HORTICULTURE AND LAND SCAPING

HORTICULTURE WORK

Horticultural operations shall be started on ground previously levelled and dressed to required formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or, replaced or it shall be covered over to a thickness decided by the Engineer-in-charge with good earth. In the course of excavation or trenching during horticultural operations, any walls, foundations,etc. met with shall not be dismantled without pre-measurement and prior to the written permission of the Engineer-in-charge.

Nursery

The Contractor shall establish and maintain a suitable holding/acclimatization nursery on or adjacent to the site. It shall be protected from construction works, shaded from sun and wind, and shall be provided with an adequate supply of irrigation water. The size, location, and timing of establishing the site nursery shall be approved by the Engineer-in-charge.

Horticultural Supervisor

A written approval of the Engineer-in-charge shall be obtained for the Contractor's proposed

Horticultural Specialist.

The written approval of the Engineer-in-charge shall be obtained for any temporary or permanent replacements.

The Engineer-in-charge shall inspect all plants for approval and shall supervise the planting of all accents and ornamental palms.

Approved Chemicals

Only chemicals approved and listed by the IIHR India shall be used. All chemicals shall be non-toxic to human beings, birds, and animals and subject to the approval of a qualified specialist. The Contractor shall be liable for ensuring that all chemicals are stored separately, handled, and supplied strictly in accordance with the manufacturer's printed instructions. Neem cake shall be used as biological pesticide where specified.

PRODUCTS AND MATERIALS

Soil

Sweet soil shall be free draining, non-toxic and capable of sustaining healthy plant growth. The soil shall not contain calcium carbonate, subsoil, refuse, roots, heavy clay, noxious weeds, phytotoxic materials, coarse sand, rocks, brush, litter, or any other deleterious materials.

The trenched ground shall be levelled and rough dressed and if there are any hollows and depressions resulting from subsidence which cannot be so levelled, these shall be filled properly with earth brought from outside to bring the depressed surface to the level of the adjoining land and to remove discontinuity of slope and then rough dressed again. The supply and spreading of soil in such depressions is payable separately. In rough dressing, the soil at the surface and for 75 mm depth below shall be broken down to particle size not more than 10 mm in any direction.

The soil shall have the following characteristics:

1. PH 6.0 to 7.5 of saturated soil
2. EC less than 2500 mmhos in saturated extract
3. Chlorides <220 ppm in saturated extract
4. Sulphates <15 ppm in saturated extract
5. SAR <5%
6. Nitrates 75 ppm in saturated extract.

Loam made up by particle size as follows: sand (2mm to 0.05mm) 70% to 80%
silt (0.05mm to 0.002mm) 25% to 30%clay (<0.002mm) 5% max.

'Black' sand shall not be approved.

The representative samples of sweet soil shall be analyzed for all the above characteristics and results Submitted to the Engineer-in-charge for approval.

The soil report shall include recommendations on soil amendment, and fertilizer application, depending on the soil analysis results.

Compost

Compost shall be approved well-rotted cow manure (poultry manure shall not be accepted), free from any deleterious matter. The rotted manure is to be guaranteed to be free from nematodes and harmful bacteria. Special care is to be taken to ensure manure is weed free (especially cypress rotundus)

Vermi compost shall be recycling of garden waste/ kitchen waste or other preferable kind of waste. It can be done by natural composting/ vermin composting and mechanical composting (In vessel Composting (OWC)) technique coverts the waste into manure to increase soil fertility and used as manure. It shall be added in soil mixture as suggested by Engineer-in-charge

Fertilizers

General fertilizer shall be sulfur coated compound N.P.K.16-18-5+ trace elements for shrubs, trees, and grass areas, and shall be Osmocote or equal and approved by the Engineer-in-charge.

- Slow-release fertilizer tablets shall be equivalent to N.P.K.18-18-5+TSE or N.P.K 17-17-4+TSE and shall be used for trees and shrubs.
- Fertilizer shall be furnished in standard containers with the name, weight and guaranteed analysis of the contents clearly marked.
- When a mixed fertilizer is specified, the first number shall represent the minimum percentage of soluble nitrogen, the second number shall

represent the minimum percentage of available phosphoric acid and the third number shall represent the minimum percentage of water-soluble potash.

