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1 LANDSCAPE PLANTING

1.1 GENERAL REQUIREMENTS

1.1.1 Scope

1 General. Work covered under this section consists of furnishing all management, labor, equipment, materials, products and accessories necessary to perform all operations required for landscape planting herein specified.

2 Inclusive Work. Landscape planting is inclusive but not limited to rough and finished grading, the setting-out and staking of locations of all plant materials, planting beds and areas of turf, supplying and installing all plant materials in their correct locations, numbers, on-center spacing and extent, their care and maintenance immediately upon planting, the provision of warranties of installed work, the protection of installed and adjoining work and all the necessary for completing all planting operations in a workmanship like manner, according to the provisions of the Project Documentation. In addition, work shall be according to best industry practices and international standards in horticulture and landscape contracting.

3 Details. The illustrative details pertaining to this scope of work are in Appendix B and Appendix C. is illustratively provided as guidance for the minimum acceptable requirements. The Contractor shall execute his work using these as guidance and according to the design intent of the plans and drawings of the Contract's Project Documentation.

4 If the technology or material or specification are not mentioned in this section, modifications are permitted and shall be subjected to approval as mentioned in the introduction of QCS (00-02)

5 The purpose of QCS is to provide as a general technical guide for acceptable construction work practices in the State of Qatar, considering this; any addition for technology, material, specification, standard that are not mentioned in this section or their modification, shall be subject to approval as stated in the introduction of QCS (00-02)

6 Related Sections. The Contractor shall ensure full coordination with all other trades, disciplines and work onsite that relate to the following:

Section 6	Road works
Section 14	Roofing
Section 12	Earthworks Related to Buildings
Section 20	Drainage Works for Buildings
Section 21	Electrical Works
Section 27	External Works
Section 28	Landscape Irrigation

1.1.2 References

ANSI Z60-1, ...American Standards for Nursery Stock

BS 1377 .....Methods of test for soils for civil engineering purposes

BS 3936 .....Nursery Stock and Shrubs

BS 3998 .....Tree Work

BS 4043 .....Transplanting Trees

BS 4428 .....General Landscape Operations

BS 5236 .....Cultivation and Planting of Trees in the Extra Large Nursery Stock Category

Standard Plant Names, American Joint Committee on Horticultural Nomenclature (AJCHN)

Grade and Standards for Nursery Trees, Part II: Palms and Trees, Department of Agriculture, Florida, USA

Flora of Qatar. http://www.floraofqatar.com/

Iyad K Jubran and Danilo V Hizon. Landscape Plants in the Arab Gulf Countries, latest edition.

Mary Rose Duffield and Warren Jones. Plants For Dry Climates: How To Select, Grow, and Enjoy, latest edition.

Ross Clark. Specifying Trees: A Guide to Assessment of Tree Quality, latest edition. Nat Specs.

George E Post. Flora of Syria, Palestine and Sinai, American University of Beirut.

Sunset Western Garden Book, latest edition.

Tropica Color Encyclopedia of Exotic Plants and Trees, Alfred Byrd Graf

GE Rayment and FR Higginson. Australian Laboratory Handbook of Soil and Water Chemical Methods, latest edition. Inkata Press, North Ryde Sydney Australia

Royal Horticultural Society. The Complete Gardener's Manual, latest edition.

Royal Horticultural Society. RHS Encyclopaedia of Plants and Flowers, latest edition.

The Royal Horticultural Society. A-Z Encyclopaedia of Garden Plants, latest edition.

1.1.3 Quality Assurance

1 Compliance. Landscape planting shall conform to the relevant requirements of the respective standards, unless otherwise directed by the Engineer.

2 Experience. Landscape work must be undertaken by an experienced subcontractor specializing in landscape work. Work shall be performed and supervised at all times by qualified personnel.

3 Certificates. All landscape materials shall be shipped with certificates of inspection as required by the Engineer. Manufacturer's certified analysis for standard packaged products shall be provided.

4 Quality. Defective or unacceptable plant material shall be considered to be any tree, shrub or other plant that is:

(a) Dead, dying, damaged, non-vigorous in growth or otherwise defective upon completion of the works after six weeks or at the first leafing out, whichever is later.

(b) Asymmetrical in growth and deformed

(c) Slow rate of growth or stunting not typical of the species, three [3] months after planting

(d) Infested with pests, nematodes, fungi or with symptoms of viral or bacterial disease

(e) Not in accordance with the Project Documentation [e.g. not the specified size, not having the adequate numbers of breaks or branches, not having the minimum number of canes, not the specified species or cultivar]

1.1.4 Submittals

1 Catalogs. The Contractor shall submit catalogue data and literature of manufacturers and suppliers.

2 Manufacturers' and/or Suppliers' Certified Analyses. The Contractor shall submit manufacturer's certified analysis of all standard products and materials. The certificates of origin for all chemicals and pesticides should clearly state that the product is used in the manufacturer's country. Such analyses shall include quality certifications from independent third-party laboratories.

3 Product and Material Certificates. The Contractor shall submit certificates confirming the origin, size, age of all plant materials and that the same are free from insects and disease.

4 Authority Approvals. The Contractor shall ensure that all landscape materials, products and accessories for work under this Part, including irrigation water and its infrastructure, have the required authority approvals affixed.

5 Method Statements. The Contractor is to submit his method statements as required for work or parts of the work in this Part [eg. Plant moving, fertilizer application] for the approval of the Engineer.

6 Plant Procurement Schedules. The Contractor shall submit Plant Procurement Schedules within fourteen (14) days of the start of the Contract. This schedule shall identify the source of every plant species to be included in the Works and highlights which plants that must be imported due to non-availability in Qatar. The schedule shall be documented with the listing of names and locations of all nurseries, growers and plant material sources. The schedules are a guide and any departure from the guide needs to be justified on technical grounds that the species will thrive in Qatar.

7 Weekly Work Schedules. The Contractor shall submit a weekly work schedule for approval before work is started. The schedule shall identify tasks to be completed on a weekly basis and the anticipated schedule for completing the tasks. The Contractor will then modify and submit the schedule on a weekly basis identifying tasks completed, tasks to be completed, problems encountered and recommendations additional to a monthly report contains all the above in details.

8 Specimen Plants that are representative of the species, as so required by the Engineer shall be provided and planted to the required planting sizes and maintained onsite in a designated location as a reference benchmark of quality.

9 'As-Built' Record containing a true and accurate record of the work installed in drawings which record the locations, sizes and species of plants installed onsite. The 'as-built' record shall be in both editable electronic formats of CAD and PDF, including a legible hardcopy to the required number of sets in both A 2 and A1 formats. Any approved modifications to the original plans and drawings shall be clearly marked and tagged and be made an official part of the 'As-Built' Record.

10 An Operations and Maintenance [O+M] Manual is to be provided by the Contractor well organized into Sections or Volumes. Instructions shall be furnished for year-round care of installed plants to be followed by the Owner.

11 Format, Organization and Sets shall be as specified in Clause 1.15.2 Content and Coverage. As a minimum, the Manual will include the following:

(a) irrigation regime including water application rates and maintenance procedures

(b) fertilisation: including fertiliser descriptions, application rates and application schedule

(c) salinity control: including leaching methods and leaching program monitoring

(d) pesticide/fungicide/herbicide applications: including safety application rates, procedures, and schedules

(e) Turf grass management [e.g. mowing, aeration, topdressing thatch removal, rolling, over seeding, sprigging]

(f) propagation and seasonal replacement of all flowers and flowerbeds

(g) general maintenance: including pruning, stakes and ties, replacement and clean-up, protective fencing and grading

(h) equipment inventory: including maintenance procedures and manufacturer's maintenance manual

(i) Landscape maintenance personnel requirements for staff and field crews, their qualifications and job descriptions.

1.1.5 Job Conditions

1 Working in Parts to Completion. The Contractor shall proceed with and complete planting operations as rapidly as possible as portions of the Site become available, working within seasonal limitations for each type of landscape work required.

2 Adverse Conditions. No planting shall be carried out during periods of heavy rain, sandstorms, heavy winds, or during intense daytime heat. Plants and trees shall only be moved or planted between mid- September and mid-May.

3 Variance in Planting Times. When special conditions warrant a variance to the planting time and conditions, a proposed planting schedule shall be submitted to the Engineer for review and approval. In such cases, the planting will be installed at no additional cost and all conditions and obligations such as maintenance and warranty remain the same as specified herein.

4 Precedence of Planting

(a) Large Planting Stock First. Planting of palms, trees and shrubs will occur prior to planting of lawn turf grass and groundcover beds.

(b) Planting After Irrigation Installed. Planting shall not proceed without first having an approved and functional irrigation distribution network laid out, installed, tested and commissioned.

1.2 SHIPPING, DELIVERY, STORAGE AND HANDLING

1.2.1 Shipping and Delivery

1 Record of Deliveries. Logs of all materials and products shipped and delivered onsite shall be kept and accurately logged and maintained in an organized records of deliveries, containing details of items and delivery dates and times, including those which had been rejected for removal off the site.

2 Inspections

(a) Pre-Shipping Inspections. Prior to handling and shipping, all plants shall be inspected, tagged and labelled, dug, and made ready for transport in accordance with standard horticultural practices and procedures. The Engineer shall inspect all plants at the source prior to delivery to the Site. The Engineer shall be notified of the delivery schedules in advance so the plant material can be inspected upon arrival at the Site.

(b) Non-Waiver of Inspections. Inspections of plant materials prior to shipping does not constitute a non-waiver of inspections of the same upon delivery onsite.

(c) Rejected Deliveries Onsite. All delivered plant materials that have been deemed non-conforming and unacceptable shall be segregated and removed from the Site immediately. The Engineer reserves the right to reject any plant material that does not meet the quality requirements of the Project Documentation.

3 Protection While in Transit

(a) General. At all times, the Contractor shall protect plants to prevent damage to the root balls, containers, crown, branching structure and foliage. All plant material shall be delivered in a closed vehicle or in open vehicles with the load properly secured and covered in transit for protection from drying winds.

(b) Protecting Sod. Lawn grass sod in rolls shall be protected with light, vented fabric on transit to reduce the risk of drying and stress. If not already adequately moist upon harvest, lightly water the sod uniformly prior to transport to further extend its shelf life.

(c) Fertilizer, Pesticides, Fungicides and Chemicals shall be delivered to the Site in original unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, or trademark, origins, dates of manufacture or packing and dates of expiry. In lieu of containers, fertilizers and seed may be furnished in bulk packaging with accompanying notarized certificates indicating the relevant information with each delivery. Fertilizer and seed shall be kept dry and protected from contamination.

(d) Seed shall be delivered and stored in the supplier's original containers or packaging indicating botanical and common names, their certified purity percentages, germination rates and germination instructions.

4 Preparing Palms for Shipping and Transport. Palms selected for moving and transport shall be prepared and transported in the following manner. Transport shall be by covered truck and shall not exceed 24 hours from time of loading until arrival at the site. In general, Palms of solitary single-trunk habit shall be prepared, handled and transported in the following manner:

(a) Tag the palms to be dug-up and balled-out.

(b) Mark along the trunk with indelible ink or paint the north orientation of the palm's original growing condition.

(c) For solitary palms, prune offs any extraneous growth. Remove all suckers, all flowering and fruiting parts and approximately 30% of the outermost or lowermost fronds.

(d) Trim remaining fronds to 60% of original length, lift fronds to enclose and protect the growing tip. Wrap fronds in burlap cloth and securely tie in place.

(e) Saturate the entire root zone with water prior to excavation.

(f) Initially dig with hand tools vertical sided trenches around the root ball to a minimum depth of 750 mm, cleanly cutting roots no closer than 250 mm from the trunk. Dig and cut roots with clean, sharp cutting tools and equipment.

(g) Undercut roots at the base of the excavation, and carefully wrap the root ball with burlap and secure with wire mesh to contain soil and to avoid breaking the root ball. Water the wrapped root ball to keep it sufficiently moist.

(h) Lift the palm with a well-secured sling, fully supporting the root ball to avoid breaking it and avoiding any shock which may damage the growing bud.

(i) When the palms are to be shipped, gently place the palm horizontal on a level surface and tighten the wrapping and tying of fronds around the growing bud. At least two layers of burlap must be used.

(j) Periodically water the bur lapped root ball. Do not allow it to dry out and tear at any time.

(k) Do not damage the growth bud in any manner.

(l) Do not water the trunk of the palm.

(m) A bed of 150mm of moist organic soil shall be placed on the floor of the truck. The palms shall be hoisted by means of nylon or canvas slings and placed horizontally on the bed of the truck. They shall be laid carefully in an alternating fashion. Moist burlap shall be placed over the roots to keep them moist.

(n) The entire load shall be covered snugly with two [2] layers of tarpaulin when transported by open trucks or freight cars.

(o) The palms shall be secured in such a manner so as to prevent wind from lifting the tarpaulin and drying out the palms.

(p) On arrival onsite and if not to be planted directly in pre-prepared pits, the palms shall be unloaded to their designated acclimatization facilities, using nylon or canvas slings.

1.2.2 Storage

1 Records of Storage. Logs of all materials and products kept in storage onsite shall be kept and accurately logged and maintained in organized records of item inventory, quantities and containing details and delivery dates and times.

2 Protection and Storage of Plant Materials Onsite

(a) General. Plants shall be installed as soon as possible after delivery to the site. Plant materials shall be protected from exposure to wind and direct sunlight prior to installation. Plants not installed on the day of arrival shall be stored in shaded areas, protected from the wind and maintained and watered to good horticultural standards until planted. Care shall be taken to ensure that the sufficiently moist until planted in their final locations.

(b) Seed and Sprigs shall be kept in dry, cool storage away from adverse conditions and contaminants in areas as designated or approved by the Engineer.

(c) Lawn grass Sod. Store lawn grass sod in stacked rolls in pallets in a shaded, dry, cool protected area away from adverse conditions and contaminants in areas as designated or approved by the Engineer. If planting within eight [8] hours after harvest is not possible, cover the sod with light, vented fabric to reduce the risk of drying and stress.

3 Protection of Other Materials Onsite

(a) Bulk Materials. Soil, compost, other organic materials, and other mineral amendments supplied and delivered in bulk shall be delivered to the Site and stored separately in approved locations and in a manner to avoid wetting and contamination from sand, debris, weeds, weed seed and other materials until soil mixing operations commence.

(b) Packaged Products and Materials. Fertilizers, mineral soil amendments, compost in packaging, pesticides and other chemicals shall be delivered to the site in the manufacturer's or supplier's original unopened packaging or containers, each fully plants do not dry out. Plant shall be stored on site for more than 3 days prior to planting.

(c) Groupings. Root-balled and container-grown trees and all other plants shall be placed close together with root balls covered with approved soil mix or straw and kept sufficiently moist until planted.

(d) Bare-Rooted [BR] Plants. Any bare-rooted trees and shrubs shall be heeled into prepared trenches and covered with agricultural soil or approved soil mix and kept labelled, conforming to applicable regulations and bearing the trade name, production and expiry dates and warranty of the producer. All products if stored by the Contractor on-site shall remain his responsibility.

1.2.3 Handling

1 General. Prior to shipping, plants shall be treated with an approved anti-desiccant. Care shall be taken to avoid injury to plants.

(a) Moving. Plant materials shall not be dropped from vehicles nor rolled down slopes. Container grown plants shall be handled by the container.

(b) Lifting. Plants shall not be handled by the trunk or stem, with the exception of large trees and date palms to be lifted by crane using purpose-made slings and harness.

(c) Root Protection. Balled-and-bur lapped [BB] plants shall be handled carefully to avoid cracking or breaking the root ball, tearing of burlap wraps or damaging any other part of the plant.

Prior to moving, root balls of trees and large shrubs that are not container grown shall be pruned and wrapped in burlap [BB] with hessian or jute bands of 750mm width. Wrap the bands with overlaps and securely tie.

Root systems of all plants shall not be allowed to dry out at any time and shall not be exposed to excessive heat.

(d) Pruning, Palms. Prior to moving and harvesting of palms, prune off approximately thirty [30%] percent of the mature fronds.

(e) No Pruning, Trees and Large Shrubs. Prior to shipping from source to the site, do not prune trees and large shrubs to be harvested and moved. Protect plants to retain their symmetrical form.

2 Vines and Climbers shall be handled such that their branches and foliage remain upright and that their supporting stakes shall be kept in place and unbroken in their original containers without damaging their root balls, until the time of planting.

3 Law grass Sod. Unless otherwise specified in the Project Documentation, sod shall supplied in rolls shall be in stacked in pallets no more than 5 roll high. Stacking shall be such that each layer above is in a perpendicular row to it. Sod rolls or in pallets shall not be dropped from vehicles or rolled down slopes.

Handle delivered sod such that sod is installed within eight [8] hours of harvest.

4 Chemicals [e.g. pesticides, fungicides, anti-desiccants, protective paints] shall be handled in a manner to avoid leaks and cross contamination. No measuring, mixing or work of any kind shall be permitted within the storage area and such shall be handled according to industry-standard safety protocols with the right safety apparel, tools, equipment and environmental conditions by adequately trained personnel.

5 Expired Material. Products [e.g. chemicals, fertilizers, soil amendments] shall not be used in the project and shall be monitored and clearly segregated from the rest in storage to be removed immediately from the site. Logs of expired and about-to-expire [e.g. within three (3) months of expiry] products and materials shall be kept and maintained.

6 About-to-Expire Material. Products that have an indicated shelf life that are due to expire within three [3] months from the date of intended delivery or the date of delivery shall be considered expired and shall be rejected.

7 Original Packaging. Prior to disposal off the site, any original bags, packaging or containers of used products and materials [e.g. fertilizer, chemicals, soil amendments] shall be temporarily and neatly stored in a designated location with labels intact for the purpose of inspection by the Engineer to verify measurement or re-measurement of quantities consumed for the project.

1.3 PRODUCTS AND MATERIALS

1.3.1 GENERAL REQUIREMENTS

1 General Requirements for Plants

(a) Certified True to Type, Species and Cultivars. All planting stock and turf material shall conform to the varieties specified or shown in the Project Documentation and be certified and guaranteed to be true to species and cultivar as to botanical names in established and widely accepted publications and the international horticultural trade. Any synonyms shall be checked with the Engineer.

(b) Substitutions shall only be made when a plant, or alternative as specified, is not commercially or practically obtainable and the Engineer authorizes a change order providing for use of the nearest equivalent obtainable.

2 **Sourcing From Similar Growing Conditions.** Plants shall be supplied from localities similar to the climatic conditions of the Project and be grown in those conditions for 9 months, a minimum of one [1] complete growing season.

3 **Acclimatization**. Plants delivered onsite requiring acclimatization to adjust to local growing conditions shall be according to acclimatization protocols and procedures in adequate nursery facilities and in accordance with the Contractor's Method Statements approved by the Engineer.

1.3.2 PLANT MATERIALS

1 Sources. Only nursery grown plants shall be provided from certified sources, except for certain palm species which may also be sourced as field-grown, also from certified sources.

2 Planting Stock, in General

(a) Quality, in General. Plants to be used in the works shall be sufficiently established in their containers, free of objectionable disfigurement, well-branched, well-formed planting stock of symmetrical growth typical of the species. They shall be vigorous, free from disease, sunscald, windburn, abrasions, harmful insects or eggs, Plant structure shall be well balanced, with adequate branching, upright and self-supporting.

