope of civil contractor) Neoflor Ultra stamp powder of desired colour, is applied using dry shake method @ 5kg per sqm, after excess bleed water has evaporated. Neoflor Ultra stamp powder is light-fast UV resistant pigment with other appropriate chemical compounds.

• After Neoflor Ultra stamp powder has been applied and slick finished, Neoflor Ultra Release powder @ 200 gms per sqm, is applied prior to stamping. The release agent will keep the stamp tools from pulling up concrete and impart another color shade to the work. Texture skins are to be used to texture to the edge of the form boards to ensure complete texturing to the edge of the slab.

•Texturing continues down the edge of the form. The first mat laid is critical to the layout of the job as all other mats will be placed square to the first mat.

• Use tamper firmly to imprint the texture and pattern of the stamp into the concrete. Keep the stamps fitted tightly together to create neat grout lines. Protect the surface from falling dust, dirt etc. In case of summer, the surface has to be covered with plastic sheet (min. thickness 200 microns) and water should be poured on top to keep the surface cool.

• Allow the concrete to set after stamping for 1 - 4 days, before the excess release agent is pressure washed from the surface. After the slab is allowed to dry completely, two coats of UV-stable, NEOFLOR ULTRA SEALER 30% Solids Clear Sealer @ 150 ~ 250 gms per sqm are applied to the surface using a roller. The sealer protects the slab from staining and enriches the final color by amplifying the colors in the hardener and release agent. Protect the surface from falling dust, dirt etc. Allow pedestrian traffic after 72 hours.

The base concrete shall be paid seperately as per the type or grade of concrete from Concrete Works chapter from Common and Building Works Vol.II of USOR 2013..

Stamped Concrete Textures

Sketch 30

END.

Chapter - 4

GARDEN EQUIPMENTS AND ACCESSORIES

1.0 SCOPE

The scope of services covers all operations and services including, labour, equipment, services and transport for all materials, etc. completing the entire work within the scheduled time, maintaining the entire hardscaping work for one year after virtual completion of the work. For this chapter specification refer MCGM's Mechanical and Electrical department specifications.