Planting Medium

- Planting medium shall consist of a homogeneous mixture of soil, compost and fertilizers as specified.
- One bag of compost shall contain 25kg of compost and shall be applied at the following rates:

palm pit	One and a half bags per pit (applied 6months after planting)tree pit
	One bag per pit
shrub pit	Half bag per pitgrass/ground cover bed
	Half bag pe
shrub bed	One bag per m^2
bedding plants	1 bag per m^2

- General fertilizer shall be applied at the following rates:

palm pit	175 gms per pit (applied 6months after planting)
tree pit	100 gms per pit
shrub pit	50 gms per pit
shrub beds	100 gms per m^2grass/ground cover bed
	100 gms pe

- Slow-release fertilizer tablets shall be applied at the following rates:

trees	21gms for every 10mm of trunk diameter
shrubs	21gms for every 300mm of height

Plants

General

All plants shall be of the size specified in the Plant Schedule & Planting Palette at the time of delivery to the site and shall be obtained from an approved source. The Contractor shall allow for all imported and locally sourced plants to be 'grown on' in the holding nursery in order to meet the required specification at time of planting.

All plants shall be supplied as specified in tender documents and the Contractor is expected to import stock if it is not available locally. All imported plant material must be sourced from a reputable Nursery to be approved by the Architect and Engineer-in-charge prior to purchase. Plants shall be true to and supplied under Latin names. Synonyms must be checked with the Architect and Engineer-in-charge.

Engineer-in-charge shall inspect and approve all imported and locally sourced plant material at place of origin. Samples from all plant material shall be made available for approval by theArchitect and Engineer-in-charge.

(i) When inspected, plants shall show no sign of pest infestation, disease, infection, nutrient deficiencies or sunscalds.

(ii) All plants shall be container grown, except for field-grown palm species. Container grown nursery stock shall be vigorous, healthy, and have a well-established root system spread throughout the growing medium container to maintain a firm ball when the container is removed.

(iii) All trees and particularly palms forming avenues or formal planting lines shall be selected to be uniform size and appearance all to the approval of the Architect and Engineer-in-charge. Clear stem height, overall height, and trunk girth shall be consistent and standardized amongthe selected trees/palms stock.

(iv) The Tender must be based, without exception, upon plants that are specified. If plants are subsequently found to be unobtainable, alternatives may be submitted, stating how they differ from the Specification. Such substitutions may not be acceptable, and submission of further alternatives may be required. Approval in writing shall be obtained for any substitution.

(v) Plants shall be true to and supplied under Latin names. Synonyms must be checked with the Architect and Engineer-in-charge. Nomenclature of trees and plants shall confirm to the scientific names given in:

(vi) Royal Horticultural Society, "Directory of Gardening"

Oxford University Press, reprinted 1974 and Supplement 1969

(vii) Hortus 3.

(viii) Exotica

All plants must agree with the botanical description in these books. Hortus 3 and Exotica are the only authorities for plants that are not listed in the RHS Directory.

Trees

a) Tree stock shall be container grown, or bur lapped with geo fabric and grown in sandy beds.

b) Trees shall have a girth of 10cm to 25cm unless otherwise specified in the planting schedule (girth/ trunk circumference shall be measured at 1.0m above the soil level, excluding container height).

c) The tree trunk shall be free of any damage caused by insect, fungal or viral infestation and free from any physical damage or scarring.

d) The tree trunk shall be straight and vertical. There should not be any abrupt changes in girth of the trunk.

e) The form or shape of the crown shall be typical for the specimen of the species. The crown shall not be significantly deformed by wind, pruning practices, pests or other factors.

f) Trees shall be single stemmed unless otherwise specified.

g) Main branches shall be well spaced with a minimum of four branches at planting.

h) The size, colour and appearance of leaves shall be typical for the time of year and stage of growth of the tree species. Leaves shall not be damaged or discoloured.

i) The root system shall be free of injury from biotic (insects, pathogens) infestation and shall be uniform throughout the soil mix or growth media. Container grown nursery stock shall have a well-established root system reaching the sides of the container to maintain a firm ball when the container is removed.