(b) Planting stock shall be in accordance with NATSPEC 0253/0255, Landscape Plants Trees and Supply.

(c) Root Systems. All planting shall have normal healthy, well developed and intact root systems and are not root-bound in their containers. The Engineer shall reject any plant that is root bound. All costs of repotting will be the Contractors responsibility.

(d) Acclimatization. Plants which are provided in pots or other containers and which have been acclimatized to outside conditions are acceptable, provided they are equal in quality to field grown stock.

3 Palms and Palm-Like Plants

(a) General. Palms and plants of palm-like habit shall have straight parallel sides and healthy trunks that are not rotted, infected nor deformed pests or disease. Root systems shall not extend above the ground level which the palm was originally planted. Palms should have a vigorous root system, a vigorous growing bud, a crown of new fronds, the fronds of the color of an adult palm. Palms shall be balled-and-bur lapped [BB], unless otherwise specified as container-grown.

(b) Palms, Solitary. Palms or palm-like plants [eg. Ravenala] specified as solitary palms shall have straight trunks that are free of deformities, bends and extraneous suckers. Palms shall have intact and vigorous growing buds.

(c) Palms, Clustering. Palms specified for their special effects for their natural clustering, multi-stem habit shall have the minimum number of five [5] mature stems or canes, roughly of the same heights. All stems or canes shall have vigorous growing buds.

(d) Palms with Special Effects. Solitary palms grown for special effects [e.g. bent palms] shall conform to the specifications for solitary palms and as specified in the Project Documentation.

(e) Measurement: Clear Brown-Trunk [CBT] Height. Palms shall generally be measured as clear brown-trunk height which shall be the height measured from the original nursery growing line to the base of the lowermost mature fronds. Height artificially gained by the removal of fronds shortly before measurement to gain CBT height shall not be considered in measured height.

(f) Sizes, Solitary Palms. Unless otherwise specified in the Plant Materials Schedules of the Project Documentation, the minimum height of solitary palms shall be 2.50m CBT.

(g) Measurement Tolerances: Palms as Avenue Planting. Solitary palms arranged as avenue planting or in formal clusters shall have tolerance of heights within +/- 150mm in CBT heights.

(h) Measurement Tolerances: Palms as Informal Clusters. Solitary palms arranged in informal or random clusters may be of perceptibly varying CBT heights as indicated in the Plant Materials Schedules of the Project Documentation. Unless otherwise indicated, variance can be within 2-4 meters.

(i) Measurement Tolerances: Multi-Cane Clustering Palms. Such naturally clustering palms [eg. Chrysalidocarpus, Rhapis] shall have mature canes within +/- 150mm in cane heights.

4 Trees

(a) General. Trees shall be either balled-and-bur lapped [BB] or container-grown. Deciduous and evergreen trees shall have a single main trunk with a single leader and a minimum number of four [4] main branches or breaks, of vigorous growth, well-balanced crowns, symmetrical in habit and display no damaged bark, cross-over branching nor weak crotches.

(b) Species and sizes shall be according to the Plant Materials Schedules of the Project Documentation.

(c) Avenue or Street Trees. Trees shall meet the general requirements as [1] above. In addition, it shall have a clear un-branched trunk height of two [2.0] meters from finish paving level to allow unobstructed passage of pedestrians and bikers.

(d) Trees with Special Effects. Any trees intended for special effects [e.g. oversized trunks, gnarled branching, and buttress roots] shall also meet the applicable requirements for trees in general. In addition, these shall meet the intended character as shown in reference images in the Project Documentation and/or the suppliers' product catalogs and literature.

(e) Measurement, in General. Tree heights shall be measured from the original nursery growing line to the tip of the highest branch. Heights and trunk caliper diameters shall be according to the Plant Materials Schedules of the Project Documentation.

(f) Measurement Tolerances. Tree heights of the same species shall be within +/- 150 mm variance in heights.

5 Shrubs

(a) General. These are grown and supplied either as balled-and-bur lapped [BB] or container-grown plants. Shrubs shall be new-season stock having been transferred to the current container size a minimum of twelve [12] weeks prior to inspection at the nursery.

(b) Unless otherwise specified, shrubs shall be a minimum number of four [4] branches or breaks or canes, depending on habit, of well-balanced vigorous growth, symmetrical in habit typical of the species or cultivar, free of pests, disease, damage or stunted growth.

(c) Shrubs: Woody Perennials. These shall be woody perennials of generally multi-stemmed bushy habit supplied to planting heights ranging from 500mm to a maximum of 4,500mm.

(d) Shrubs: Clumping Perennials. These shall be either of semi-woody or herbaceous growth, of clumping dense habit [eg. large ornamental grasses, sedges], growing naturally taller than groundcovers supplied to planting heights ranging from 500mm to a maximum of 800mm.

(e) Shrubs as Small Trees. Shrubs supplied to planting heights of 3,000-4,500mm are also considered small trees, whether of 'standard' form or multi-branched.

(f) Shrubs as 'Standard' Form. These are shrubs grown and supplied with a strong, straight main trunk in the manner of trees to heights of 3,000-4,500mm, unless otherwise specified.

(g) Shrubs as Hedges. These shall be of the same species, of the same approximate heights and spreads.

(h) Shrubs for Special Effects. These are shrubs grown and supplied with special effects [e.g. oversized bonsai, topiary] to heights of 3,000-4,500mm, unless otherwise specified.

(i) Shrubs as Groundcovers. In cases where plants of shrub habit are used as groundcover planting, these shall be categorized and measured as groundcovers.

(j) Measurement, in General. Shrub heights shall be measured from the original nursery growing line to the average height, and not from the longest stem or branch. Heights and stem caliper diameters shall be according to the Plant Materials Schedules of the Project Documentation.

(k) Measurement Tolerances. Heights of shrubs shall be within +/- 100 mm variance in heights.

6 Vines and Climbers

(a) General. These shall be woody perennials of generally multi-stemmed, vigorous, dense climbing habit supplied to planting heights ranging from 500mm to a maximum of 1,500 mm grown and supplied either as balled-and-bur lapped [BB] or container-grown plants.

Vines shall be new-season stock having been transferred to the current container size a minimum of 12 weeks prior to inspection at the nursery.

Unless otherwise specified, vines shall be a minimum number of four [4] branches or breaks, well-balanced vigorous growth, symmetrical in habit typical of the species or cultivar, free of pests, disease, damage or stunted growth.

(b) Support. Vines shall be supplied with sturdy, supporting stakes to achieve an upright growth. Staking supports shall not come loose nor shall plant growth anchored to supports show damage to stems, foliage and root balls.

(c) Measurement, in General. Vine heights shall be measured from the original nursery growing line to the average height, and not from the longest stem or branch. Heights and stem caliper diameters shall be according to the Plant Materials Schedules of the Project Documentation.

(d) Measurement Tolerances. Heights of vines shall be within +/- 100 mm variance in heights.

7 Perennial Groundcovers and Seasonal Annuals

(a) Perennial Groundcovers in General. These shall be perennials, of woody or herbaceous growth lower than shrubs, creeping, prostate or clumping in habit supplied and installed well-established in their containers and provided with the required number and length of runners or breaks appropriate for the size specified.

Groundcovers are generally low in height, growing naturally to 500mm or less planted for the purpose of mass planting to cover bare soil.

(b) Seasonal Annuals in General. These shall be summer or winter annuals of herbaceous growth, creeping or clumping in habit supplied and installed well-established in their containers and provided with the required number and length of runners or breaks appropriate for the size specified.

Annuals are generally low in height, growing naturally to 500 mm or less planted for the purpose of mass planting for seasonal colour to cover bare soil.

(c) Groundcovers and Annuals shall be new-season stock having been transferred to the current container size a minimum of twelve [12] weeks prior to inspection at the nursery.

Unless otherwise specified, groundcovers and annuals shall be a minimum number of four [4] branches or breaks or canes, depending upon habit, of well-balanced vigorous growth, symmetrical in habit typical of the species or cultivar, free of pests, disease, damage or stunted growth.

Groundcover plants shall be of the species, sizes, and planted to on-center spacing as shown in the Plant Materials Schedule of the Project Documentation, sufficient to cover fully the designated area as shown and intended on the drawings.

(d) Sizes, in General. Unless otherwise specified, groundcovers and annuals shall be 100mm diameter containers and to the heights indicated in Appendix C, Plant List, Spacing and Sizes.

(e) Sizes, Annuals. Unless otherwise specified, annuals shall be supplied in planting sizes of a minimum 100mm high, in 100mm diameter containers and with at least four [4] flowers.

(f) Measurement, in General. Heights shall be measured from the original nursery growing line to the average height, and not from the longest stem or branch. Heights shall be according to the Plant Materials Schedules of the Project Documentation.

(g) Measurement Tolerances. Heights shall be within +/- 20 mm variance in heights.

8 Lawn grass Turf

(a) General. These shall be lawn grass species of perennial habit, supplied either as plugs, sprigs or sod as approved by the Engineer according to the Project Documentation. Growth shall be vigorous, fresh, with a well-matted root system and typical of the species and cultivar. Turf material of whatever type shall be from an approved source with a certification of species.

Plugs and sod shall have clean-cut edges, a well-formed soil layer adhering to the root zone, free of disease, pests and die-back and damage. The adhering soil shall be free from gravels, debris and other deleterious material.

(b) Quality and Sizes, Plugs. Plugs shall be supplied as well-established growth obtained from heavy, dense turf. Otherwise, plugs that are container grown shall be in sizes of 12 plugs per tray.

If taken from sod, plugs shall be cleanly and sharply cut from existing sod. Plugs shall either be round or square, a minimum of 50mm square to a maximum of 100mm square.

(c) Quality and Sizes, Sprigs. Sprigs shall be loose green growth of grass stolon's or rhizomes, obtained from heavy and dense turf, free from weeds. Sprigs that have been exposed to heat and excessive drying will be rejected.

Sprigs shall be a minimum of 75 mm to a maximum of 150 mm length for each stolon. Each stolon shall have a minimum of well-formed nodes. If planted other than by broadcast, a minimum of three [3] stolon's shall be planted in each planting hole in a triangular pattern.

(d) Sod

(i) Sod Size. Unless otherwise specified, sod rolls for either hand or palette-stacking shall be harvested and transported in nominal minimum size of 450 mm width X 2,000 mm long, with a nominal roll diameter averaging 300mm. Edges of sod shall be cut truly parallel, ensuring uniform dimensions.

(ii) Sod Age. Sod shall be from a certified source, strongly rooted of no less than two [2] years old and no more than seven [7] years old.

(iii) Sod Mow Height, Sod Thickness. Mowing height of the growing turf layer shall be a minimum 38mm and maximum of 64mm. Thickness of sod, including its live growth, intact root zone and soil portion shall be a minimum 50mm. In no case shall the soil portion of the sod be less than 16mm.

(iv) Roll Weight. Each roll of sod shall weigh between a nominal 15.85kg to 20.50kg depending on moisture content.

9 Accent Plants

(a) General. These shall be any of a variety of palms and palm-like plants, trees or shrubs indicated in the Plant Materials Schedules of the Project Documentation intended as accent planting for their special effects.

(b) Palms and Palm-like Plants as Accents. Refer to Clause 1.3.2.3, for general requirements, and specifications.

(c) Trees as Accents. Refer to Clause 1.3.2.4 for general requirements, and Specifications.

(d) Shrubs as Accents. Refer to Clause 1.3.2.5, for general requirements, and specifications.

10 Minimum Acceptable Sizes.

(a) The minimum acceptable sizes of all plants measured before pruning in normal position shall conform to the measurements specified in the Project Documentation. Unless otherwise specified, minimum acceptable sizes shall be as indicated in Appendix A, Plant List, Spacing and Sizes. Plants larger in size than specified may be used with the approval of the Engineer, at no extra cost.

11 Plant Materials Schedules. The Project Documentation shall include well-organized Plant Materials Schedules. Such schedules are to be provided listing the designated plants with the following basic information:

(a) Botanical Name, with the specific cultivar

(b) Common English Name, and Common Arabic name [if available]

(c) Quantity, in units or square meter as applicable

(d) Size [e.g. height, calliper diameter of trunk at breast height, container size, number of breaks or branches or runners]

(e) On-centre spacing, in mm

(f) Peak irrigation water demand, in litters per day [lpd.]

(g) Additional Pertinent Data

1.4 ACCESSORIES IN GENERAL

1 Samples and Technical Literature. The Contractor shall submit samples of materials for approval not necessarily limited to the following. For standard products, samples shall be accompanied with the manufacturer's analysis or technical literature containing application rates, installation methods or other related information shall be acceptable.

For all other materials, technical literature is to be provided by recognized, independent third-party laboratories for the following, as applicable:

(a) Pesticides, Fungicides

(b) Mulch, Inorganic [e.g. stone aggregate, sintered slag, site-reclaimed aggregate]

(c) Mulch, Organic [e.g. wood chips, bark mulch]

(d) Gravel drainage aggregate

(e) Geotextile soil separator

(f) Root barriers

(g) Pruning Paint

(h) Tree wound sealer

(i) Conventional anchoring, palms and trees [eg. wood stakes, guywires, guying cables, turnbuckles, rubber hose chafing guards]

(j) Alternative anchoring systems, palms and trees

(k) Temporary shade planting screens

(l) Edging and restraints

(m) Labels

(n) Irrigation water

1.4.2 Mulch, Inorganic

1 General. These shall be any granular material applied as a top-dressing finishing surface, loose laid, either as a decorative finishing, as a means to reduce evaporation loss of water in planting pits or beds and to protect soil from sunbaking. Mulch shall be any of the following, from approved sources as project conditions require and indicated in plans and details of the Project Documentation approved by the Engineer.

2 Availability of Sources. Confirm in writing that the mulches are commercially available to the sizes and quantities required in the Project Documentation. This confirmation shall be submitted at the time of submittal of samples for approval.

3 Substitutions. Types and colors of mulches can only be changed with the Engineer's written approval and acceptance of a product supported by its own technical data sheets and has a proven record of having been used in similar conditions.

4 Depths of Layers. Mulches shall be applied to the depths specified in the plans and drawings of the Project Documentation. Unless otherwise specified, depth of mulch layer shall be a minimum 100mm.

5 Stone Mulches. These vary in size and texture to include natural stone pebbles, gravels and cobble. Stone mulches shall be dimensionally stable as to not readily crumble nor disintegrate.

(a) Pebbles, Size Range. These are rough or smooth granular aggregate ranging in size from 2mm-15mm diameter, of the colour or colour mixes as specified in the plans and drawings.

(b) Gravels, Size Range. These are rough or smooth granular aggregate ranging in size from ≥15mm to 50mm diameter, of the colour or colour mixes as specified in the plans and drawings.

(c) Cobble, Size Range. These are rough, smooth or polished granular cobble ranging in size from ≥50mm to 90mm diameter, of the colour or colour mixes as specified in the plans and drawings.

6 Lightweight Expanded Clay Aggregate [LECA]. These shall be rounded, dimensionally stable porous clay aggregate, of horticulture-grade that meet the size ranges for natural stone pebbles and gravels as indicated in the plans and drawings. Colour shall be in hues of red as typical of LECA.

7 Sintered Slag. These shall be granular, dimensionally stable furnace slag that meet the colour or colour mix and size ranges for natural stone pebbles and gravels as indicated in the plans and drawings.

8 Recycled Glass Chips. These shall be dimensionally stable, recycled, decorative glass chips that meet the colour or colour mix and size ranges for natural stone pebbles and gravels as indicated in the plans and drawings. Chips shall be tumble-processed to have well-worn edges.

9 Site-Reclaimed Aggregate. These shall be dimensionally stable, reclaimed aggregate consisting of crushed and graded concrete removed from demolished pavements, structures or landscape work, for reuse as approved in writing by the Engineer. Colour or colour mixes and size range for such shall be as for natural stone pebbles, gravels and cobble as indicated in the plans and drawings. Site-reclaimed aggregate shall be supplied well-graded and free of earth clods, dust and sand particles, debris and other deleterious material.

10 Recycled Rubber Mulch. These shall be dimensionally-stable shredded rubber chips, recycled from used car tyres, meeting the following specifications:

(a) Size Range. Unless otherwise indicated for custom sizes as indicated in the plans and drawings, size range of chips shall be either 4mm-15mm, or 20-60mm.

(b) Colour Range. Unless otherwise indicated for custom colours and colour mixes as indicated in the plans and drawings, colours shall be red or green.

(c) Environmental Heat Tolerance. Manufacturer shall confirm that mulch shall remain dimensionally stable, without softening, melting nor agglutinating under prolonged exposure to a temperature of 60C.

11 Separation of Materials. As indicated in the plans and drawings of the Project Documentation, differing types of mulches and colours shall be physically separated to maintain decorative patterns as in the intent of plans and drawings.

(a) Soil Separation Fabric. Where indicated in the plans and drawings, layers of mulch shall be underlain by a pervious geotextile as a soil separator fabric to prevent loss of material mixing with the overlain subgrade.

(b) Edging and Restraints. Where indicated in the plans and drawings, restrain edges of beds of mulch to the requirements of Clause 1.4.10, Edging Materials.

1.4.3 Mulch, Organic

1 General. These shall be any granular material applied as a top dress finishing surface, loose laid, either as a decorative finishing, as a means to reduce evaporation loss of water in planting pits or beds and to protect soil from sunbaking. Mulch shall be any of the following, from approved sources as project conditions require and indicated in plans and details of the Project Documentation approved by the Engineer.

Mulch shall not easily crumble nor flake. Colors shall be fast and non-bleeding.

2 Size Range. Organic mulch shall have the following sizes, unless otherwise specified:

(a) Length 10mm-60mm

(b) Width 10mm-50mm

(c) Thickness 3mm-15mm

3 Bark Mulch shall be to the colors or color mix and size range for the written approval of the Engineer.

4 Wood Chips shall be from pine, colored and treated with an organic, non-toxic coloring agent. Submit samples for the Engineer's approval.

5 Depths of Layers. Mulches shall be applied to the depths specified in the plans and drawings of the Project Documentation. Unless otherwise specified, depth of mulch layer shall be a minimum 100mm.

1.4.4 Geotextile Soil Separator.

1 For use as soil separator between mulch layers and subsoil shall be water-permeable, non-woven, needle-punched fabric to the thickness indicated in the plans and drawings of the Project Documentation.

1.4.5 Gravel Drainage Aggregate

1 for use as subsurface drainage layer beneath the bottom of tree pits and planting beds shall be dimensionally stable, non-porous granular material that does not easily flake nor crumble. Aggregate shall be as specified in the plans and drawings of the Project Documentation.

(a) Size Range. Unless otherwise specified, size shall be 15mm-50mm diameter.

(b) Depth of Layer. Unless otherwise specified, the minimum depth of gravel drainage layer shall be 150mm.

1.4.6 Root Barriers

1 1 General. Root barriers shall be any manufactured durable, dimensionally stable material or product that can withstand prolonged buried conditions in the soil to deflect the growth of tree roots away from foundation structures and buried utility lines. Their installation shall allow percolating groundwater to seep through the surrounding subsurface, but allows no roots to pass through the material due to the inherent impermeability of the material itself.

2 Samples, technical Literature. Submit samples with related technical literature, according to the design intent of the Project Documentation, for approval by the Engineer.

