CHAPTER 4 : SPECIFICATIONS

CHAPTER 4 SPECIFICATIONS

This section contains the specification relating to environmental matters in the execution of JKR projects in line with **JKR EMS : MS ISO 14001** and shall be read in conjunction with the Standard Specification For Buildings, Road Works and JKR Green Mission. However where these matters appear also in other sections of the Contract Document, this specification shall take precedence.

4.1 LEGISLATION AND REGULATIONS

The Contractor shall at all times **adhere to all existing statutes** regarding the protection of the Environment.

Prior to the execution of the project, the Contractor shall comply with the Environmental Quality Act (EQA) 1974 (Act 127) and other related environmental legislation including, but not limited to:

a) National Land Code (Act 56 of 1965)
b) Town and Country Planning Act 1976, (Act 172)
c) Street, Drainage and Building Act, 1974: Act 133 and Amendment, 1978
d) Protection of Wildlife Act, 1972 (Act 76)
e) Forestry Act 1984 (Act 313)
f) Land Conservation Act 1960 (Act 385)
g) Occupational Safety and Health Act 1994 (Act 514)
h) Solid Waste and Public Cleansing Management Act 2007 (Act 672)
i) Federal Territory (Planning) Act 1982 (Act 267)
j) Workers Minimum Amenities Act 1990 (Act 446)
k) Local Government Act 1976 (Act 171)

The Contractor shall be liable for and shall indemnify the Government against any damages, expenses, liability, losses, claims, prosecution, proceedings, fines and penalties caused by any non-compliances or contraventions of the above legislation and regulations.

4.2 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

In line with EQA 1974, Act 127, Section 34A (1-8), the Contractor shall submit a report on project's impact on the environment if the project is listed as prescribed activities in the Environmental Quality (Prescribed Activities) (EIA) Order, 1987. The report should be prepared in accordance with the requirements as per the latest "A Handbook of EIA Guidelines" by the Department Of Environment.

4.3 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

4.3.1 Objectives

The main objective of the Environmental Management Plan (EMP) is to set out a comprehensive programme which will form the basis for implementing

environmental mitigation measures, environmental monitoring and environmental auditing of the construction works by the Contractor as listed below:

a) to set out various environmental protection / conservation measures that conform with the environmental conditions stipulated in the Specifications, EIA report and by other relevant authorities (e.g. the Department of Environment (DOE);

b) to ensure that the Contractor comply with all applicable environmental standards and guidelines, legislative requirements and other relevant conditions related to the environment;

c) to specify a detailed environmental monitoring and auditing programme to ensure that the Contractor and all his Sub-contractors comply with all stipulated requirements throughout the duration of the project; and

d) to streamline the different functions of various sections and authorities related to the environmental matters during construction.

4.3.2 Preparation of the EMP

The Contractor shall submit an EMP prepared by a registered environmental consultant and approved prior to commencement of any works on site. The EMP shall be submitted to the S.O. for endorsement **within 45 days** from the date of Letter of Acceptance in compliance with the Conditions of Contract and/or in compliance with the requirements of the conditions of approval of the EIA report by the Department of Environment. For design and build projects, the need statement shall prevail.

The EMP shall make reference to the following but not limited to:
- DOE Format for the Preparation of EMPs
- JKR Environmental Management System (EMS)
- The approved EIA report
- EIA Approval Conditions from DOE (attached if any).

It should be clearly noted the EMP is a document for practical use on site by nominated personnel and thus should be concise, up to date and site specific.

4.3.3 Scope of EMP

Scope of EMP is as per DOE Guidelines on Preparation of EMP.

4.3.4 Deliverables

The following documents shall be submitted by the Contractor:

Table 1: Deliverables to be submitted by the Contractor to the S.O./P.D.

Documents	***No. of Copies***	***Reporting Frequency***	***Timing***
Environmental Management Plan (EMP)	5	Once only (However, EMP should be updated when necessary)	Within 45 days from the date of the Letter of Acceptance and/or as compliance to the conditions of approval of the EIA report
Environmental Quality Report (EQR)	5	Monthly	4 weeks after monitoring
Environmental Monitoring and Audit Report (EMAR)	5	Quarterly	2 weeks after audit
Closure Audit Report (CAR)	5	Once Only	2 weeks prior to issuance of Certificate of Practical Completion (CPC)

Note : To ensure consistency, a standard reporting format for EMP, EQR, EMAR and CAR is provided in Appendix 2.