Shrubs/ Ground Covers/ other plants

a) Shrubs and ground covers shall be twin or multi stemmed, full and bushy. The form or shape of the plants shall be typical to its species. Should be nursery grown in 12" grow bags.

b) The size, colour and appearance of leaves shall be typical for the time of year and stage of growth of the plant species. Leaves shall not be damaged or discolored.

TRENCHING IN ORDINARY SOIL

Trenching is done in order to loosen the soil, turn over the top layer containing weeds etc. and to bring up the lower layer of good earth to form a proper medium for grassing, regrassing,hedging and shrubbery. Trenching shall be done to the depth ordered by the Engineer-in- charge. The depth is generally 30 cm for grassing and 60 cm for regrassing in good soil.

The trenched ground shall, after rough dress, be flooded with water by making small kiaries to enable the soil to settle down. Any local depression unevenness etc. shall be made good by dressing and/or filling with good soil.

Weeds or other vegetation which appear on the ground are then uprooted and removed and disposed off and paid.

Trenching

Trenching shall consist of the following operations:

The whole plot shall be divided into narrow rectangular strips of about 1.5 m width or as directed by the Engineer-in-Charge.

These strips shall be sub-divided lengthwise into about 1 m long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it.

In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus.

The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.

Measurements

Length and breadth of the plot shall be taken correct to 0.1 m and depths correct to cm. Cubical contents shall be calculated in cubic meters, correct to two places of decimal. No deduction shall be made nor extra paid for removing stones, brick bats and other foreign matter met with during excavation upto initial lead of 50 m and stacking the same.

The rate shall include the cost of all labour and material involved in the operations described above, including cost of all precautionary measures to be taken for protections and supporting all services etc.met with during trenching.

SUPPLY AND STACKING OF SLUDGE

It shall be transported to the site in lorries with efficient arrangement to prevent spilling enroute.It shall be stacked at site. Each stack shall not be less than 50 cm height and volume not lessthan 3 cum.

Measurements

Length, breadth and depth of stacks shall be measured correct to a cm. The volume of the stack shall be reduced by 8% for looseness in stacking and to arrive at the net quantity for payment.

Rate

The rate shall include the cost of labour and material involved in all operations described above, including carriage up to one km. The rate shall also include royalty if payable.

SUPPLY AND STACKING OF MANURE

Farmyard Manure: Same as above.

SPREADING OF GOOD EARTH

Good earth shall be removed from stacks by head load and spread evenly over the surfaceto the thickness ordered by the Engineer-in-charge. It shall be spread with a twisting motion to avoid segregation and to ensure that spreading is uniform over the entire area.

Measurements: The quantity of good earth spread shall be determined by the difference in the volume of good earth in stacks before and after spreading duly reduced for looseness in stacking by 20% of good earth.

Rate: The rate shall include of all the labour and material involved in all the operations described above, but does not include the cost of the good earth which shall be paid for separately unless specifically described in the item.

SPREADING OF SLUDGE/MANURE

Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-Charge. The mixing shall be spreadas described in 2.9.1 to the thickness ordered by the Engineer-in-Charge.

Measurements

The quantity of good earth and sludge or manure mixed shall be determined by the difference in the volume of good earth and sludge or manure in stack, before and after spreading duly accounted for voids and looseness in stack.

Rate

The rate shall include of all the labour and material involved in all the operations described above, but does not include the cost of good earth sludge or manure which shall be paid for separately, unless otherwise described in the item

MIXING OF GOOD EARTH AND SLUDGE/MANURE

The stacked earth shall, before mixing be broken down top particle of sizes not exceeding 6 mm in any direction. Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-charge.

Measurements

The quantity of good earth and sludge or manure mixed shall be determined by the difference in the volume of good earth, sludge or manure in stack, before and after spreading duly accounted for voids and looseness in stack.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above, but does not include the cost of good earth sludge or manure which shall be paid for separately, unless otherwise described in the item.