(a) Applicable Conditions. Unless otherwise indicated in the design intent of the Project Documentation, install root barriers within tree pits whose centers are within 1.5 meters horizontal distance from the edge of structural foundations, subgrade structures and utility services and pavements.

(b) Impermeable Root Barriers shall be modular in construction, either of injection-molded or extruded UV-resistant, recyclable polypropylene [PP] or polyethylene [PE] plastic. Unless otherwise specified, panels are to be 600mm width with a mini-mum 2mm thickness.

(c) Permeable Root Barriers are to be used only in special conditions as approved by the Engineer. These shall allow percolating groundwater to pass through, but shall have surface properties that deflect the growth of tree roots.

(d) Unless otherwise specified in the Project documentation, these shall be geotextile of approved thickness, having a durable, uniform coating of copper sulphate on the root-deterrent side.

1.4.7 Pruning Paint

1 Shall be any horticulture-grade paint used to field-mark mark plants for pruning or removal. Use color-coded paints as approved by the Engineer to indicate priority of action [e.g. pruning, removal].Submit samples and literature for the Engineer’s approval.

2 Pruning paint shall not be used in lieu of tree wound sealer.

3 Tree Wound Sealer shall be any horticulture-grade sealer applied directly to pruned cuts to inhibit bacterial, viral or pest infestation. Submit samples and literature for the Engineer’s approval.

1.4.8 Guys, Stakes and Supports

1 Conventional Staking and Supports, Planting On-Grade. Unless otherwise specified, staking and supports for planting on-grade shall be the acceptable minimum, using any or a combination of the following:

(a) Stakes, Wooden. Stakes in general for tree support shall be rough sawn wood, free from knots, bends, warps, rot, cross grain, or other defects that impair their strength. Stakes shall be treated with pentachlorophenol or other approved non-injurious green preservative.

(b) Bracing, Wooden. Bracing stakes shall be a minimum of 50 mm X 50 mm X 2,400 mm long, pointed at one end.

(c) Ground Stakes, Wooden shall be a minimum of 50 mm X 50 mm X 900 mm long, pointed at one end.

(d) Guywire shall be 2.7 mm annealed galvanized steel wire.

(e) Guying Cable shall be a minimum of five [5] strand, 2.76 mm diameter cadmium-plated galvanized steel cable.

(f) Hose Chafing Guards shall be new 2-ply reinforced rubber or plastic hose and shall be of the same color for the entire Project. The length of hose chafing guards shall be 1½ times the circumference of the plant at its base.

(g) Twine for tying shall be lightly tarred medium or coarse stranded, sisal yarn.

(h) Deadmen Anchors. Guywires or guying cables shall be securely fastened to any suitably weighted anchor [e.g. concrete, steel]. Deadmen shall be placed buried in planting pits that do not obstruct the root ball.

(i) Flags for safety shall be fastened to each of the guys and be of UV-resistant white or yellow surveyor's tape.

2 Guying and Supports, Planting over Structural Slabs and Surrounding Pavements. As project conditions require, staking and supports for planting in conditions other than on-grade, shall ensure that any guywires or guying cables are securely anchored to well-placed eyebolts embedded into the surrounding concrete pits.

3 Guying and Supports, Planting In Large Containers. As project conditions require, staking and supports for planting in large containers, whether on-grade or over structural slabs, shall ensure that any guywires or guying cables are securely anchored to well-placed eyebolts integrated into the manufacturer's supplied containers.

4 Other Alternative Support Systems. As project conditions require, alternative support systems, whether proprietary or bespoke, shall be as specified in the details of the Project Documentation. Submit samples with product literature for the Engineer's approval.

5 Temporary Shade Planting Screens, unless otherwise specified in the Project Doucmentation, shall be typically 1750mm tall of monofilament high-density polyethylene [HDPE] fabric, having a shading density of 75%. Support screens by stakes as indicated in the plans and drawings.

1.4.9 Edging and Restraints

1 Edging and Restraints shall be either galvanized steel, polyethylene, electrostatically painted aluminum to the specified finishes, colors or other suitable parameters used as industry standard and as approved by the Engineer. The material shall be to the sizes and radii dimensioned in the drawings. Edging anchors shall be as recommend by the manufacturer.

2 Accessories. All edging materials shall be supplied and installed complete with any required drive stakes and anchors.

3 Concrete Anchor Blocks, Mass Concrete. Where the specified edging requires anchor stakes to be driven or secure fastening, these shall include concrete anchor blocks or mass concrete.

1.4.10 Irrigation Water

1 Sources. Irrigation water shall be provided by the Contractor from either an onsite or off-site source approved by the Engineer as being suitable for irrigation. Sources may be from a treated sewage effluent [TSE] main line or a potable water source or a mix of both.

2 It shall be the Contractor's responsibility to ensure there are adequate water storage tank facilities for the project, and to obtain the necessary authority approvals and permits for such.

3 Precedence of Use. Where there are more than one [1] sources of irrigation water available to the project, TSE shall be used as irrigation water for general landscaping.

(a) General Irrigation for Palms, Trees, Shrubs and Groundcover Beds. These planting areas not subject to human contact shall be irrigated by TSE.

(b) Planting Areas of Human Contact. Lawns planted to turf grasses shall be irrigated by potable water only, unless otherwise directed by the Engineer.

1.5 EXECUTION

1.5.1 PREPARATORY ACTIVITIES

1 **Understanding of Scope of Work**. Prior to any operations, the Contractor shall have fully satisfied himself of the correct understanding of the scope of work under this Section, and related works covered by other Sections of the Specifications.

2 **Site Examination**. Prior to any operations, the Contractor shall investigate the site to ensure full awareness of existing site conditions affecting the performance of its work in this Section. The Contractor shall not proceed with planting operations until unsatisfactory conditions are discussed and resolved with the Engineer. Familiarity with site conditions include, but are not necessarily limited to:

(a) Site boundaries and extent of work

(b) Conditions of all adjoining developments in surrounding public realm and plots

(c) Site topography, in relation to site surface drainage

(d) Existing subsurface conditions [e.g. water tables, obstructions such as hardpans, rock formations]

(e) Locations and alignments of all existing above-grade and subsurface utility lines and structures

(f) Locations and alignments of all proposed above-grade and subsurface utility lines and structures by authorities.

(g) Existing vegetation in numbers, species and footprint marked for retention, relocation or demolition.

(h) Existing structures, pavements and infrastructure marked for retention, rehabilitation or demolition.

3 **Site Enclosures.** The Contractor shall build temporary fencing to the boundaries of the entire project, and its parts, as indicated on plans as required for the protection of the public, for access control not necessarily limited to:

(a) Site storage yards

(b) Existing stands of vegetation to be protected for retention, as defined from the outer drip line and root zone of trees.

4 **Site Office facilities.** The Contractor shall build the required temporary onsite office facilities as indicated on plans and as approved by the Engineer.

1.5.2 Existing Topsoil

1 Stripping. Where the design intent of the Project Documentation requires the storage of stripped topsoil for reuse onsite, carefully strip topsoil to a uniform depth of 300mm.

2 Handling Onsite. Segregate and do not mix stripped topsoil with other excavated subsoil and debris. Handle and stockpile stripped topsoil to avoid contamination, compaction, loss or damage.

3 Storage. Store neatly in windrows no higher than 1.50 meters to ensure aerobic, healthy conditions. Cover piled topsoil with breathable fabric to prevent sunbaking, loss from wind erosion and drying out. Store stockpile no longer than twelve [12] months from the date of stripping. If storage beyond twelve [12] months is required, submit alternative Method Statement for alternative stockpiling.

1.5.3 Planting Season and Conditions

(a) Adverse Conditions. No planting shall occur during adverse weather conditions [e.g. sandstorms, heavy rains and winds, intense daytime temperatures]. Any works which have commenced before the onset of adverse conditions shall be immediately stopped and any installed or ongoing work shall be protected.

(b) Planting Season and Times. Unless otherwise directed by the Engineer, planting shall commence shortly before the onset of the cooler winter months, generally between mid-September and mid-May. Moving plants into their planting locations shall have required that preparatory soils and site preparation have proceeded earlier.

(c) Special Conditions. When special conditions warrant a variance in the planting times above, a proposed Planting Schedule shall be submitted for the Engineer's approval. In such cases, the Planting Schedule shall be accompanied by a Method Statement narrating mitigating measures to be met and that such planting shall be at no additional cost to the project all obligations such as warranty and maintenance shall be the Contractor's responsibility.

1.5.4 On-Site Acclimatization.

1 Where required, prior to planting, all plant materials shall be acclimatized onsite at all times. Upon delivery, plant materials shall be temporarily stocked in onsite designated acclimatization facilities.

(a) Immediate Planting. Where no such acclimatization facilities exist onsite, all delivered planting materials shall be immediately planted into their pre-prepared pits or beds. In such cases, such planting shall have been acclimatized prior to site delivery in the source nursery or other designated nursery to overcome any transplanting shock.

(b) Scheduling of Deliveries. In such cases of immediate planting upon delivery, schedule and time deliveries of planting stock such that enough stock arrives within the workday to be set in pre-prepared pits and beds.

(c) Heeling-in. If palms and trees have to be held for more than twelve [12] hours before planting, these shall be heeled-in in trenches in designated areas onsite, with root balls kept moist at all times.

(d) Imported Palms and Trees shall be acclimatized at the source or designated nursery at least three [3] months prior to removal and shipping from the nursery.

1.6 SITE PREPARATION FOR PLANTING AREAS

1.6.1 General Requirements

1 Verifying Site Conditions Prior to Commencing Works. The Contractor shall examine areas to receive landscaping for compliance with requirements and conditions. When conditions detrimental to plant growth are encountered, such as rubble, adverse drainage or obstructions, lack of or malfunctioning irrigation infrastructure, supply constraints in irrigation water, the Contractor shall notify the Engineer prior to planting.

2 Utility Lines, Alignments and Structures. The Contractor shall determine all locations of above grade and underground utility lines and structures and perform work in a manner which will avoid damage to these. Any damage to underground utilities and structures shall be promptly reported in writing to the Engineer, coordinated with all authorities and repaired at the Contractor's expense.

3 Sub-Grade Conditions. The Engineer shall verify that sub-grade conditions are as indicated in the Project Documentation. Where the Project Documentation does not indicate so, the Contractor shall at his expense verify the presence of any potential obstructions by excavating a series of test trenches that allow visual confirmation of these obstructions.

4 Recording Conditions. Any obstructions are encountered that impact the work under this Section, [e.g. utility lines, rock formations] these shall be properly marked onsite and faithfully and correctly recorded in scaled plans and drawings as part of the project records.

5 Grade Stakes shall be maintained until removal of these is mutually agreed upon by all parties concerned.

6 Adjoining Lines and Grades. When lines and grades of adjoining work are encountered that are detrimental to finished grading and planting operations, the Contractor shall notify the Engineer in writing prior to planting.

1.6.2 Sub-Surface Grading

1 Weeding and Grubbing. All remaining perennial weed growth not removed by prior grubbing shall be treated with an approved herbicide to the manufacturer's recommended rates of application, method, times and safety measures prior to commencing any grading work.

2 Workable Conditions. Grading operations shall occur when the surface soil and sub-soil are reasonably dry and workable.

3 Rough Grading for Smooth Contours. Areas to be graded shall first be rough-graded and shaped to smooth flowing contours with all minor hollows and sharp or prominent ridges removed. Unwanted obstructions [e.g. rubble, debris] shall be removed to allow smooth contours to be formed. Rough grading shall be built-up and formed to levels over which final finish grading of planting soil mix shall be later overlaid.

4 Disposal of Unwanted Material. Any unwanted existing rock projections, boulders, rubble and debris shall be removed immediately from the work site and disposed of to a location as agreed with the Engineer.

5 Loosening Non-Cohesive, Cohesive Subsoil. Non-cohesive, light subsoil shall be loosened with a 3-tine ripper to a depth of 300 mm at 600 mm centers.

6 Limestone and other cohesive substrate shall be loosened with a single tine ripper to a depth of 450 mm at 1-meter on-centers.

7 Soil Overburden. A minimum of 150 mm of approved soil shall be spread uniformly over the loosened area and incorporated into the sub-grade soil to obtain a homogenous and well-draining soil mix.

8 Compaction. The area shall be compacted to a minimum of ninety percent [90%] of maximum dry density as determined in accordance with Test 13 of BS 1377.

1.6.3 Finished Grading

1 Finish Planting Grades, in General. Grades shall be brought to the finished ground levels as indicated on the project drawings or as agreed with the Engineer to a tolerance of ± 25 mm finished ground levels shall be 30 mm below adjoining paving or kerbs after compaction and settlement. Grading shall be carried out in such a manner that even gradients are formed between the spot levels indicated on the project drawings. No depressions shall remain which could collect standing water.

2 Slope Gradients

(a) Large Sloped Areas Planted to Turf grass. Large areas of turf grass that are to be maintained by mechanized equipment shall be to gradients that make movement of mechanized equipment [e.g. rider mowers] convenient. As such, such slopes shall be finish-graded not to exceed thirty-three percent [33%] in gradient.

(b) Sloped Areas Planted to Groundcovers. Such slopes planted to mat-forming or dense clumping, deep-rooted groundcovers may be of slopes greater than thirty-three percent [33%] in gradient.

(c) Slopes Abutting Pavements and Structures. Slopes directly abutting pavements and structures shall be finish-graded such that surface run-off is contained and does not directly run onto pavements or up stands. Toes of slopes shall meet adjoining pavements or up stands in a zone of flat grades with a minimum 300mm width.

3 Alternatively, the toes of slopes shall be finish-graded as a smooth U or V channel as indicated in the Project Documentation.

4 Build-Up Layers. Soil mix shall be placed in lifts not greater than 150 mm in thickness. Compact the lifts with water to allow adequate settling, without creating muddy unworkable conditions.

5 Compaction. The filled area shall be compacted to a minimum of ninety percent [90%] of maximum density as determined in accordance with test 13 of BS 1377.

1.6.4 Setting-Out and Staking of Planting

1 Setting-Out

(a) General. Planting pit locations and planting bed outlines shall be staked and marked according to the intent of the planting plans in the Project Documentation. Pits and beds shall be staked two (2) days before any excavations are made for inspection with the Engineer.

(b) Setting-Out Individual Pits within Beds. Locations of palms, trees, shrubs and accents within shrub or groundcover beds shall be staked such that these remain well within and are not at the edge of the bed boundaries.

2 Notice for Inspections. The Contractor shall notify the Engineer in writing two (2) days before the start of such inspections.

3 Adjustments and Coordination. Plant locations may be adjusted by the Engineer to meet site conditions prior to approval of staked locations. In the case of conflicts with the locations of manholes, inspection chambers or mechanical vents within planting areas, these shall be promptly coordinated and resolved with all related trades and disciplines.

1.6.5 Protection of Existing Vegetation and All Adjoining Work

1 Protecting Installed Soft cape. All planting areas, whether newly planted established prior to planting operations shall be covered before any excavations are made in a manner that will afford adequate protection.

2 Existing shrubs, trees and groundcover beds shall be temporarily barricaded with visibly marked barricade elements in a manner to protect them during planting operations.

3 Irrigation. All planted areas for protection they shall be maintained with a functional irrigation system and adequate irrigation water supplies to ensure their survival. Where no permanent nor piped-in irrigation system is in place at the time of planting, the Contractor shall ensure that a temporary method of irrigation shall be adequate.

4 Protecting Adjoining Hardscape. All existing hardscape areas such as paved or surfaced areas shall be likewise barricaded or covered as appropriate to protect such work from damage from planting operations.

5 Traffic Rerouting. Any proposed temporary pedestrian and vehicular traffic rerouting as required for protecting both hardscape and planting areas shall be for the approval by the Engineer and all temporary works for such shall be for the Contractor's account.

6 Heavy Machinery. Restrict heavy machinery and equipment from moving within areas prepared for planting at all times.

1.7 PLANTING

1.7.1 Plant Pits and Beds

1 Order of Precedence. In preparing pits and beds, larger planting materials [e.g. palms, trees and large shrubs], whether located as isolated or individual plantings or within shrub or groundcover beds, shall take precedence over others.

2 Excavation. Plant pits shall be dug to produce true vertical sides and flat un-compacted bottoms. Scarify sides and bottoms of pits that have glazed surfaces. Excavated material shall be disposed of in a proper manner. If approved by the Engineer, excavated material may be used as fill in areas where fill material is required.

3 Subsurface Tests for Percolation and Drainage. Unless otherwise instructed, break up the bottoms of pits or beds to 300mm for trees and palms and 400mm for shrubs and groundcover to ensure subsurface drainage prior to performing tests as below.

(a) Testing Time. Perform tests one [1] day after excavated pits had been completed. Notify the Engineer in writing of such test dates at least one [1] day ahead according to an approved Method Statement.

(b) Marker Bar. Place within the pits and beds a marker bar as a reference point.

(c) Frequency Sample. Unless otherwise directed by the Engineer, perform percolation tests at a minimum rate of 1 test per 50 plants of individual species.

(d) Test Procedure. Fill pits or beds with irrigation water to half, marking the level of water reached. Monitor the rate of percolation over a period of one [1] hour.

(e) Acceptable Percolation. Water levels that drop by more than 20mm within the hour shall be considered passed and acceptable.

(f) Failed Test. Pits and beds which fail the percolation test shall be marked on plans and on the ground, to be remedied by breaking or ripping up the bottom of pits and beds. Repeat test procedure.

(g) Remedial Work on Pits and Beds. If acceptable percolation cannot be achieved, relocate or cancel the location of pits or beds. If relocation or cancellation are not possible, install remedial measures such as installing a suitable drainage layer of gravel or a piped connection to a soak away to achieve positive drainage.

4 Backfilling. Backfill excavated pits and beds with approved soil mix in lifts not exceeding 150mm each. Allow adequate settling of lifts by water compaction to levels suitable for placing plant root balls such that the original root collars or growing levels of plants match the levels of finish planting grades.

5 Pit and Bed Sizes. Minimum acceptable pit and bed sizes shall be as in Table 1.

Table 1:
Plant Pit and Bed Sizes Schedule

Plant Category	Pit or Bed Size [mm]
For Free-Standing, Specimens or Solitary Planting	
Palms	2000 square x 2000 deep ~~mm~~
Trees, Large and Medium	1500 square x 1500 deep ~~mm~~
Trees, Small or Shrub, Large	1000 square x 1000 deep ~~mm~~
Shrubs, Small	600 square x 600 deep ~~mm~~
Climber or Vines	600 square x 600 deep
For Plant Groupings	
Shrubs, as hedges	600 wide x 600 deep x full length of trench
Groundcover, seasonal flowers and turfed areas	500 mm depth x area of bed
Turf grass	400 mm depth with proper drainage if ground below is impermeable x area of bed

6 Planting in Zones of High Water Tables. Unless otherwise directed by the Engineer, preparing planting pits and beds in zones of high water tables shall be according to the following conditions.

(a) Below +2.5m Level. Pits and beds in this level requires an impermeable membrane to be placed at the bottom of pits or beds. The membrane shall be laid such that it slopes to a low point to collect out to drain.

(b) Between +2.5 to +3.5m Level. Pits and beds within this level shall require placement of a minimum 100mm gravel drain layer at the bottom of pits and beds, and overlain by a an approved geotextile membrane.

(c) Above +3.5m Level. Pits and beds in this level shall not require any under laid membrane or gravel drainage layer as above.