4.4 SITE OFFICE AND FACILITIES

4.4.1 Site office, workshop, canteen and store

a) The Contractor shall provide and maintain on site, suitable and sufficient offices for the S.O., his representatives and the Contractor own use.

b) The Contractor shall also provide and maintain on site suitable workshops and stores with impervious flooring including grease traps.

c) The Contractor is prohibited from discharging oil and grease to any watercourses. Any spilled oil and grease shall be promptly removed and this contaminated waste shall be kept in proper containers. Used oil and grease shall be kept in separate containers for recycling. All containers shall be stored in secured areas prior to disposal by a licensed contractor as per the Environmental Quality (Scheduled Wastes) Regulations (Amendment) 2007.

4.4.2 Accommodation for Workmen

a) The Contractor shall provide and maintain on site, suitable and sufficient accommodation and camps for his workmen and supervisory staff as required in the Contract.

b) The location of the workmen's accommodation shall be agreed beforehand with the S.O. and shall be such as to avoid obstruction and nuisance to the Works and public and shall be laid out in an approved and orderly manner.

c) The construction and habitation of the accommodation shall comply with the requirements of all government and local authorities.

d) All accommodation for workmen shall be properly ventilated and lighted with sufficient toilet and bathing facilities and waste and refuse collection bins/disposal. Cooking is prohibited in sleeping quarters.

e) The Contractor shall also provide adequate supply of water for canteen usage and allowable cooking areas.

f) The Contractor shall be wholly responsible for the workmen at the accommodation provided. Activities such as hunting/ trapping of wildlife should be strictly forbidden and fines/ penalties shall be imposed on the Contractor by the relevant Government Departments.

4.4.3 Utilities

a) Water Supply

i. The Contractor shall provide and maintain a potable water supply system to all facilities required in the construction area. The supply shall be taken from sources approved by the S.O.

ii. The Contractor shall submit his plans for the water supply and reticulation system, including filtration, chlorination and other proposed treatment where required, to the S.O. for approval, not less than thirty (30) days prior to the provision of water supply.

iii. Potable water shall comply with the requirements of Ministry of Health Standards.

b) Sanitation

i. The Contractor shall provide and maintain sufficient toilets at appropriate locations on site as approved by the S.O. Toilets shall be complete with adequate water closets, urinals and hand-basins, and proper sanitary system.

ii. The Contractor shall maintain all toilets in a clean and sanitary condition and shall comply with requirements of the Ministry of Health.

iii. All waste-water must be treated such that its discharged effluent meets the requirements of all existing legislation and regulations.

c) Solid waste disposal

i. The Contractor shall undertake the collection and disposal of solid waste such as litter, kitchen and canteen refuse, non-hazardous solid waste including office, workshop and accommodation waste. Solid waste collection shall be made at least twice a week or as and when directed by the S.O..

ii. Solid waste shall be stored in proper bins and containers, collected and disposed off at designated site(s) approved by the S.O. or to a locally available landfill by a licensed contractor.

iii. A waste management schedule shall be set up to ensure that licensed contractors carry out the collection and disposal of waste materials at regular intervals. Proper facilities for the temporary collection of solid waste shall be established at the site office for construction debris and solid waste.

iv. The Contractor should adopt ways to minimise waste such as reduce, reuse and recycle of waste. Example of waste minimisation is to reduce the amount of waste from concrete usage, first is by ordering the correct quantity and batch or by using concrete panels. Excess concrete can then be recycled as concrete blocks and bench or reused as hardcore materials.

4.5 SITE CLEARING AND EARTHWORKS

No site clearing and earthworks shall be carried out prior to EMP approval by relevant parties/authorities.

4.5.1 Site Clearing

a) Site clearing shall be done in stages and within construction limit. No burning of cleared vegetation and debris shall be allowed unless prior approval has been obtained from the Director General of the Department of Environment.

b) Erosion mitigating measures shall be installed or constructed before commencement of site clearing and earthworks. This includes planning for 'work in stages' and also plans for diverting as much as possible surface runoff from the work areas.

c) For road projects, site clearing should be from the centre of the road outwards towards the construction limit to enable escape of wildlife into neighbouring jungles.

d) Cleared vegetation and debris should be disposed off to approve designated spoil tips. The Contractor shall be responsible for identifying these disposal areas (unless stated otherwise). The approved disposal areas shall be prepared before any site clearing is allowed to commence.

e) Cleared vegetation, debris and spoils should on no account be deposited or pushed into water-courses, streams and rivers.

f) Trees and vegetation identified for conservation must be protected by the Contractor at all costs.

g) Other clearing activities such as access road construction, site office and work-camp construction, etc shall be carried out with minimal cutting of trees and site clearing. The intended area shall be marked out for the S.O.'s inspection and approval prior to any site clearing works.

h) Holes and cavities resulting from clearing, grubbing, de-stumping and de-rooting shall be backfilled with acceptable materials and compacted to approximate densities of adjacent areas.

i) The Contractor shall provide all necessary temporary drainage for keeping the site and other areas free of standing water. Efforts must be made to channel the surface runoff as much as possible away from the work areas.

j) If due to unforeseen circumstances turfing cannot be carried out immediately to the slope exposed areas, temporary protection/cover (e.g. plastic sheet or equivalent) shall be applied over exposed surfaces by the Contractor at his own cost.

k) Should the Contractor fail to ensure compliance with any of the above, the S.O. without prejudice to any other rights or remedies available to the Government under this Contract may employ and pay other persons to execute the work and all costs incurred in connection with such employment shall be recoverable from the Contractor as stipulated in the Conditions of Contract.