GRASSING WITH SELECTION NO. 1 DOOB GRASS

The area from where the grass roots are to be obtained shall be specified by the Engineer- in-Charge at the time of execution of the work and no royalty shall be charged on this account from the contractor. Grass is to be arranged by contractor (cost of grass to be paid separately).

The soil shall be suitably moistened and then the operation of planting grass shall be commenced. The grass shall be dibbled at 10 cm, 7.5 cm, 5 cm apart in any direction or other spacing as described in the item. Dead grass and weeded shall not be planted. The contractor shall be responsible for watering and maintenance of levels and the lawn for 30 days or till the grass forms a thick lawn free from weeded and fit for moving whichever is later. Generally planting in other direction at 15 cm, 10 cm, spacing is done in the case of large open spaces, at 7.5 cm spacing in residential lawn and at 5cm spacing for Tennis Court and sports ground lawn. Rates are including cost of labour and material (grass shall be paid separately.)

During the maintenance period, any irregularities arising in ground levels due to watering or due to trampling by labour, or due to cattle straying thereon, shall be constantly made up to the proper levels with earth as available or brought from outside as necessary, Constant watch shall be maintained to ensure that dead patches are replanted and weeds are removed.

Measurements

Length, breadth of the lawn grassed shall be measured correct to 0.1 meter and the area shall be calculated in sqm. correct to two places of decimal.

Rate

The rate shall include of all the labour and material involved in all the operations described above, excluding supply of the requisite quantity of good earth and grass so needed for properly maintaining the levels of the lawns. (payment of grass to be paid separately).

EXCAVATION AND TRENCHING FOR PREPARATION OF BEDS FOR HEDGE AND SHRUBBERY

Beds for hedges and shrubbery are generally prepared to width of 60 cm. to 125 cm. and 2to 4 meters respectively.

Beds for hedges and shrubbery shall be prepared in the following manner. The beds shall first be excavated to a depth of 60 cm. and the excavated soil shall be stacked on the sidesof the beds. The surface of the excavated bed shall then be trenched to a further depth of 30 cm, in order to loosen the soil, in the manner described in 2.1. No flooding will be done at thisstage but the top surface shall be rough dressed and levelled. The excavated soil from the top 60 cm depth of the bed stacked at the site shall then be thoroughly mixed with sludge over manner in the proportion 8:1 by ratio or other proportion described in the item. The mixed earth and manure shall be refilled over the trenched bed, levelled neatly and profuselyflooded so that the water reaches even the bottom most layers of the trenched depth of the bed. The surface after full subsidence shall again be refilled with the earth and manure mixture, watered and allowed to settle and finally fine dressed to the level of 50 mm to 75 mmbelow the adjoining ground or as directed by the Engineer-in-Charge. Surplus earth if any, shall be disposed off as directed by the Engineer-in-charge. Any surplus earth if removed beyond initially lead shall be paid separately. Stones, bricks bats and other foreign matter if met with during excavation or trenching shall be removed and stacked within initially lead & lift, such material as is declared unserviceable by the Engineer-in-charge shall be disposed by spreading and levelling at places ordered by him. If disposed outside the initial lead & lift, then the transport for the extra leads will be paid for separately. If a large proportion of material unsuitable for the hedging and shrubbery operations is met with and earth from outsides is required to be brought in for mixing with manure and filling, the supply and stackingof such earth will be paid for separately.

Measurements

Length, breadth and depth of the pit excavated and trenched shall be measured correct to a cm. The cubical contents shall be calculated in cubic meter correct to two places of decimal.

Rate

The rate shall include the cost of all the labour and material involved in all the operations described above. The rate shall not include the cost of supply & stacking of the manure unless the same is specifically included in the description of the item

DIGGING HOLES FOR PLANTING TREES

In ordinary soil, including refilling earth after mixing with oil cake, manure andwatering.

Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavate soil broken to clods of size not exceeding 75 mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the size as directed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required to replace suchdiscarded stuff shall be brought and stacked at site by the contractor which shall be paid for separately. The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6 mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and enable the soil tosubside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm belowthe adjoining ground level or as directed by the Engineer-in-charge.