(d) Determination of Levels. The levels mentioned above shall be determined from a reference level of the site assigned as Level +0.00m.

1.7.2 Order of Planting Precedence

1 Planting Schedules shall be such that larger planting materials [e.g. palms, trees and large shrubs], whether isolated as individual plantings or within shrub or groundcover beds, shall be planted first before all other planting.

2 Plant After Irrigation System Laid. Schedule planting only after a functional irrigation distribution network had been installed, tested and commissioned.

1.7.3 Planting Trees and Shrubs

1 Composition and Lay-Out. Plants shall be handled carefully and composed onsite to take full advantage of their individual character in relation to each other and according to the intent of the planting plans of the Project Documentation.

(a) Placement. Plants shall be placed in the center of each pit or bed, set plumb and held in place until sufficient backfill mixture has been firmly placed and tamped around the root ball. Plants shall be placed so that the level at which they were set with respect to surrounding ground level before installation is the same as after installation.

(b) Balled-and-Bur lapped [BB] plants shall have twine, metal, plastic and wire ties removed from the tops of the earth ball after backfill soil has been placed to approximately two-thirds of the ball depth, tamped lightly and watered. Backfilling around plant shall be completed in 150 mm layers after water has drained away.

Burlap wrapping shall not be pulled out nor removed from root balls. Slit burlap wrap vertically in a minimum of ten [10] equidistant locations to facilitate root growth. Slit in a manner that wrapping does not come loose.

(c) Container-Grown Plants. Plants supplied in non-biodegradable containers shall be removed in such a way as to prevent damage to their root systems. Before planting, any damaged or broken roots shall be carefully trimmed and removed. Plants in biodegradable of organic containers may be installed with the container in place.

2 Water-Retention Basin. A water-retention basin shall be formed around the planting pits as indicated in the drawings of the Project Documentation. Retention basins shall be as any of the following:

(a) Earth Saucer Berm. Form a 100mm -150 mm high earth saucer of shall be formed around individual palms, trees or large shrubs. The diameter of the saucer should be larger than and outside the backfilled area.

(b) Dished Inwards. Without an earth saucer, the surface of the planting pit or bed shall be dished inwards towards the center of the pit to retain irrigation water.

(c) Edge Restraints. Install edge restraints around individual palms, trees or large shrubs. That are at least 50mm proud of the finish level of the inside of the planting pits.

(d) Pits Surrounded by Paving. Planting pits fully surrounded and restrained by paving require no earth saucers. Water retention shall be achieved by the depressed finish level of the planting pit itself.

3 Staking and Supports. Stake and support only trees and palms that will not stay vertical against the prevailing winds after planting. After planting, plants shall be guyed or staked in the following manner, unless otherwise directed by the Engineer. Trees and shrubs shall be protected against wind where necessary or directed to ensure satisfactory establishment of plant.

(a) Trees 1.2 to 1.8-Meter Tall shall be held in place with one (1) bracing stake. The stake shall be positioned close to the tree on the windward side. The stake shall be driven vertically into firm ground taking care not to injure the roots. The tree shall be held firmly to the stake with a double strand of wire placed 1m above ground level. A chafing guard shall be used were the wire is in contact with the tree trunk.

(b) Trees 1.8 to 2.5-Meter Tall shall be held in place with two (2) bracing stakes placed on opposite sides. The stake shall be driven vertically into firm ground taking care not to injure the roots. The tree shall be shall be held firmly in place with a double stand of wire placed 1m above ground level and chafing guards shall be used where the wire is in contact with the tree.

(c) Trees Taller than 2.5 Meters shall be held firmly in place with three (3) guying lines of double strand wire placed equidistantly around the tree. The wire shall be anchored with ground stakes driven into firm ground outside the earth saucer. The wire shall be anchored to the tree at a point 1m above ground level. a flag shall be securely fastened to each guying wire.

1.7.4 Planting of Palms

1 Moving. Palms shall be lifted and moved with a crane and purpose-made sling with harness or other approved method to avoid any damage to any part of the palm.

2 Orientation. Prior to setting in pits, orientate certain species of solitary palms [e.g. date palms] as marked by red paint from their original north orientation grown at source to geographic north of the project site.

3 Planting. Palms shall be placed in the center of each pit, set plumb and held in place until sufficient backfill mixture has been firmly placed around the root ball. The top of the root ball should be 100 mm below the top of the planting pit. The pit shall be backfilled with specified soil mix to approximately two thirds of depth of the root ball, tamped lightly and water-compacted. Such that the original growing line of the root collar shall match the finish planting level.

Backfilling around plant shall be completed in 150 mm layers and water-compacted.

4 Water-Retention Basin. -150 mm high earth saucer of shall be formed around individual plants. The diameter of the saucer should be larger than and outside the backfilled area. In lieu of the above, the surface of the planting pit or bed shall be dished inwards towards the center to retain irrigation water.

1.7.5 Planting Lawn grass Turf

1 Generally, Prior to Planting. After the areas required to be turfed have been set-out and brought to the specified rough levels, undertake at the minimum the following:

(a) Coordinate With All Adjoining and Related Works. Coordinate with all adjoining works not necessarily limited to installed underground lawn sprinkler system piping and watering heads, including those for trees, palms, shrubs and groundcovers.

(b) Bed Preparation. Prepare portions of the site to the required depth prior to backfilling with approved soil mix.

(c) Backfill with approved soil mix to lifts of 150mm until the required finish levels are met. The first lift of backfill shall be thoroughly mixed with the bottom of the bed to a 100mm depth. Fertilizer and other soil conditioners at manufacturers' recommended rates shall be spread uniformly and worked thoroughly into the soil mix to achieve a homogenous mix.

Where backfill had been compacted, break up and thoroughly cultivate by machine [e.g. roto-cultivator] to improve soil texture.

(d) Blending Slopes. Blend finishes contour levels to merge with adjoining lines and levels. Where slopes meet level areas, these shall transition into smooth gradients. Avoid abrupt grades, uneven spots, ridges and depressions.

(e) The soil shall be raked smooth to a true and even surface. All stones greater than 25 mm diameter, debris and deleterious material are to be removed.

2 Planting Methods. As project conditions require and as approved by the Engineer, planting lawn grass turf shall be either by plugs, sprigging, sodding or seeding. Prepare areas such that these can be completely worked to completion at manageable stages at a time.

(a) Verify that areas to receive planting had been prepared prior.

(b) After planting, immediately maintain the planted areas with irrigation.

(c) The perimeters of the planted areas shall be marked and cordoned-off for protection from foot and equipment traffic, until after the second mowing following complete grass coverage or as directed by the Engineer.

3 Plugging. Use quality of plugs from approved sources to the specified sizes.

(a) Triangular Spacing. Plant plugs in a triangular pattern according to locations of holes previously set-out. Holes shall been prepared and sized as to easily insert the plugs in them.

(b) Install Fresh. Plant plugs into holes while fresh, within eight [8] hours of having been cut from sod or delivered from trays.

(c) Tamping. Firmly tamp soil mix immediately around plugs to ensure these are not loose. Ensure plugs' growing layer is not at a level below the surrounding soil. Have enough prepared soil mix for tamping and infill.

4 Sprigging. Use quality of sprigs or stolon from approved sources to the specified sizes.

(a) Broadcast. Sprigs shall be broadcast uniformly by hand, with mechanical equipment or other approved method. The maximum planting spacing between viable sprigs shall be 300 mm. Sprigs shall be forced into the prepared soil to a minimum of 25 mm by hand, disk-rolling or other approved method.

(b) Tamp-Rolling. Immediately after sprigging, the entire area shall be firmed with a roller not exceeding 135 kg for each meter of roller width. The planted area shall have a smooth uniformed finish without depressions or ridges.

(c) Irrigation. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 70 mm. Watering shall continue until majority of sprigs can sustain themselves on the normal irrigation program. Run-off erosion and peddling shall be prevented at all times.

5 Sodding. Use quality of sod from approved sources to the specified sizes.

(a) Laying. Install sod shall be laid on cultivated soil within twenty-four [24] hours of harvest. The turf shall be laid to form a solid mass with tightly fitted joints. The edges of the sod turf shall be butt-jointed. Strips shall be staggered to offset joints in adjacent courses.

(b) Tamp-Rolling. Sod shall be tamped with a water-roller drum to ensure that roots have full contact with the subgrade. Soil shall be worked into minor spaces between pieces of sod and excess soil removed.

(c) Final Levelling. Fill any low patches and depressions with dune sand to achieve final levels.

(d) Irrigation. The sodded area shall be watered with a fine spray immediately after completing each day of sodding, or as often conditions require. Water shall be applied to ensure a moisture saturation of the soil subsurface to a minimum depth of 100 mm Watering shall continue until turf can maintain itself on the approved irrigation program.

6 Seeding

(a) Pre-Sowing Preparation. One [1] day before sowing, uniformly apply inorganic fertilizer at the rate of 50 gm/m^2 over areas to be seeded and water in. Do not sow in waterlogged or windy conditions.

(b) Spreading, Sowing. Seed shall be spread over a fine levelled, cultivated soil bed by mechanical seeder, unless otherwise directed. Sow at the rate of 1 kg/30 m2 unless otherwise specified in two [2] equal sowings. The second sowing shall be at a perpendicular direction to the first.

(c) Raking and Harrowing. Following seeding, the bed shall be raked, lightly harrowed or tilled to cover the seed with soil to a maximum depth of 25 mm.

(d) Mulching. Cut straw or other fibrous mulch shall be applied over seeded areas to protect from direct sun exposure and blowing winds. Whenever necessary, mulch shall be covered with jute netting to hold the mulch in place. The netting shall not be removed until directed by the Engineer.

(e) Irrigation. Water shall be applied lightly and frequently until one week after 50 % germination and then gradually increase duration and period between watering until normal irrigation program is met.

1.7.6 Plant List, Spacing and Sizes

1 The Contractor shall be guided by the requirements of Appendix A, Plant List, Spacing and Sizes. The list of species serves as a guide.

1.7.7 Edge-Trimming, Shaping of Plant Beds

1 Trimming Overgrowth. Planting beds and lawns that have overgrown their edges into adjoining planting beds, gravel beds or pavements shall be periodically trimmed to their defined edges using sharp tools or equipment.

2 Edge of Planting Saucers and Basins. Trim vegetation overgrowth intruding into planting saucers and basins to define their shapes. Restore, reshape and tamp firm any disturbed slopes and grades of saucers and basins.

1.7.8 Mulching

1 Mulching within Planting Beds shall be spread to a uniform depth of 100 mm no later than forty-eight [48] hours after planting, and to uniformly cover bare soil. Mulch shall be restrained within their intended planting beds and kept out of adjacent lawns and paved areas.

2 Replenishment. Replenish mulch of the same material periodically to compensate for settling such that these shall be built-up to the required finish surface levels.

1.7.9 Watering of Plants

1 Root zone Penetration. Upon completion of areas of planting, the Contractor shall water planted areas as necessary to maintain adequate moisture within the root zone for healthy growth. Physically inspect subsurface soil conditions to determine root zone moisture penetration.

2 Water Delivery. Water shall be allowed to flow gently to the required application rates around the plant and shall not be delivered to cause disturbance to the roots or soil. Run-off erosion, puddling and wilting due to uneven watering shall be prevented. Earth saucers shall be periodically rebuilt and reshaped as needed to retain water.

3 Irrigation Schedule. Irrigate installed planting work to the approved irrigation schedules,

1.7.10 Remedial Pruning

1 General. Immediately after planting and prior to staking and guying, all plants are to be pruned as directed by the Engineer and in accordance with accepted horticultural practice sand an approved Planting Program. Such pruning shall apply to plants that had not been previously pruned prior to moving and shipping onsite and to plants held in acclimatizing nurseries.

2 Foliage Retention, Trees and Shrubs. Immediately after planting, prune off the vegetative mass of trees and shrubs to compensate for loss of roots and transporting shock. Pruning shall be done carefully. Any damaged, dead, cross-over or diseased branches shall be cut back and any weak or malformed growth shall be removed. The typical growth habit of the individual plant shall be retained with a symmetric form.

3 Cuts shall be clean, flush with the parent trunk or branch and made only with clean, sharp tools or equipment. Improper cuts, stubs, dead and broken branches shall be removed. Cuts or wounds shall be treated with an approved wound sealer. Do not use pruning paint to dress cuts or wounds.

(a) Palms and Palm-Like Plants, Solitary Habit. Fronds to be pruned shall be cut clean to their bases, close to the trunks. In pruning fronds, care shall be done as not to damage the growing bud. Any extraneous suckers shall be fully removed and cut to their bases.

(b) Palms, Clustering. Small or clumping palms when pruned of damaged or unhealthy canes shall be cut such as to leave clean-cut stubs about 100mm proud of finish planting grade.

(c) Trees, Shrubs and Climbers. Right-angle cuts to the line of growth shall not be permitted. Trees, shrubs and climbers shall not be poled or the leader removed, nor shall the leader be pruned or topped off.

4 Minimize Disturbance. To reduce the risk of transplanting shock, prune in a manner that minimizes disturbing installed plants from shaking root balls from their as-planted positions.

1.7.11 Clean-Up and Site Restoration

1 Excess and Waste Material shall be removed daily. Pavements and work areas shall al-ways be kept in a clean and orderly fashion. Pedestrian access points and vehicular access points shall be maintained and kept clear and accessible at all times. All rubbish and litter shall be cleared as it accumulates within the landscape work area.

2 Onsite Holding Areas Designated Offsite Disposal Area. When planting and turf work has been completed, all debris including subsoil, excess agricultural soil, litter, debris and all unwanted material shall be stored onsite in a temporary holding area while awaiting disposal.

3 All material for removal and disposal offsite shall be to a location or locations as agreed with the Engineer.

4 Restoring, Restituting Adjoining Work. Any existing adjoining planted areas, pavements, facilities, utility lines and structures that have been damaged from work under this Section shall be restored and made good to their original conditions at the Contractor's expense. Restored work shall meet and merge with original lines and grades.

1.7.12 Maintenance during Planting Operations

1 Newly Installed planting shall be immediately maintained to establish best horticultural practices. Maintenance operations shall continue until the plant establishment period commences.

2 Inclusive Scope. Generally, maintenance includes pruning, wound dressing, straightening and adjustment of supports and stakes, mulch replenishment, fertilizing, irrigation, pest and disease management, erosion control, salinity control or mitigation and other necessary operations not necessarily limited to the following:

(a) Weeding. Plant beds, planting basins and lawns shall be kept free of weeds and other undesired vegetation.

(b) Adjusting Levels, Plumbs. Plants shall be periodically checked for settlement and shall be reset to the proper levels and kept plumb to grade as necessary.

(c) Adjusting Edging and Restraints. Any edgings and restraints that have come loose or have been misshapen shall be adjusted.

(d) Turf Management. Maintain areas planted to lawn grass to established best practices for turf management.

3 Irrigation. All planting shall receive adequate water application rates and that all areas are uniformly covered according to the times of watering and seasonal adjustment according to approved irrigation schedules.

(a) Fully Functional System. The Contractor shall likewise ensure that the entire irrigation system and its components are properly functioning. Periodically Inspect for leaks and malfunctions and their mitigation.

(b) Uniform Coverage. Ensure that irrigation results in no runoff erosion and dry spots.

1.8 WARRANTY MAINTENANCE FOR LANDSCAPE ESTABLISHMENT

1.8.1 CARE OF COMPLETED LANDSCAPING

1 General Requirements. Planting completed under this Section shall be subject to warranty maintenance for the purpose of establishing the installed work in a healthy growing condition. Upon substantial completion of landscaping work as approved by the Engineer, the plant establishment period shall immediately commence.

Maintenance shall be to established best horticultural practices and to an approved Maintenance Program of the Operations and Maintenance [O+M] Manual.

Where construction procedures or site conditions may cause damage or impact to existing landscaping, it shall be the Contractor's responsibility to take measures to protect and maintain existing work under maintenance throughout the duration of the project, including the replacement of materials at his own expense if accepted by the Engineer.

(a) Identifying Tags of Existing Plants. Existing plants shall be kept tagged with a durable, weather-resistant label indicating the correct plant names. Labels shall be securely attached without causing neither damage nor deformity to stems and branches and not to be removed until directed by the Engineer.

(b) Weed Control

(i) General. Remove weeds before reaching flowering stage as part of preventive maintenance. In the event weeds have flowered, handle and dispose carefully such that weed seed does not come loose, spread and disperse.

(ii) Unless otherwise directed by the Engineer, weeding shall be according to a work schedule or calendar as contained in the O+M Manual.

(iii) Preferred Method. Remove all undesirable plant growth around all planting areas. Hand weeding shall take precedence over other methods, together with regular cultivation of the soil surface to a depth of 50mm to prevent weed establishment. Where rhizomes or tubers of weeds are encountered, remove and segregate these from the soil for disposal.

(iv) Weed Growth in Planting Basins. Unwanted grass and weed growth shall not be allowed to reach a height of 50mm in planting basins and beds before being completely removed. Remove underground roots.

(v) Weed Growth in Turf. Regularly inspect for weed growth in lawns. Patches of weed growth shall not be allowed to spread and reach flowering stage nor a height of 50mm in turf. Remove underground roots.

(vi) Frequency. All areas shall be weeded on a weekly basis. Tilling the topsoil as a means of weed control shall also be on a weekly basis.

(vii) Herbicides shall be used with care and only as directed by the Engineer according to an approved Method Statement.

(viii) Tilling and Cultivation. Regularly till and cultivate the topsoil in pits and beds uniformly to a depth of 80-100mm. Replace any displaced decorative mulch to their finish levels after tilling. Do not allow inorganic mulches to mix with the topsoil.

(c) Pest and Disease Management.

As part of preventive maintenance, undertake an integrated pest and disease control regime with specific measures according to a Method Statement approved by the Engineer and as specified in the O+M Manual.

(i) Early Diagnosis for Prevention. The Contractor shall field trained staff knowledgeable in early diagnosis of environmental conditions, pest and disease identification and pest control measures as a means of preventive control.

(ii) Control Measures. Measures shall be flexibly executed to respond to actual environ-mental conditions and to specific pest and disease incidences. Any use of pesticides shall be applied judiciously to manufacturer's safety instructions and upon the direction of the Engineer.

(iii) Safety. Any use of chemical pesticides and fungicides shall be to manufacturer's safety recommendations. These shall be applied by experienced and trained personnel in a manner and during times and frequency of application that does not cause leaf burn nor die-back.

2 Soil Analysis during Establishment Period.

Arrange analysis of representative soil samples according to a Method Statement to be approved by the Engineer.

(a) Sample Locations, sample Size. Unless otherwise directed by the Engineer, samples from locations within the project shall be at six [6] month intervals. The number of samples shall be according to the size of the project.

(b) Test Results shall be by an approved independent third-party laboratory and shall comply at the minimum to specified standards for pH levels of planting medium. If samples do not comply, take corrective measures to achieve the required pH level.

1.8.2 Monthly Inspections.

1 All landscaped areas are to be inspected monthly by the Engineer, with lists of remedial work issued to the Contractor after each inspection. All items in the remedial list are to be made good by the Contractor by the time of the next scheduled inspection [i.e. within one month].

1.8.3 Site Cleaning and Waste Management.

1 All soft cape and hardscape portions of the site shall always be kept clean, tidy and free of debris and litter at all times according to established best practices in a Method Statement for approval by the Engineer.

(a) Handling. All litter handled onsite shall be bagged or containerized and removed daily to an offsite location or locations approved by a Qatar municipality.

(b) Waste Segregation at Source. Segregate compostable waste generated by yard litter and pruning separately from recyclable, non-bio compostable waste. Further segregate the recyclable streams of waste by type [e.g. glass bottles, plastic, paper and cardboard, cans] and collect in color-coded bags or receptacles for easy identification.

1.9 CARE OF INSTALLED NON-NATIVE PLANTS

1.9.1 Irrigation, in General.

1 All installed plants shall be irrigated regularly according to an approved Operations and Maintenance [O+M] Schedule for irrigation. Maintain the necessary water-retention basins for efficient watering.

1.9.2 Fertilizing, in General.

1 Fertilize according to an approved fertilizing schedule and calendar. Coordinate fertilizing schedules with irrigation schedules. Turf fertilizing rate at establishment phase is based on the soil mixture chemical test

(a) Application Rates and Schedule. Unless otherwise directed by the Engineer, fertilize according to Table 2, General Fertilizer Application Rates and Schedule during Maintenance.

(b) Correcting for Iron Deficiency. Apply diluted iron [Fe] formulation to correct for and prevent -any symptoms of iron chlorosis.

(c) Correcting for Nitrogen Deficiency. Apply granular urea or ammonium sulphate to correct for and prevent any nitrogen chlorosis.

To ensure ready availability of nitrogen, use fully stabilized and composted organic amendments [e.g. composted biomass, composted manure].

Table 2
Yearly General Fertilizer Application Rates during Maintenance period

Item	Type of Fertilizer	Plant Category							
		Turf grass	Ground covers	Seasonal Annuals	Hedges	Shrubs	Vines or Climbers	Trees	Palms
1	Urea/ Ammonium sulfate	none	none	none	none	none	none	none	920g N X year
2	Controlled Slow Release Fertilizer [NPK]	20g N per m2 X year	10g N per m2, X year	10g N per m2, X year	10g N per m2 X year	10g N per m2 X year	10g N per m2 X year	10g N per m2 X year	240g N per m2 X year
3	Organic Amendment [manure or compost]	4kg per m2 X year	5kg per m2 X year	5kg per m2 X year	5kg per linear m X year	10kg X year	10kg X year	10kg X year	50kg X year

NOTES
(1) Palms, refers to large solitary palms [e.g. Phoenix, Washingtonia, Bismarckia]
(2) Controlled Slow-Release Fertilizer, shall be granular or tablets of complete NPK formulation With micro nutrients and trace minerals. NPK ratios are 1-1-1, 4-1-2 and 2-1-3.
(3) N denotes actual Nitrogen. Amounts and ratios of fertilizer may be subject to alteration based on soil Chemical test.
(4) Organic Amendments, refers to fully stabilized composted manure, compost, coco-peat or other amendments biocompatible amendment
(5) X year denotes yearly

1.9.3 Fertilizing Palms, Trees and Large Shrubs

1 Fertilizing Holes. Where no fertilizing tubes are installed, dig temporary holes by auger a minimum 40 mm diameter X 500 mm deep, at 600 mm on-centers shall be dug by hand or with a mechanical device, over the outer half of the spread zone of each tree.

2 Cover Holes. Backfill the holes after fertilizing with approved soil mix.

3 Replace Mulch. Replaced any displaced decorative mulch to their finish levels after tilling. Do not allow inorganic mulches to mix with the topsoil.

1.9.4 Fertilizing Shrubs and Groundcovers.

1 Existing shrubs and ground-cover beds shall be top-dressed with slow release fertiliser granules. Fertiliser adhering to plants shall be flushed with irrigation water.

1.9.5 Fertilizing Turf grass.

1 Fertilize turf grass according to monthly schedule and rates in Table 4 and Clause 1.12, Turf Management.

1.9.6 General Pruning and Cavity Work

1 General. Prune periodically to horticultural best practices according to an approved Operations and Maintenance [O+M] Manual.

(a) Undesirable Growth. Any extraneous growth [e.g. suckers, buds, cross-over branches], deadwood larger than 15 mm in diameter, branches interfering with or hindering growth of plants and diseased branches shall be removed. Stubs, improper cuts and broken limbs shall be removed.

(b) Extraneous Growth. Prune off promptly any extraneous suckers, buds and branches which divert and delay growth away from the desired symmetry and balance of the plant.

(c) Pruning Times. Light pruning for plant shaping shall be regularly done all year at designated times, while heavy pruning shall be during dormant periods of the species.

2 Cavity Work. A suitably qualified tree surgeon shall perform any required cavity work on existing trees and related pruning.

(a) Filling Material. Cavity filling shall be an approved inert polyurethane foam-filled material, filled to flush to trunk surface. Do not use concrete or other material for filling.

(b) Painting. After curing of filling material, coat filling with a non-toxic, color-fast paint of color to closely match surrounding tree bark.

3 Pruning to Control Growth

(a) Symmetry of Form. The Contractor shall periodically cut back or remove branches as necessary to give plants proper shape and balance, typical of the species. Prune to avoid unnecessary top-heavy growth.

(b) Bushiness in Shrubs and Hedges. In the case of shrubs and hedges where dense growth is required from top to bottom, prune or shear as early after planting and periodically thereafter to establish horticultural best practices to encourage bushiness of growth and avoid a 'leggy' habit of growth.

(c) Dense Growth for Vines. All pruning cuts for vines and climbers shall be made 1cm above a healthy growing bud or sound outward-growing side shoot, at about a 45-degree angle to the growing point. Prune so that stems are generally of equal length and to avoid a 'leggy' habit of growth.

(d) Dense Groundcover, Seasonal and Herbaceous Plants. Pinch and shear as early after planting and periodically thereafter to established horticultural best practices to encourage more branching and dense growth such as to fully cover bare ground at the earliest possible time.

4 Cuts and Wound Dressing

(a) Cut Clean and Flush. Cuts shall be clean and flush with the parent limb or trunk, made with clean, sharp tools. Cuts shall be such that do not trap moisture.

(b) Wound Dressing. Cuts and wounds larger than 25mm diameter shall be painted over exposed cambium and tissue with an approved tree wound dressing, unless otherwise directed by the Engineer. Where applying wound dressing may cause potential infection, such shall not be mandatory.

1.9.7 Pruning Hedges and Topiary

1 General. Shear or trim to established best horticultural practices in a manner that does not expose any woody growth. Immediately after planting, train and prune plants to encourage bushy, dense growth at the earliest possible time and avoid a 'leggy' habit of growth.

2 Frequency. Trim or shear every four [4] weeks during periods of high vegetation growth, every two [2] weeks in case of excessive growth of certain species.

3 Shaping Topiary. Shear topiary to their intended steel wire-frames installed as a pruning guide. Topiary in geometric patterns shall be trimmed using stretched ropes as a guide to shaping.

1.9.8 Removing Wraps from Palms.

1 Remove burlap wraps from palms when new fronds show adequate vigorous growth. Remove wrap carefully such as not to damage the growing bud and young fronds.

1.10 PLANT REPLACEMENT

1.10.1 General.

1 During the establishment period, The Contractor shall replace any plants at his expense that are dead, fail to survive or attain healthy vigorous growth as a result of inadequate maintenance operations during the establishment maintenance period. The final or Practical Completion Certificate [PCC] shall not be issued until all plants listed in the Plants Materials Schedule of the approved 'As-Built Plans' are successfully established and to the satisfaction of the Engineer.

(a) Inspection Survey. A joint survey of the landscaping works shall be carried out by the Engineer with the Contractor fifty [50] days after acceptance of substantial completion.

(b) Joint inspections are to be arranged in writing at least two [2] weeks prior to the inspection dates.

(c) Removal of Dead Plants. Following the survey, the Engineer shall direct the Contractor to remove and replace all plants determined as dead.

(d) Plants of Questionable Status. Plants that exhibit questionable abilities to survive will be tagged by the Contractor in the presence of the Engineer and be reviewed after an additional twenty five [25] days to determine acceptance or rejection. The Contractor shall make reasonable efforts to stabilise the quality of the tagged plants.

1.10.2 Quality of Replacement Stock

1 Plants scheduled for replacement shall meet the applicable quality requirements of planting stock as specified in Clause 1.3.2, Plant Materials. Quality of replacement stock shall not be lesser nor inferior than the originally supplied and installed. Stock for replacement may exceed the quality as originally supplied and installed at no extra cost to the project.

1.10.3 Transplanting Plants.

1 Plants to be transplanted onsite as replacements shall be governed by the applicable requirements and procedures specified in Clause 1.6, Site Preparation for Planting Areas and Clause 1.7, planting.

1.11 IRRIGATION WATER CONSUMPTION

1.11.1 Sizing Tank Capacities.

1 Sizing onsite irrigation tank capacities and provision of irrigation water for landscaping shall take into account the projected peak daily irrigation water demand of the project's landscaping by plant category according to Table 3, Peak Daily Irrigation Demand.

1.11.2 Annual Irrigation Water Budget.

1 Using Table 3, Peak Daily Irrigation Demand as guidance, prepares an Annual Irrigation Water Budget as part of an Operations and Maintenance [O+M] Manual for approval by the Engineer.

1.11.3 Seasonally Adjusted Irrigation

1 Seasonal Variation. Daily water requirements by plant category shall be seasonally adjusted. During rains, irrigation system feeding drip emitters shall be switched off when precipitation rate exceeds 12mm.

2 Salt Leaching. Where salt leaching is required, adjust irrigation rates on specified days according to an approved Method Statement.

Table 3
Peak Daily Irrigation Demand, LPD
[For details, refer to Appendix a, Section 28 Part 2 Irrigation Systems]

Age	Plant Category	Daily Water Requirement [litters per day, LPD]	Unit of Measure	Remarks
mature, +8 years	Palms	65	per individual plant	(1) Rates in lpd are projected maximum or peak demand in summer as a guide. (2) Seasonally adjust rates to calculate an Annual Irrigation Water Budget. (3) Actual irrigation water rates shall be according to daily readings from a weather station to ensure delivery of the required application rates. (4) Accent plants that fall into any of the plant categories shall have their water demands projected according to category. (5) Rates for groundcovers used as indoor and outdoor green walls do not apply
	Large Trees	35		
mature, +3 years	Small Trees	10		
	Large Shrub	10		
	Vines and Climbers	10		
	Hedges	10	per metric length	
mature, +3 years	Small shrub	07	per individual plant	
none applies	Groundcover Perennials	05	per square meter	
	Seasonal Annuals	05		
	Turf grass	07		

1.12 TURF MANAGEMENT

1.12.1 Materials and Products

1 Planting Material. Refer to Clause 1.3, Products and Materials for the general requirements of plant materials. For specific requirements, refer to Clause 1.3.2.8, Lawn- grass Turf. Material for any replacement shall be the same species as that installed and as in the Plant Materials Schedule of the ‘As-Built’ drawings.

2 Material for replacement shall either be sprigs or plugs, unless otherwise directed by the Engineer.

3 Supplier or Grower shall be a certified Qatar-based company specializing in the production of turf grass.

4 Accessories. Refer to Clause 1.4, Accessories in General for required accessories applicable in turf management.

1.12.2 Workmanship.

1 In replacing or replanting any turf lawn grass, refer to Clause 1.7.6, Planting Lawn grass Turf.

2 Installer shall have a minimum of five [5] years relevant experience in turf grass installation and maintenance and approved by the Engineer.

3 Coordinate With All Adjoining and Related Works. Coordinate maintenance with all adjoining works not necessarily limited to installed underground lawn sprinkler system piping and watering heads, including those for trees, palms, shrubs and groundcovers.

1.12.3 Site Preparation.

1 For general requirements, refer to Clause 1.6, Site Preparation for Planting Areas. For specific requirements, refer to Clause 1.7.6, Planting Lawn grass Turf.

1.12.4 General Care.

1 The general care and management of turf shall be according to an approved Operations and Maintenance [O+M] Manual. Where maintenance requires variation in procedures, submit a Method Statement for approval by the Engineer.

2 Watering. During establishment of turf areas, ensure that sufficient water is applied to maintain healthy growth. Irrigate by sprinkler until full depth of topsoil is saturated.

3 Mowing Program. Mow the turf areas periodically according to a mowing schedule as approved by the Engineer. Mow regularly to ensure tight, dense turf growth to discourage weeds. In mowing, avoid damage to any edging restraints separating or demarcating turf areas from other planting beds and pavement. Any displaced edging restraints shall be promptly repaired and made good.

(a) First Mowing. When ninety [90%] percent turf cover has been achieved, mow first to a height of approximately 50 mm.

(b) Subsequent Mowing. Mow subsequent cuts during the growing season to keep turf at approximately 50 mm height. Do not allow any patches of weed growth in them to exceed this height and flower.

(c) Avoid Thatching. During regularly scheduled mowing, do not mow severely to avoid die-back and thatching. Keep mowing height to a minimum height of 30mm.

~~(d)~~ Hard Mowing. Unless otherwise directed by the Engineer, hard mow three [3] times a year. Mow to a 10mm height, with care to avoid die-back and thatching.

(e) Mowing Direction. During each mowing event, vary the direction of mowing. Mow in parallel strips at uniform and consistent speed.

The second mowing pass shall be perpendicular to the first. At the end of each mowing event, the mown turf shall be to within the prescribed heights in (b) and (c) above.

(f) Mowing Method. Mow using mechanized equipment [e.g. rider mowers, cylindrical mowers] where mowing equipment cannot reach, trim with appropriate smaller equipment. Ensure cutting blades are kept sharp.

(g) In tight spaces where no mow strips are provided close to vertical walls, trim manually.

4 Fertilizing with Inorganic Fertilizer.

After regular mowing, fertilize turf uniformly with controlled slow-release fertilizer six [6] times a year.

(a) Fertilize monthly according the schedule and rates in Table 4. Schedule and Rates for Inorganic Fertilizer for Turf grass.

(b) Irrigate after fertilizing to dissolve the fertilizer into the turf.

Table (4)
the monthly Schedule and Rates for Inorganic Fertilizer for Turf grass

Month	Schedule Maintenance application rate		
	Urea/ Ammonium Sulphate, g	Controlled Slow-Release NPK, g	Organic Amendments, g
January	none	none	(1) Material shall be stabilized and thoroughly composted (2) Apply as directed by the Engineer
February	none	1.5 N	
March	none	4.0 N	
April	none	none	
May	none	4.5 N	
June	none	none	
July	none	4.5 N	
August	none	none	
September	none	4.0 N	
October	none	none	
November	none	1.5 N	
December	none	none	

Notes [1] NPK controlled-release Nitrogen [CRN] ratios 4-1-2 or 2-1-3 are based on growth season and lawn maintenance practices. The ratio of fertilizer is subject to alteration based on actual soil chemical tests

[2] N denotes actual available Nitrogen

5 Aeration. Upon the direction of the Engineer, aerate the turf with a tined equipment to a minimum depth of 120mm.

(a) Frequency. Aerate once yearly, unless otherwise directed by the Engineer,

(b) After Aeration, fertilize according to the rates and schedules in Table 4 Application Rates and Schedule during Maintenance. Two [2] days after fertilizing, tamp roll the turf.

6 Coordinate With Irrigation System. Coordinate with irrigation maintenance to ensure that the top levels of sprinkler heads shall 25mm below the finish lawn grade. Adjust sprinkler heads to ensure none are proud of the turf grass finish level.

7 Clean-Up. Always keep the site in a clean and tidy condition.

(a) Grass Clippings, Leaf Litter. Collect and remove freshly mown grass clippings and any leaf litter in bags for disposal to an approved location. Any clippings left behind shall be raked clean and removed from the turf.

(b) Stray Mulch. Any misplaced mulch material [e.g. gravel, wood bark, shredded rubber] shall be removed from turf and returned to their adjoining beds.

1.12.5 Maintenance Warranty Periods.

1 Maintenance warranty periods of turf areas shall be according to their method of planting as below:

2 General. Turf areas shall be maintained for no less than the period stated and longer as required to establish an acceptable lawn. Any extension of the maintenance period shall be as directed by the Engineer.

3 Turf Planted by Seeding shall be maintained through three [3] maintenance cuttings, but not less than sixty [60] days after substantial completion.

4 Turf Planted by Plugging, Sprigging or Sodding shall be maintained through two [2] maintenance cuttings, but not less than thirty [30] days after substantial completion.

1.13 APPLICATION OF PESTICIDE

1.13.1 General Requirements.

1 When pesticide becomes necessary to control a disease or pest, trained and certified personnel shall apply the required pesticide in accordance with the manufacturer's recommendations and a Pest Management Programme contained in the approved Operations and Maintenance [O+M] Manual.

2 Application Method. Hydraulic equipment shall be provided for liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. Observe safety measures in application.

3 Method Statement. Prior to application the Contractor shall submit a Method Statement for treatment for approval by the Engineer. Any variation in the treatment shall clearly be indicated, including discretion in increasing or decreasing dosages, frequency and times of application.

4 Apply in staggered times to reduce the risk of any untoward stress reactions, plant dieback and bioaccumulation.

5 Safety Measures. Apply when environmental conditions are not windy to prevent atmospheric drift. Areas freshly applied with pesticides shall be cordoned off from public use and access. Safety measures [e.g. safety instructions, warning tape, temporary signage in English and Arabic] shall be coordinated with the Safety Engineer.

1.13.2 Preventive Maintenance.

1 As part of its integrated Pest Management, the Contractor shall practice preventive maintenance. It shall assign personnel trained in early detection and treatment of the symptoms of pest infestation and disease to avert widespread use of pesticides.

1.13.3 General Application Schedule.

1 Unless otherwise directed by the Engineer, the application of pesticides shall be according to the following broad schedule:

2 November. Apply fungicide of Metalaxyl in a slow release formulation such as granules to control soil-borne fungi. This shall be in addition to another general fungicide and a systemic insecticide to control t other types of fungi and the insects which are capable of being active during cool weather.

3 February. Apply the same formulation of Metalaxyl with a mixture of another general fungicide and a systemic insecticide taking into consideration that the Contractor shall use a different type of the general fungicide and insecticide than the previous application to avoid pests' resistance.

4 May. Apply a mixture of insecticides consisting of systemic and contact insecticides addition to a general fungicide.

5 September. Repeat the same as for May, but vary the mixture of insecticides and fungicides to reduce the risk of pest resistance.

1.14 WARRANTY MAINTENANCE AND HANDOVER

1.14.1 General.

1 Upon substantial completion of landscaping work as approved by the Engineer, the plant establishment period shall immediately commence. The plant establishment period [i.e. defects liability period] shall be in effect until the end of the warranty period. At the end of the warranty period, all plants and turf shall be in a healthy and living condition.

1.14.2 Inclusive Scope.

1 The scope of warranty maintenance shall cover, but not necessarily be limited to the same as in Clause 1.14.2, Inclusive Scope. The Contractor shall provide all the needed not necessarily limited to products and materials, equipment and tools, testing, labor and management to fulfil maintenance warranty.

2 The Contractor shall maintain the landscape works to best established practices in landscape maintenance to the intent and as specified in Clause 1.8.1, Care of Completed Landscaping.