COMPLETION AND MAINTENANCE

a) Substantial Completion

i) At the date of Substantial Completion all plants shall be in their specified position andcondition.

b) Plant Establishment Period

i) The Plant Establishment Period shall be for three months from the date of Substantial Completion and may run consecutively with the One Year Maintenance Period. Any plant material not showing acceptable levels of growth shall be replaced by the Contractor who shall bear all the associated costs.

c) Failure of Plants

i) Any plants that are found to be missing, defective or not in good condition at any time during the contract period and maintenance period shall be immediately replaced by the Contractor, who shall bear all the associated costs.

d) Maintenance Period

The Maintenance Period shall run for a period of one calendar year from the date of Substantial Completion of the whole of the Works.

i) The Contractor shall maintain insurances of relevant items as required by the Contract throughout the Maintenance Period.

ii) The contractor shall carry out maintenance of the planting strictly in accordance with the Operations and Maintenance manual as approved by the Client. The Contractor is to provide all required labour, plant and materials to comply with the approved procedures.

iii) During the Maintenance period the Contractor shall make adequate provision for irrigation and/or operate the irrigation system as required and maintain same for handover to the Client on completion of the Plant Establishment Period, comprehensively overhauled and in perfect

working order.

iv) The contractor shall keep necessary number of personnel (gardeners, laborers, irrigation supervisor) in proper uniform, full time at site, and shall be required to send additional manpower as and when required to carry out special maintenance works like removing dry palm fronds, aeration, planting seasonal, replacing trees and all the treatments required for plant protection.

v) A qualified and experienced agricultural engineer, approved by the Client, shall be required to inspect the site regularly for correct diagnosis of pests or diseases and to take timely remedial measures.

vi) An experienced plumber will be deputed to the site on regular intervals to check the irrigation system and adjust/replace the equipment that is not working properly. Seasonal adjustments to the irrigation operation schedule and programming of controllers shall be done by a qualified irrigation engineer, prevailing according to the weather conditions and Client's requirements.

vii) The contractor shall maintain, at all times, sufficient stock of regularly utilized fertilizers, chemicals, tools, spare parts and other consumables at site.

viii) Trimmings, cut branches, dry leaves and other waste shall be removed daily from the site and disposed of in the Municipality dump.

ix) The site shall be kept neat, tidy and in good condition at all times.

x) In the case of any horticultural staff designated by the Client, the Contactor shall fully train such staff for the duration of the Maintenance Period at no additional cost.

e) Operations and Maintenance Manual

i) The Contractor shall compile a comprehensive Operations and Maintenance Manual which will include the following:

a) Pesticide/fungicide/herbicide applications - including safety application rates and procedure, schedules of pesticides/fungicides/herbicides.

b) Water application rates and maintenance procedures, including a detailed description of Irrigation and Storm water drainage methods.

c) Fertilization - including fertilizer descriptions, application rates and programs.

d) Salinity Control - including leaching methods and leaching program monitoring.

e) Turf Grass Management - including mowing procedure, replacement of turf grass by stolon and sods and routine management procedures; aeration, top dressing, vertical mowing, thatch removal, cleaning, rolling and over seeding.

f) Propagation and replacement of seasonal flowers every 3 months

maximum or when deemed necessary.

g) General Maintenance Monthly Operations Schedule - including pruning, stakes and ties, berm work, replacement and clean-up, protective fencing etc.

h) Equipment Inventory, maintenance procedures and full manufacturers maintenance manual.

i) Personnel

ii) The Operation and Maintenance Manual for Soft Landscape shall be submitted to the Architect and Engineer-in-charge/Client by the Contractor for approval at least three months prior to the date for Substantial Completion of any part of the Works and must be approved prior to the commencement of the Plant Establishment Period. Three bound copies of the manual in A4 format shall be presented to the Client.

REFERENCES

Standards

The following Standards are referred to in this specification:

i. Pest Management in Horticultural crops, IIHR Bangalore

ii. Proceeding of the National consultation Seminar on Horticultural Research & Development,
IIHR Bangalore

iii. Neem Cake- An organic formulation for Insect Pest Management in Horticulture, IIHR Bangalore