1.14.3 Establishment Period

1 Shall be in effect until the end of the warranty period. Duration of maintenance during this period shall be as indicated in the landscape construction Contract. The Contractor shall remain responsible for maintaining all the works until final acceptance and handover, to the satisfaction of the Engineer.

2 Works Completed Within One [1] Growing Season. In such a case and unless otherwise specified, the establishment period shall be until after the end of the warranty period after the date of substantial completion of work covered by this Section and as specified in the Contract.

3 Works Covered by Several Establishment Periods. Where landscape works extend beyond more than one [1] growing season due to the project's size and complexity, or where there was variance to the planting times, the following shall apply:

(a) Separate Establishment Warranty Periods. Plant establishment periods shall be furnished for corresponding parts or zones of the works completed.

(b) Demarcated Boundaries. The boundaries of landscape works covered by differing warranty periods shall be clearly marked in plans with each's written calendar dates of warranty coverage provided.

1.14.4 Replacement Plants during Establishment Period.

1 Replacements shall be according to Clause 1.10, Plant Replacement.

1.14.5 Final Acceptance and Handover

1 Preliminary Inspection. Two [2] weeks prior to the end of the plant establishment warranty period, a joint preliminary inspection shall be undertaken by the Engineer and the Contractor in order to gain approval for Final Handover. The time for this inspection shall be established in writing.

(a) Bases for Review. In order to ensure adequate handover procedures, the site meetings held each month between the Contractor and the Engineer shall be the basis for reviewing maintenance works.

(b) Quality of Maintenance Works. The quantity and types of plants installed and the acceptability of the plants shall be determined. The plant establishment and warranty period will end with this inspection, provided that the Contractor has complied with the work required under Clause 1.8.1.1, General Requirements. The Contractor shall also comply with the following requirements.

2 Plant Replacements Made Good. Dead, missing or defective plant material or turf shall be replaced. Replaced plants will be of the same size and species as originally specified.

3 Weed Control. Weed plant beds and saucers. Prior to inspection treat these areas with an application of approved pre-emergent herbicide.

4 Remove Supports. At the end of the establishment warranty period, it is expected that all planting would have established themselves so as not to require supports. Remove stakes, guy wires and wrappings from plants as may be directed by the Engineer.

5 Remedial Measures. Complete remedial measures as directed by the Engineer.

6 Repairs. Any damages caused to work under warranty, and to adjoining work shall be repaired and made good by the Contractor.

7 Final Inspection. A final joint inspection, if required, shall be undertaken by the Engineer and the Contractor to determine that the deficiencies noted in the preliminary inspection have been corrected. The time for this inspection shall be established in writing at least two [2] weeks prior to inspection.

(a) Written Acceptance. If after final inspection, all works have been performed in accordance with the 'As-Built' Drawings and to established best practices and procedures, the Engineer shall issue in writing a Practical Completion Certificate [PCC].

(b) Non-Acceptance. If all or certain portions of the works are not acceptable, the official Establishment Maintenance Warranty Period for such shall be extended at no extra cost to the Client, until the defects in the works are made good and final acceptance is obtained.

1.15 POST-HANDOVER MAINTENANCE

1.15.1 GENERAL

1 Maintenance Personnel.

All management and technical personnel and work crews shall have relevant qualifications and experience in Qatar-based landscape contracting company specializing in landscape planting.

2 Inclusive Scope.

(a) The scope of post-handover maintenance shall be as provided for in Clause 1.15.1.2, Inclusive Scope.

(b) The Contractor shall maintain the landscape works to best established practices in landscape maintenance to the intent and as specified in Clause 1.8.1, Care of Completed Landscaping.

1.15.2 Operations and Maintenance [O+M] Manual.

1 Upon completion of the landscape establishment warranty period [i.e. the defects and liability period] and prior to final acceptance, the Contractor shall provide an O+M Manual containing best practices in procedures and methods in landscape maintenance:

2 Format and Number of Sets. The Contractor shall provide in A4 size format, four [4] durably-bound waterproof hardcopy sets of an O+M Manual. The Manual shall be legible, easily understandable, navigable and well-organized into Sections. The hardcopy sets shall be accompanied by four [4] electronic files in PDF format.

3 Language Versions. The O+M Manuals shall be supplied in separate sets in both English and Arabic. The Contractor shall ensure that the Arabic version is a faithful translation of the English.

4 Where there is a discrepancy between the Arabic and English, the English shall prevail.

5 Irrigation Manual. The manual shall contain within it a complete Irrigation Manual detailing, among others, irrigation application rates, diagnostic procedures and systems maintenance, water quality testing, clear procedures for inspections, monitoring and reporting.

6 Landscape Maintenance Manual. The manual shall also contain a complete Land-scape Maintenance Manual detailing, among others, horticultural practices in plant care [e.g. Fertilizer application rates, soil analysis, materials testing, pest management, turf management, and clear procedures for inspections, monitoring and reporting].

1.15.3 Maintenance Period.

1 Duration of maintenance period after handover shall be as indicated in the maintenance services Contract. The Contractor shall remain responsible for maintaining the works until the Maintenance Certificate shall have been signed by the Engineer and delivered to the Owner stating that the works have been completed and maintained to his satisfaction

1.16 PENALTIES

1.16.1 Penalties for Non-Performance and Delays.

1 The Contractor shall carry out the maintenance work as scheduled and directed by the Engineer. Failure to do so shall subject the Contractor to penalties as stated in its Contract.

2 Cost Implications**.** The Contractor shall bear all cost implications arising from its negligence and inaction and no payment shall be processed pending the calculation of penalties and having been informed in writing by the Engineer of such applicable penalties.

3 **Applicable Penalties.** Penalties are not necessarily limited to delays in the scope of maintenance activities as specified in Clause 1.7.13 (2), Inclusive Scope for maintaining the following:

(a) Palms and trees
(b) Shrubs and hedges
(c) Climbers or vines
(d) Groundcover beds
(e) Accent plants
(f) Turf management

4 In addition to the above, delays by the Contractor in providing the following more than six [6] days after having been instructed in writing by the Engineer shall be subject to penalties:

(a) Qualified and experienced staff
(b) Complement of equipment and tools
(c) A complete Operations and Maintenance [O+M] Manual as required in Clause 1.15.2
(d) providing plant replacements to required species, sizes and quantities
(e) irrigation system parts and components necessary for the functional support of planting

1.16.2 Recoverable Amounts Due to Penalties.

1 In the event the Contractor fails to satisfactorily carry out the work specified, the Engineer shall initiate removal proceedings against the negligent Contractor and employ persons other than the Contractor's staff to carry out remedial and unfulfilled or remaining maintenance works.

2 In doing so, the Engineer in behalf of the Client, shall recover from the Contractor such costs incurred from any monies due, or which become due, to the Contractor.

1.16.3 Termination and Removal of the Contractor.

1 Should the Engineer decide to terminate the work of the Contractor for due reason, the Contractor shall be entitled to only part of the acceptable work delivered, quantum merit as assessed by the Engineer.

1.16.4 New Appointed Contractor.

1 In the event of removal of the Contractor, the Engineer shall appoint a new Contractor to carry out remedial work and all other unfulfilled and remaining maintenance works not performed by the former Contractor. In such a case, payments for the removed Contractor shall be made only after payment due to the new Contractor that carried out the defective, unfulfilled, defective and remaining work had been processed.

1.17 RESOURCE ALLOCATION

1.17.1 Staffing and Personnel Complement.

1 The Contractor shall separately list its full complement of management and technical personnel, any specialist consultants, its field supervisors and work crews with details of scheduling of their work onsite and offsite, their assignment as full or part-time for the duration of the maintenance period.

1.17.2 Equipment Complement.

1 The Contractor shall separately list its full complement of tools and equipment with details of scheduling of their use onsite and for the duration of the maintenance period.

1.17.3 Testing Laboratories.

1 List any independent third-party laboratories which shall provide any testing services.

1.18 APPENDIX A. PLANT LIST, IRRIGATION DEMAND AND SIZES

The following Table does not claim to be an exhaustive list of species suited to or adaptable to Qatar conditions and is subject to periodic amendment from time to time. This Table is provided as design guidance only and does not restrict any project from using its project-specific Plant Materials Schedules. The information provided is meant to be design guidance primarily in establishing irrigation water demand, irrigation zoning by group and minimum acceptable plant sizing.

1.18.1 Palms and Palm-like Plants

Botanical Name	Common Name	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/ day/year	Pot Size cm	Root Ball dia cm	Clear Trunk/ Total Height/ Required Size
Bismarkia nobilis	Bismark Palm	3		22			2.0 m
Brahea armata	Mexican Blue Palm	3	35	22	40		1.50 m
Chamaerops humilis	European Fan Palm	2	25	15	30		1.50 m
Chamaerops humilis	Mediterranean Fan Palm	2	25	15	40		
Cocos nucifera	Coconut palm	4	65	29		75	2.0 m
Cycas revoluta	Sago palm	3	35	22	25-30		0.50 m
Dioon edule	Mexican Cycad	3	35	22	25-30		1.0 m
Elaeis oleifera	American oil palm	3	35	22		75	1.50 m
Hyophorbe lagenicaulis	Bottle Palm	3	35	22		75	1.25 m
Hyophorbe verschaffeltii	Spindle Palm	3	35	22			1.25 m
Livistona chinensis	Cabbage Palm	3	35	22	40		2.0 m
Livistona marie "Oombulgurri"	Australian Cabbage Palm	3	35	22	40		2.0 m
Livistonia chinensis	Chinese Fan Palm	3	35	22	30		1.50 m
Nanorrhops ritcheana	Mazari Palm	3	35	22	24		
Phoenix canariensis	Island Date palm	4	65	29		125	2.0 m
Phoenix dactylifera	Date palm	4	65	29		125	2.0 m
Phoenix roebelenii	Miniature Date Palm	3	35	22		60	1.0 m
Phoenix roebelenii	Miniature Date Palm	3	35	22	40		2.0 m
Phoenix sylvestris	Wild Date Palm	4	65	29	40		2.0 m
Roystonea regia	Cuban Royal Palm	4	65	29		60	1.50 m
Sabal domingensis	Hispaniola Palmetto	4	65	29		60	2.0 m
Washingtonia filifera	California Fan Palm	3	35	22		75	2.0 m
Washingtonia robusta	Washingtonia Palm	3	35	22		75	2.0 m
Wodyetia bifurcata	Foxtail Palm	4	65	29		60	1.50 m

1.18.2 Large Evergreen Trees

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/day	Mean Daily Demand l/plant/day/year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Acacia abyssinica	Nyanga Flat Top	2	25	15	24	10	60	
Acacia auriculaformis "Gaypari"	Ear Pod Wattle	2	25	15	24	10	60	
Acacia pendula "Amata"	Weeping Myall	2	25	15	30	10	60	1.0 m
Acacia salicina "Marntala	Willow Acacia	2	25	15	30	10	70	1.0 m
Adansonia gregorii "Jamulang"	Baobab Tree	4	35	25	40	15	80	1.50 m
Alstonia actinophylla “Jabiru”	Australian Milkwood Tree	3	35	22	30	10	80	1.50 m
Alstonia scholaris	Milkwood	3	35	22	30	10	80	1.50 m
Brachychiton "Bella Donna"	Belladonna Flame Tree	3	35	22	24	10	80	1.20 m
Brachychiton acerifolius “Allowrie”	Illawarra Flame Tree	3		22	24	10	80	1.20 m
Brachychiton diversifolius	Pink Kurrajong	3	35	22	24	10	80	1.20 m
Brachychiton Populneus	Bottle tree	3	35	22	25	8	50	1.50 m
Bucida bucares	Antigua Whitewood	3	35	22	40	10	80	1.50 m
Caesalpinia ferrea	Leopard Tree	3	35	22	40	10	80	1.50 m
Casuarina equisetifolia	Horsetail tree, Australian Pine	3	35	22	25	8	50	1.50 m
Chorisia speciosa	Bottle tree	3	35	22	35	50	100	2.0 m
Corymbia apperinja "Alice Para"	White Gum	2	25	15	24	10	70	1.20 m
Erythrina orientalis variegata "Ngukurr"	Variegated Coral Tree	4	35	25	24	10	80	1.50 m
Eucalyptus bigalareta "Mijilypa"	Northern Salmon Gum	3	35	22	24	10	75	1.50 m
Ficus altissima	Council tree	3	35	22	25	8	50	1.50 m
Ficus benghalensis	Banyan Tree	3	35	22	24	10	80	1.0 m
Ficus religiosa	Sacred ficus	4	35	25	25	8	50	1.50 m
Ficus salicifolia	Willow Leaf Fig	2	25	15	24	10	80	1.0 m
Ficus sycomorus	Mulberry Fig	3	35	22	24	10	80	1.0 m
Mangifera indica	Mango Tree	3	35	22	40	10	80	1.0 m
Millingtonia hortensis	Tree Jasmine	3	35	22	24	10	80	1.0 m

Moringa oleifera	Horse radish tree	3	35	22	25	8	50	1.50 m
Parkinsonia aculeata	Jerusalem thorn	2	25	15	25	8	50	1.50 m
Pithecelobium dulce	Manila Tamarird	3	35	22	25	8	50	1.50 m
Prosopis alba	White Carob Tree	2	25	15	25	8	50	1.50 m
Prosopis cinerarea	Ghaf Tree	2	25	15	20	8	80	1.0 m
Prosopis juliflora	Honey Mesquite	2	25	15	25	8	50	1.50 m
Schinus molle	Pink pepper, Peruvian Pepper	3	35	22	25	8	50	1.50 m
Tamarindus indica	Tamarind	3	35	22				
Terminalia arjuna	Arjun Tree	3	35	22	33	10	75	1.0 m
Terminalia cattapa	Indian almond	3	35	22	25	8	50	1.50 m
Zizyphus jujuba	Chinese date	3	35	22	25	8	50	
Zizyphus spina-christi	Sidr	2	25	15	25	8	50	1.50 m

1.18.3 Medium Evergreen Trees

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/day/ year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Acacia Arabica see A.nilotica	Arabian acacia	2	20	15	24	10	50	1.50 m
Acacia arnesiana	Yellow Mimosa	2	20	15	20	6	50	1.50 m
Acacia nilotica	Scented Acacia	2	20	15	24	10	50	1.50 m
Calliandra haematocephala	Powder Puff	2	20	15	40	10	80	1.50 m
Cassia brewsterii	Velvet Cassia	3	35	22	20	8	75	0.75 m
Cassia grandis	Coral Shower	3	35	22	24	10	80	1.0 m
Cassia roxburghii	Red Cassia	3	35	22	24	10	80	1.0 m
Casuarina cristata	Belah	2	20	15	24	8	60	
Dalbergia sissoo	Indian Rosewood	3	35	22	20	6	50	1.50 m
Pongamia pinnata	Pongam	3	35	22	33	10	80	1.0 m
Saraca indica	Ashok	3	35	22	33	10	50	1.0 m
Schinus terebinthifolius	Brazilian Pepper Tree	2	20	15	20	6	50	1.50 m
Tabebuia rosea	White Trumpet Tree	3	45	22	20	6	50	1.50 m
Tipuana tipu	Rosewood Tree	3	45	22	24	8	50	1.0 m
Xanthorrhoea australis	Grass Tree	2	20	15	20	12	35	1.0 m

1.18.4 Semi Deciduous Trees

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/day/ year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Albizia julibrissin	Silk tree, Mimosa	3	35	22	20	8	50	1.50 m
Albizia lebbeck	Woman's Tongue	3	35	22	20	8	50	1.50 m
Azadirachta indica	Neem tree	3	35	22	20	8	50	1.50 m
Bauhinia variegata	Orchid tree	3	35	22	20	8	50	1.50 m
Delonix elata	Royal Poinciana, Flame Tree	3	35	22	20	8	50	1.50 m
Delonix regia	Flame of forest	4	35	25	20	8	50	1.50 m
Melia azedarach	China Berry	3	35	22	20	8	50	1.50 m
Morus alba	White Mulberry	3	35	22	20	8	50	1.50 m
Morus nigra	Black mulberry	3	35	22	20	8	50	1.50 m
Peltophoroum inerme	Yellow Poinciana	3	35	22	20	8	50	1.50 m
Thespesia populnea	Portia Tree	3	35	22	20	8	50	1.50 m

1.18.5 Small Trees or Large Shrubs

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/day/year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Acacia anthochaera	Kimberley's Wattle	2	5	4	20	6		
Acacia colei	Australian Soap Wattle	2	5	4	20	8	60	
Acacia cowleana	Halls Creek Wattle	2	5	4	20	8	50	

Acacia ehrenbergiana	Salam	1	5	2	20	8	50	
Acacia etbaica	Arad	2	5	4	20	8	50	
Acacia gerardii	Grey Haired Acacia	2	5	4	20	8	50	
Acacia jennerae	Coonavittra wattle	2	5	4	20	8	50	
Acacia kempeana	Wanderry Wattle	2	5	4	15	6	30	
Acacia mountfordiae	Mountford's Wattle	2	5	4	20	8	50	
Acacia saligna "Cujong"	Golden Wreath Wattle	2	5	4	20	8	50	1.0 m
Acacia tortillis	Samr	1	5	2	20	10	60	1.0 m
Boswellia sacra	Frankincense Tree	2	5	4	20	8	60	1.0 m
Caesalpinia gilliesii	Bird of Paradise Bush	3	10	5	15-20		40	0.50 m
Calliandra haematocephala	Red Powder Puff	3	10	5	15-20		40	1.0 m
Callistemon viminalis “Tubada”	Australian Weeping bottle brush	3	10	5	15-20	3	60	1.0 m
Callophyllum inophyllum	Beauty Leaf	3	10	5	24	10	80	1.0 m
Calotropis procera	Dead Sea Apple	1	5	2	15-20		50	0.50 m
Carica papaya	Papaya	4	10	7	15-20	3	60	1.50 m
Cassia biflora	Desert Cassia	2	5	4	20	8	50	0.75 m
Cassia fistula	Golden Shower Tree	3	10	5	15-20	4	60	1.50 m
Cassia glauca	Kalamona	3	10	5	20	8	50	0.75 m
Cassia javanica	Apple Blossom Tree	3	10	5	15-20		60	1.0 m
Cassia nodosa		3	10	5	15-20		60	1.0 m
Commyphora myrrha	Myhrr	2	5	4	20	10	50	
Cordia lutea	Yellow Geiger Tree	3	10	5	20	10	50	
Cordia sebestena	Scarlet Cordia, Aloe Wood	3	10	5	15-20		60	2.0 m
Dodonaea viscosa	Hopseed Bush	2	5	4	15-20		10	0.50 m
Dracaena draeco	Dragon Tree	3	10	5	20		75	

Eremophila longifolia "Tulypurpa"	Weeping Emu Bush	1	5	2	15		20	
Eucalyptus lucens "Manyuwan"	Shiny Leaved Mallee	2	5	4	20	8	50	
Eucalyptus miniata	Darwin Woolly Butt	3	10	5	15	8	50	
Eucalyptus thozetiana	Thozets Gum	2	5	4	15	8	50	
Geijera parviflora	Wilga	2	5	4	20	10	75	
Gossypium australe "Nurom"	Australian Desert Rose	1	5	2	15		80	
Gossypium bickii	Desert Rose	1	5	2	15		80	
Gossypium darwinii	Darwin's Cotton	2	5	4	15		80	
Gossypium sturtianum "Kintore'	Sturt's Desert Rose	2	5	4	15		80	
Hibiscus rosa-sinensis	China Rose	3	10	5	15-20		30	0.50 m
Hibiscus tiliaecius	Sea Hibiscus	3	10	5	20	10	50	
Jatropha integerrima	Peregrina	3	10	5	15-20		30	0.50 m
Lagerstroemia indica	Crepe Myrtle	3	10	5	15-20	3	40	1.50 m
Lagerstroemia speciosa	Pride of India	3	10	5	24		40	1.0 m
Leptadenia pyrotechnica	Firecracker Plant	1	5	2	15		80	
Leucophylum frutescens	Texas Ranger	2	5	4	15-20		30	0.50 m
Mauera crassifolia		2	5	4	24	8	80	1.0 m
Malvaviscus arboreus pendiluflorus	Sleepy Hibiscus	3	10	5	15-20		30	1.0 m
Melaleuca bracteata	Black Ti Tree	3	10	5	24	8	50	
Melaleuca quinquenervia	Paperbark	3	10	5	24	10	50	
Moringa perigrina	Drumstick Tree	2	5	4	20	8	80	
Musa paradisiaca	Banana	4	15	7	15-20		50	0.75 m
Myoporum floribundum	Weeping Boobialla	2	5	4	20	8	80	
Nerium oleander	Oleander	2	5	4	15-20		30	1.0 m
Olea europea	Olive	2	5	4	20	6	60	1.50 m

Pandanus utilis "Arkaroola"	Screw Palm	3	10	5	20		50	
Pandanus viethchii	Variegated Screw palm	3	10	5	20		50	
Plumeria obtusa	Temple Tree	3	10	5	20	3	60	1.50 m
Plumeria rubra acutifolia	Temple Tree	3	10	5	20	3	60	1.50 m
Polyalthea longifolia	Mast Tree	3	10	5	33		75	
Punica granatum	Pomegranate	3	10	5	15-20	3	40	1.50 m
Scaevola frutescens	Beach Naupaka	3	10	5	20		40	
Tabebuia argentea	Silver Trumpet Tree	3	10	5	33	10	50	1.0 m
Tabebuia spectabilis	Yellow Tabebuia	3	10	5	33	10	50	1.0 m
Tamarix aphylla	Tamarix or Athol Tree	2	5	4	15		30	
Tamarix sp.	Athel Tree	2	5	4	25	6	50	1.50 m
Tecoma stans	Yellow Bells	2	5	4	15-20		20	1.0 m
Tecomella undulata	Roheda	2	5	4	20	10	50	1.0 m
Thevetia peruviana nereifolia	Yellow Oleander	3	10	5	15-20		20	1.0 m
Vitex agnus castus	Chaste Tree	2	5	4	15-20		20	0.50 m
Vitex purpurea	Arabian Lilac	2	5	4	20		50	
Zizyphus numalaria	Jahrber	2	5	4	20	8	30	

1.18.6 Shrubs

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/day/year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Acacia simsii	Sims wattle	2	5	4	20	6	40	
Acacia victoriae "Alita"	Elegant Wattle	1	5	2	20	6	50	
Acalypha wilkesiana		3	10	5	20		20	0.50 m

Aerva javanica	Desert Cotton or Snow Bush	1	5	2	15	5	30	
Atriplex numalaria	Old Man Saltbush	1	5	2	15		30	
Bougainvillea glabra	Bougainvillea	2	5	4	20		30	1.0 m
Caesalpinia pulcherrima	Barbados Pride	3	10	5	20		40	0.75 m
Calligonum comosum	Arta	1	5	2	15		60	
Carissa edulis	Akamba Bush	2	5	4	20		50	
Carissia grandiflora	Natal plum	2	5	4	20		30	0.50 m
Cassia alata		3	10	5	20			0.50 m
Cassia bicapsularis	Senna	3	10	5	20		30	0.50 m
Cestrum diurnum	Day Jasmine	2	5	4	20		20	0.50 m
Cestrum nocturnum	Night Jasmine	3	10	5	20		20	0.50 m
Crotalaria cunninghamiana	Bird Flower	2	5	4	15		30	
Duranta repens	Blue Butterfly Bush	3	10	5	20		50	
Eremophila alternifolia "Irmangka"	Narrow Leaved Emu Bush	1	5	2	15		20	
Eremophila bignoniflora x polyclada "Kurubimi"	White Emu Bush	1	5	2	15		20	
Eremophila christopheri "Areyonga"	Blue Emu Bush	1	5	2	15		20	
Eremophila maculata " Brevifolia Eridunda"	Red Emu Bush	1	5	2	15		20	
Eremophila maculata "Atitjere"	Red Emu Bush	1	5	2	15		20	
Eremophila obovata		1	5	2	15		20	
Eremophila polyclada "Imampa"	Fine Leaf Emu Bush	1	5	2	15		20	
Eremophila racemosa	Pink Emu Bush	1	5	2	15		0	
Eremophila Summertime Blue	Deep Blue Emu Bush	1	5	2	15		20	

Euphorbia larica		1	5	2	15		60	
Galphimia glauca		3	10	5	15		80	
Haloxylon salicornicum	Rimth	1	5	2	15		50	
Ixora chinensis	Flame of the Woods	3	10	5	20		10	0.30 m
Jasminum sambac	Arabian Jasmine	3	10	5	10-15		15	0.50 m
Lantana camara	Lantana	3	10	5	20		25	0.30 m
Lawsonia inermis	Henna	2	5	4	20		10	0.50 m
Malvaviscus arboreus	Turks Cap	3	10	5	15		80	
Ochradenus baccatus		2	5	4	15		30	
Pachypodium lamerei	Madagascar Palm	3	10		12-15		10-15	0.50 m
Pandanus singaporensis pygmaeus	Dwarf Variegated Screw Palm	3	10	5	20		30	
Radyera farragei	Desert Rose Mallow	2	5	4	15		30	
Senna artemisioides	Narrow Leaf Desert Cassia	2	5	4	15		30	
Senna desolata sturtii	Sturts Senna	1	5	2	15		30	
Tabernaemontana divaricata	Pin Wheel Flower	3	10	5	20		30	

1.18.7 Conifers

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/ day	Mean Daily Demand l/plant/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Callitris intratropica "Oenpelli"	Blue Cypress Pine	3	35	22	24	8	80	
Callitris preissii	Cypress pine	2	25	15	24	8	60	
Cupressus sempervirens	Italian Cypress	2	25	15	25	3	30	1.50 m

Hedge								
Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Atriplex halimus	Salt Bush	1	5	1.2	15		15	0.50 m
Atriplex lentiformis	Salt Bush	2	5	1.9	15		15	0.50 m
Clerodendron inerme	Wild Jasmine	3	10	2.5	15		15	0.50 m
Dodonaea viscosa	Hopseed Bush	2	5	1.9	15		15	0.50 m
Leucophylum frutescens	Texas Ranger	2	5	1.9	15		15	0.50 m
Vitex agnus castus	Chaste Tree	2	5	1.9	15		15	0.50 m
1.18.8 Succulents								
Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Agave "Victoria Regina"	Queen Victoria Agave	2	5	1.9	20			0.30 m
Agave america mediopicta	Agave	2	5	1.9	20			0.30 m
Agave americana	Century Plant	2	5	1.9	30			0.30 m
Agave attenuata		2	5	1.9	20			0.30 m
Agave parryi		2	5	1.9	20			0.30 m
Aloe africana		2	5	1.9	20			0.30 m
Aloe claviflora		2	5	1.9	20			0.10 m
Aloe debrana		2	5	1.9	20			0.10m
Aloe rupestris		2	5	1.9	20			0.20 m

Aloe sessiflora	Lebombo Aloe	2	5	1.9	20			0.20 m
Aloe striata	Coral Aloe	2	5	1.9	20			0.20 m
Aloe vera	medical plant	2	5	1.9	20			0.30 m
Euophorbia lactea	Mottled Spurge	1	3	1.2	20			0.35 m
Kalanchoe diagremontiana		2	5	1.9	15			0.15 m
Kalanchoe rotundifolia		2	5	1.9	12-15			0.15 m
Mamelaria elongata	Monstrous Lady Fingers	1	3	1.2	20			0.25 m
Yucca elephantipes	Soft-Tip Yucca	3	5	2.5	30			1.50 m
Yucca filamentosa	Adam's needle	3	5	2.5	30		30	1.50 m

1.18.9 Vines and Climbers

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/plant/day	Mean Daily Demand l/plant/day/year	Pot Size cm	Stem girth cm	Spreading cm	Clear Trunk/ Total Height/ Required Size
Antigonom leptopus	Coral vine	3	10	5	15		15	1.0 m
Bougainvillea sp	Bougainvillea	2	5	4	20		15	1.0 m
Bougainvillea spectabilis	Bougainvillea	2	5	4	20		15	1.0 m
Clitoria ternata	Butterfly Pea	3	10	5	15			1.0 m
Clytostoma callistegioides	Lavender Trumpet Vine	3	10	5	20			1.0 m
Cryptostegia madagascarensis	Rubber Vine	3	10	5	15			1.0 m
Dipladenia sanderi	Brazilian Jasmine	3	10	5	20			1.0 m
Gelsemium sempervirens	Carolina Jasmine	3	10	5	20			1.50 m
Ipomea pes-caprae		3	10	5	10		15	0.30 m
Ipomoea palmata	Railway creeper	3	10	5	10		15	0.30 m
Jacquemontia violaceae	Sapphire Vine	3	10	5	15		80	

Jasminum officinalis "Grandiflorum"		3	10	5	15		15	1.0 m
Lonicera sempervirens		3	10	5	15		15	1.0 m
Petrea volubilis	Purple Wreath	3	10	5	20		30	
Pyrostegia venusta	Flame Vine	3	10	5	15		50	
Quisqualis indica	Rangoon Creeper	3	10	5	15		15	1.0 m
Tecoma capensis	Cape Honeysuckle	2	5	4	20		30	

1.18.10 Ground covers

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Alternanthera versicolor		3	5	2.5	10		30	0.20 m
Aptenia cordifolia	Baby sun rose	2	5	1.9	10		30	0.20 m
Arctotis hybrids		2	5	1.9	15		15	
Asparagus densiflorus	Asparagus fern	3	15	2.5	10		30	0.30 m
Atriplex semibaccata	Australian Saltbush	1	3	1.2	15		10	
Canavalia rosea	Beach Pea	2	5	1.9	15		50	
Canna indica	Lana	4	5	3.2	10		10	0.30 m
Carissa prostrata	Natal plum dwarf	3	5	2.5	10		30	0.30 m
Clianthus formosus	Sturts Desert Pea	1	3	1.2	15		35	
Cortaderia selloana	Pampas grass	3	5	2.5	10		10	0.30 m
Crassula multicava		2	5	1.9	15		15	
Cuphea mexicana compacta	Mexican Heather	3	5	2.5	15		15	
Cyperus alternifolius	Umbrella sedge	4	5	3.2	10		10	0.30 m
Delaspermum alba	White ice plant	2	5	1.9	10		10	0.10 m

Drosantemum hispidum	Rose ice plant	2	5	1.9	10		10	0.10 m
Echeveria elegans		2	5	1.9	15		10	
Encelia farinosa		2	5	1.9	15		10	
Eremophila arookara "Amoonguna"	Arakoora Emu Bush	1	3	1.2	15		20	
Euphorbia milii	Crown of Thorns	2	5	1.9	10		20	0.30 m
Frankenia hirsuta	Hairy Sea Heath	1	3	1.2	15		10	
Gazania rigens	Treasure flower	2	5	1.9	10		10	0.10 m
Heliotropium curassavicum	Wild Heliotrope	1	3	1.2	12-15		25	
Ipomea pes-caprae	Railroad Vine	3	5	2.5	10		10-15	0.30 m
Ipomoea batata	Ornamental Sweet Potato	3	5	2.5	15		20	
Ipomoea palmata	Railway creeper	3	5	2.5	10		10-15	0.30 m
Iresine herbstii	Blood leaf	3	5	2.5	10		10-15	0.20 m
Lampranthus aurantiacus		2	5	1.9	12-15		30	
Lampranthus aureus	Orange Ice Plant	2	5	1.9	10		10-15	0.70 m
Lampranthus saturatus		2	5	1.9	12-15		30	
Lampranthus spectabilis	Trailing Ice Plant	2	5	1.9	10		10-15	0.10 m
Lantana montevidensis	Geeper lantana	3	5	2.5	10		10-15	0.30 m
Limmonium axillare		1	3	1.2	12-15		20	
Limonium sinuatum	Sea- Lavender	1	3	1.2	10		10-15	0.20 m
Lippia nodiflora	Lippia	3	5	2.5	12-15		10	
Ocimum basilicum	Sweet basil	3	5	2.5	10		10-15	0.30 m
Osteospermum fruiticosum	African daisy	2	5	1.9	10		10-15	0.20 m
Pedilanthus thymaloides		3	5	2.5	12-15		15	
Pennisetum setaceum	Beach grass Fountain grass	2	5	1.9	10		10-15	0.30 m
Pennisetum setaceum rubrum	Purple fountain grass	2	5	1.9	10		10-15	0.30 m

Portulacaria afra	Jade Plant	2	5	1.9	10		10-15	
Pseuderanthemum atropurpureum tricolor	Chocolate Plant	3	5	2.5	15		20	0.30 m
Rhoeo discolor	Moses in the Cradle, Boat lily	3	5	2.5	10		10-15	0.20 m
Rhoeo spathacea	Moses In The Cradle	3	5	2.5	12-15		10	
Rosmarinus officinalis	Rosemary	2	5	1.9	10		10-15	0.20 m
Ruellia tuberosa	Ruellia	3	5	2.5	10-15		15	0.50 m
Russelia equisetiformis	Coral plant, Firecracker Plant	3	5	2.5	10		10-15	0.30 m
Sesuvium portulacastrum	Sea Pureslane	2	5	1.9	10		10-15	0.20 m
Setcreasea pallida	Purple Heart	3	5	2.5	10		10-15	0.15 m
Tradescantia pallida	Purple Heart	3	5	2.5	12-15		10	
Verbena tenuisecta	Moss Verbena	3	5	2.5	12-15		10	
Vitex rotundifolia	Beach Vitex	2	5	1.9	12-15		20	
Wedelia trilobata	Creeping Daisy	3	5	2.5	10		10-15	0.15 m

1.18.11 Seasonals or Annuals

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Ageratum mexicanum	Floss Flower		5	10	10			One flower
Amaranthus tricolor	Joseph's Coat		5	10	10			One flower
Antirrhinum majus	Floral Snapdragon		5	10	10			One flower
Asclepias curassvica	Blood Flower		5	10	10			One flower
Calendula officinalis	Port Marigold		5	10	10			One flower
Callistephus chinesis	China Aster		5	10	10			One flower
Catharanthus roseus	Madagasar Periwinkle		5	10	10			One flower

Celosia cristata	Fair Fountains		5	10	10			One flower
Celosia cristata var.nana	Cockscomb		5	10	10			One flower
Celosia plumosa	Burut Plume		5	10	10			One flower
Chryanthemum morifolium	Florist's Mum		5	10	10			One flower
Chrysanthemum carinatum	Monarch Court		5	10	10			One flower
Cosmos bipinnatus	Mexican Aster		5	10	10			One flower
Dianthus barbatus	Sweet William		5	10	10			One flower
Dianthus chinensis	Chinese Pink		5	10	10			One flower
Gaillardia pulchela	Blanket Flower		5	10	10			One flower
Gazania splendens	Gazania		5	10	10			One flower
Gomphrena globosa	Globe Amaranth		5	10	10			One flower
Kochia scoparia	Summer Cypresus		5	10	10			One flower
Lobularia maritima	Sweet Alysum		5	10	10			One flower
Mathilola incana			5	10	10			One flower
Pelargonium x hybrida	Garden Geranium		5	10	10			One flower
Pellionia pulchra	Training Begoria		5	10	10			One flower
Petunia x hybrida	Petunia Hybrid		5	10	10			One flower
Polianthes tuberosa	The Pearl		5	10	10			One flower
Portulaca graniflora var. Corniche	Moss Rose, Sun Plant		5	10	10			One flower
Salvia splendens	Scarlet Sage		5	10	10			One flower
Senecio cineraria	Dusty Miller		5	10	10			One flower
Tagetes	Marigold		5	10	10			One flower
Verbena peruviana	Aztec Queen		5	10	10			One flower
Viola tricolour	Kiss-Me-Love		5	10	10			One flower
Zinnia sp.	Zinnia		5	10	10			One flower

1.18.12 Turfgrass

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Cynodon dactylon	Bermuda grass	3	5	2.5				
Paspalum vaginatum notatum	Bahia grass, Seashore Paspalum	3	5	2.5				
Zoysia japonica	Japanese Grass	3	5	2.5				

1.18.13 Ornamental Grasses, as Shrub Understory or Accents

Botanical Name	Common Name [English, Arabic]	Irrigation Group	Peak Daily Demand l/m2/day	Mean Daily Demand l/m2/day/year	Pot Size cm	Stem girth cm	Spread cm	Clear Trunk/ Total Height/ Required Size
Cybopogon ambiguus	Australian Lemon Grass	2	5	1.9	15		20	
Cymbopogon citratus	Lemon Grass	3	5	2.5	15		15	
Muhlenbergia capillaris	Gulf Muhly grass							
Imperata cylindrical 'Red Baraon'	Blood Grass	3	5	2.5	15		0	
Pennesetum villosum	African Fountain Grass	2	5	1.9	15		30	
Pennisetum divisum	Dwarf Fountain Grass	1	3	1.2	15		30	
Pennisetum macrourum	African Feathergrass	2	5	1.9	15		30	
Stipagrostis plumosa	Desert Grass	2	5	1.9	12-15		20	

END OF TABLE

1.19 APPENDIX B, TYPICAL PLANTING DETAILS

The following details provide an illustrative guide and contain the minimum acceptable conditions.

1 30mm / 20mm Cell to Capture Surface Water

2 Palm Planting Details

3 Palm Tie Details

4 Typical Tree and Excavation Details

5 Typical Tree Wooden Stakes Details

6 Small Shrub Planting Details

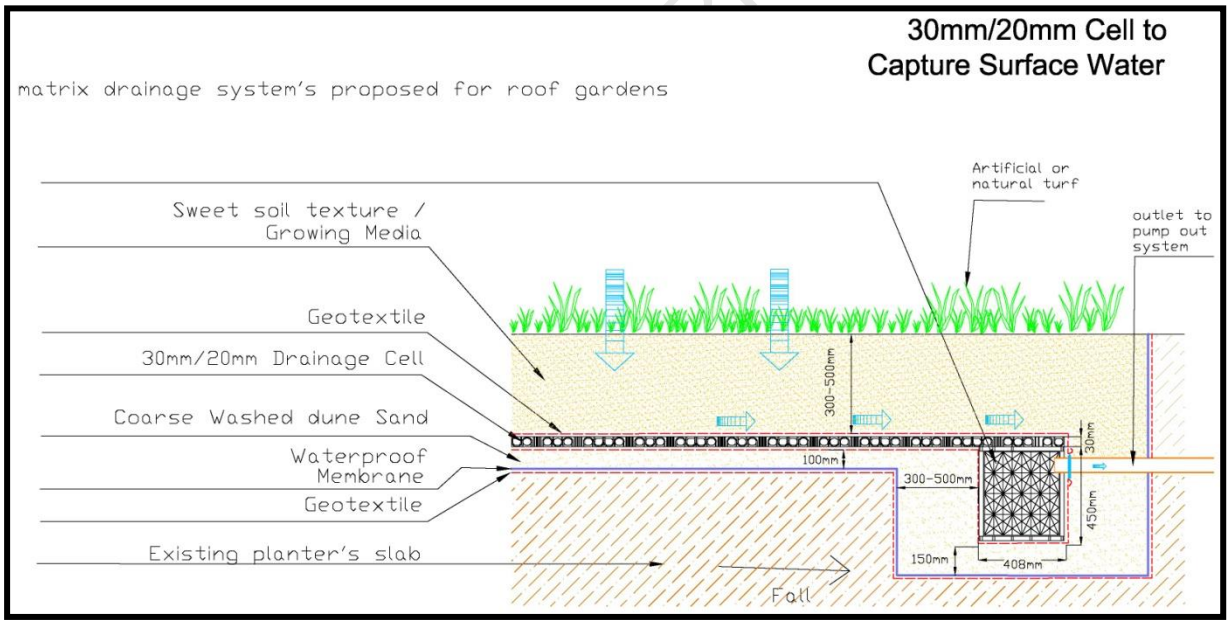
7 Hedge Planting Details

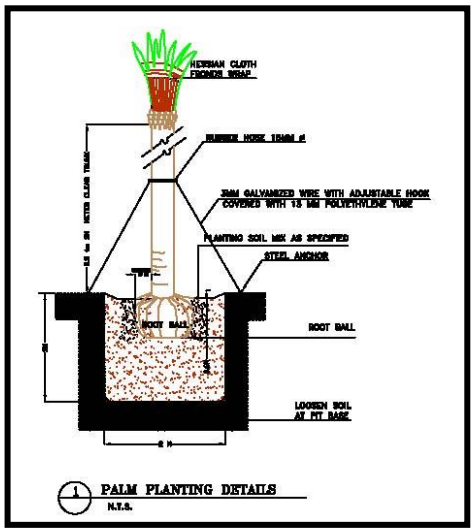
8 Large Shrub Planting Details

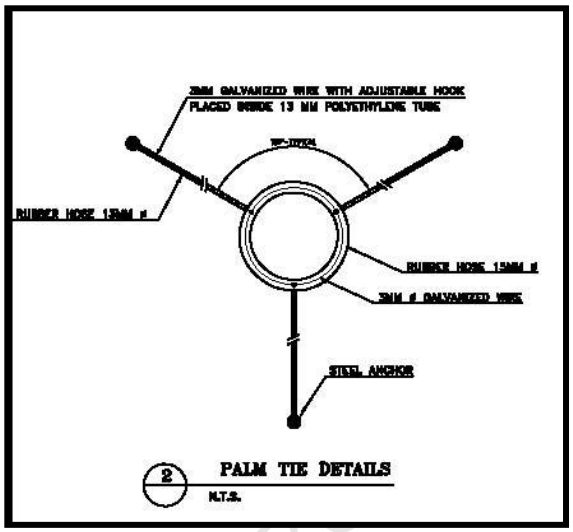
9 Grass Planting Details

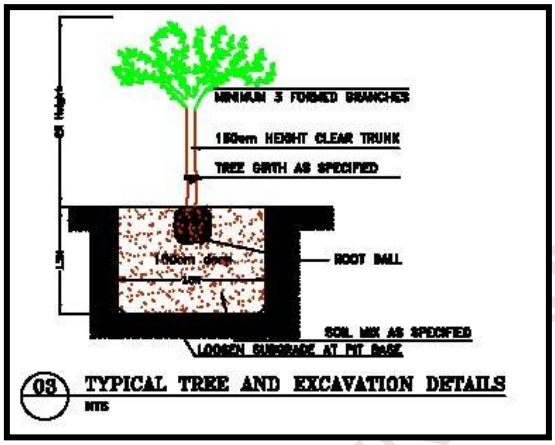
10 Ground Cover Planting Details

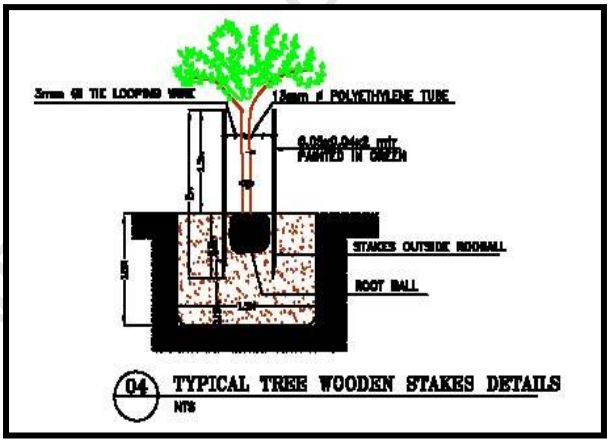
11 Plan for Ground Covers

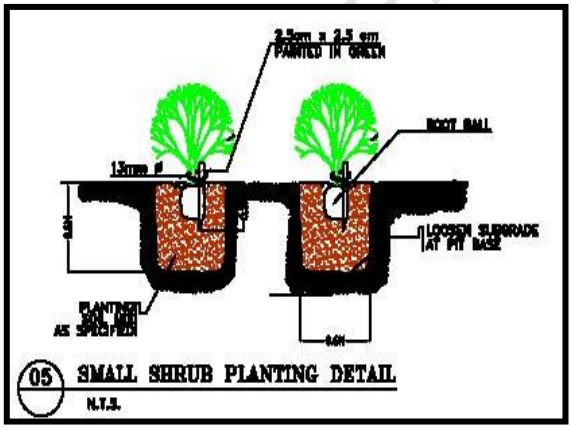


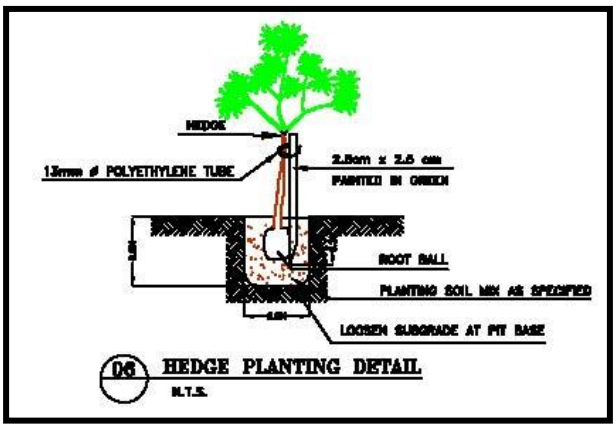


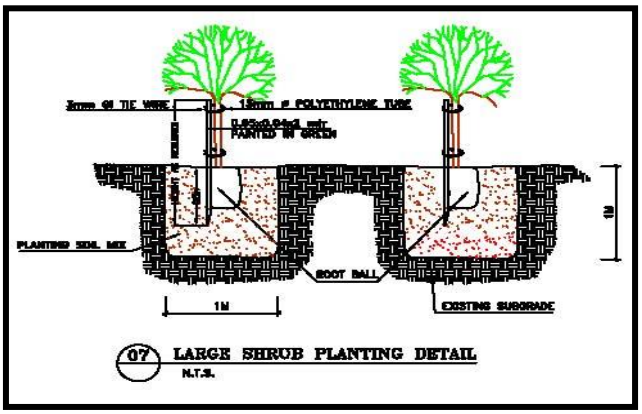




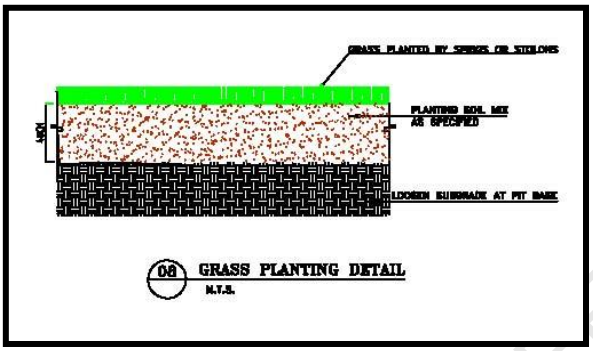




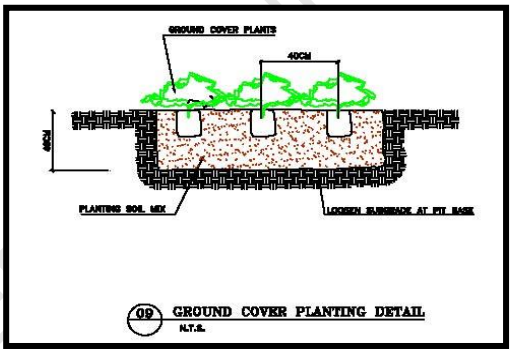




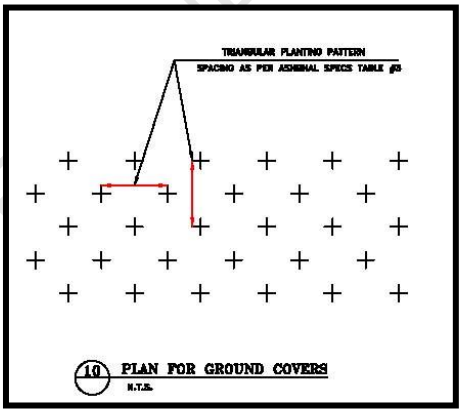
07 LARGE SHRUB PLANTING DETAIL
N.T.S.



08 GRASS PLANTING DETAIL
N.T.S.



09 GROUND COVER PLANTING DETAIL
N.T.S.



10 PLAN FOR GROUND COVERS
N.T.S.

1.20 APPENDIX C, TYPICAL LANDSCAPE CONSTRUCTION DETAILS

The following details provide an illustrative guide and contain the minimum acceptable conditions.

1 Building Foundation

2 Drainage Pipes

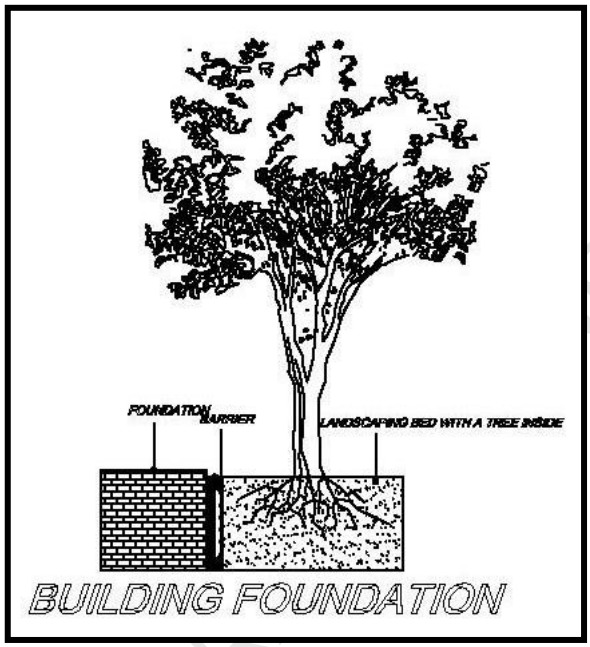
3 Nursery Pot

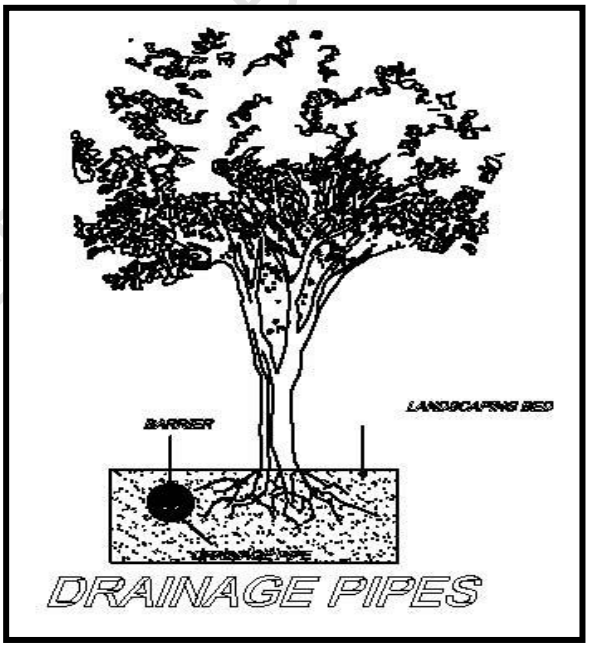
4 Side Walk / Kerbs and Cart Paths

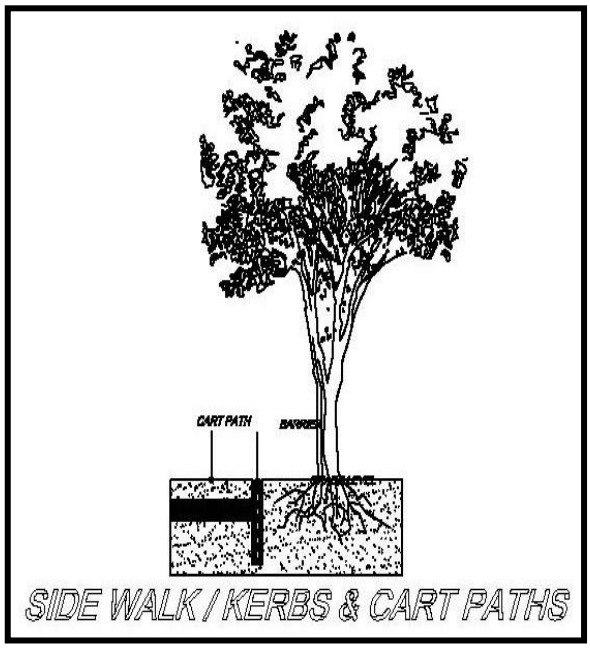
5 Greens / Trees

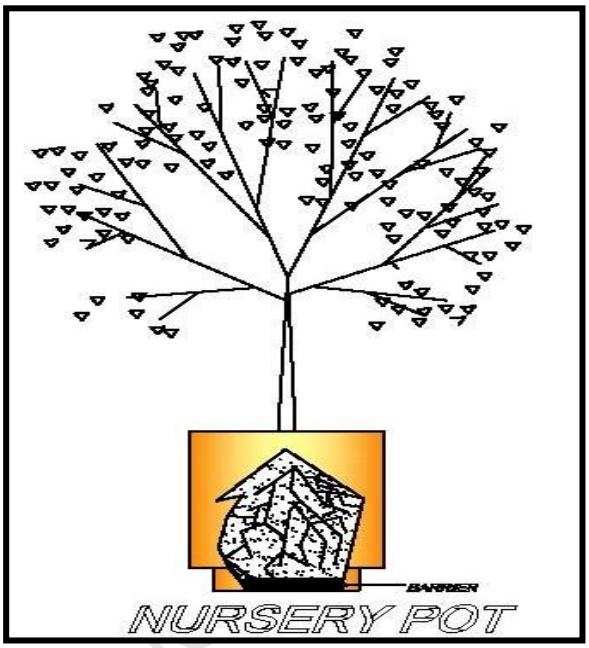
6 New Applications

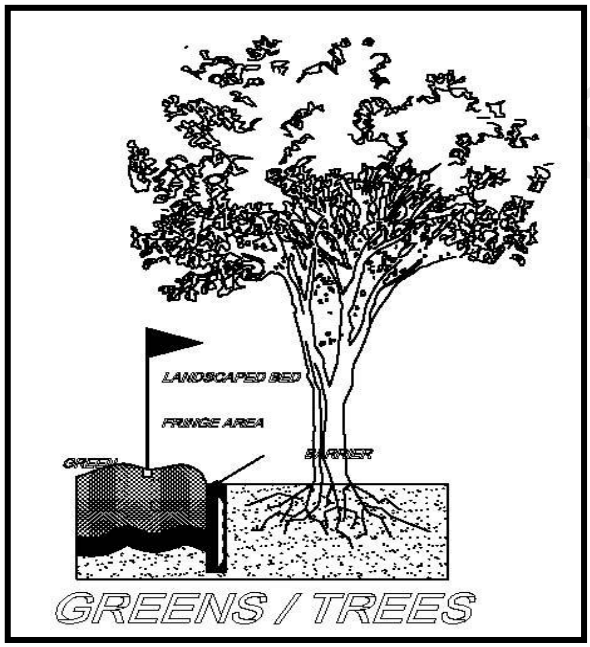
7 Underground Tank

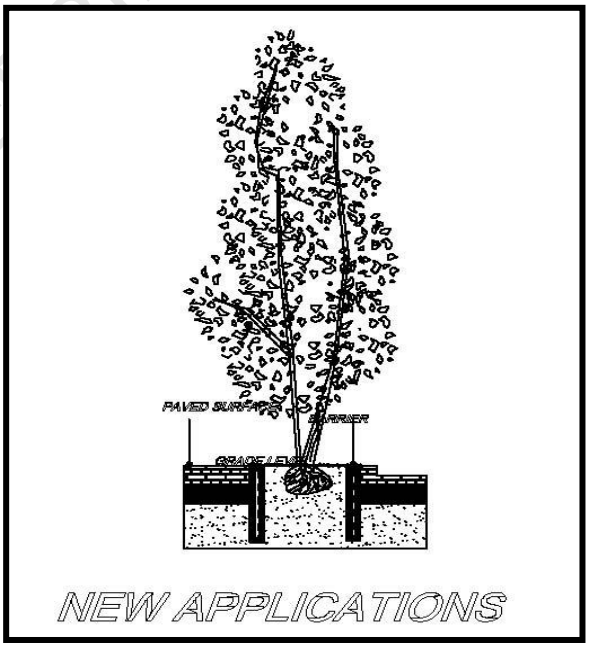


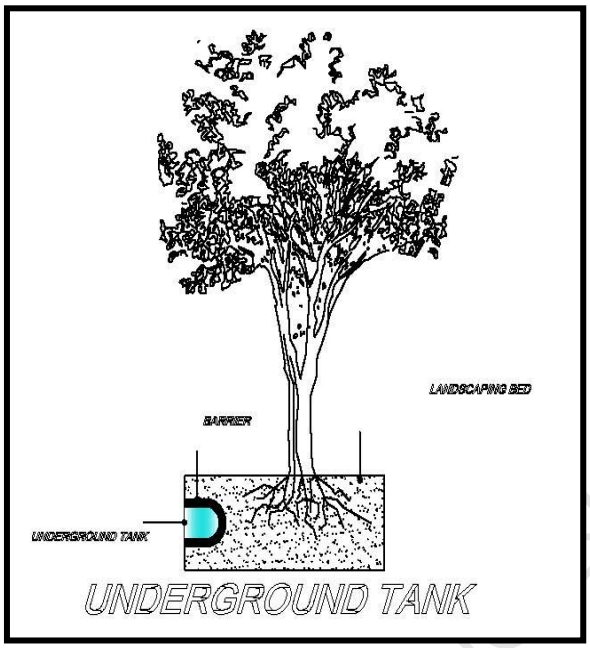



CART PATH
BARRIER
SIDE WALK / KERBS & CART PATHS


BARRIER
NURSERY POT


LANDSCAPED BED
FRINGE AREA
BARRIER
GREENS / TREES


PAVED SURFACE
BARRIER
NEW APPLICATIONS



END OF PART