4.5.2 Earthworks

a) All silt traps, sedimentation basins, erosion control measures and drainage system as shown in Drawings must be constructed in stages and maintained by the Contractor. The location of these mitigating measures shall be detailed and shown on plan in the EMP for the approval of the S.O

b) The Contractor shall provide all necessary temporary drainage for keeping the site and other areas free of standing water before the commencement of any earthworks. Effort must be made to channel the surface runoff as much as possible away from the work areas.

c) All temporary drainage, mitigation measures (e.g. silt traps and silt fence) must be constructed before the commencement of any earthworks and shall be maintained throughout the construction period to ensure their effectiveness.

d) Unsuitable materials and surplus earth shall be disposed off in designated spoil tips, within the site or off site. Unless otherwise stated, the Contractor shall be responsible for identifying these disposal areas. The dump site/ disposal areas shall be identified and approved by the S.O. before commencement of any earthworks. In the event additional disposal areas (spoil tips) are required, the Contractor shall also be responsible for identifying these disposal areas which shall be approved by the S.O.

e) The method of depositing the unsuitable materials and surplus earth to the spoil tips must be properly engineered designed and must be sufficiently graded, leveled, compacted, properly drained, revegetated and approved by the S.O. End-tipping shall not be allowed.

f) The Contractor shall schedule for earthworks to be carried out as much as possible during dry weather periods. This is to ensure that the earthwork activities being carried out is done in a systematic/orderly manner in order to minimise earth surfaces from being exposed for long periods during wet weather periods. Turfing or hydroseeding must be carried out immediately after earthworks and before work on other berm/lift commences. If due to unforeseen circumstances turfing cannot be carried out immediately, temporary protection/cover (e.g. plastic sheets or equivalent) shall be applied to the exposed slopes.

g) Should the Contractor fail to ensure compliance with any of the above, the S.O. without prejudice to any other rights or remedies available to the Government under this Contract may employ and pay other persons to execute the work and all costs incurred in connection with such employment shall be recoverable from the Contractor as stipulated in the Conditions of Contract.

4.6 ACCESS ROADS AND EXISTING ROAD

a) All access roads to the site shall be built away from the existing watercourses, streams and rivers with proper drainage system and be paved for a distance of at least 10 metres from where these access roads join existing roads.

b) The Contractor shall maintain all access roads including the drainage system throughout the construction period to the satisfaction of the S.O.

c) Where the Contractor uses existing/private roads as his access, he shall be responsible for any damage to the existing roads, bridges, drains, culverts, roadside furniture, and all other appurtenances and services on such roads caused by any work carried out by him throughout the construction period. The Contractor shall repair any damages and reinstate the same to their original condition to the satisfaction of the S.O.

d) All temporary diversion affecting public/private roads must be approved by the Government, private landowner and the S.O. All such diversions must be equipped with temporary diversion signs and comply

with the requirements of Arahan Teknik (Jalan) 2C/85 of JKR. Adequate workmen for controlling traffic diversion must be provided.

4.7 POLLUTION CONTROL

4.7.1 Water quality

a) All silt fence, silt traps, sedimentation basins and other erosion and sediment control measures as shown in Drawings must be constructed and maintained by the Contractor.

b) Water quality standards and monitoring schedule from the silt traps/ sedimentation basin/rivers/stream/water bodies shall comply as specified in Table 2 or as directed by the S.O. Silt traps and sediment basin discharges shall be monitored monthly and shall be collected within 30 minutes after a rainfall event of more than 20mm depth or more.

c) The Contractor is prohibited from discharging oil and grease to any watercourse. Any spilled oil and grease shall be promptly removed by the Contractor. The Contractor shall collect, keep in proper containers, label and store all used oil and grease and other scheduled wastes according to Environmental Quality (Scheduled Wastes) Regulations, (Amendment) 2007.

d) The Contractor shall carry out water quality monitoring at locations on existing water bodies as indicated in the EMP. Parameters to be tested are as specified in Table 2.

4.7.2 Noise Control

a) All work shall be carried out with least disturbance and noise. The Contractor shall ensure all his equipments and machineries are in proper working condition so as to minimise the amount of noise generated. The S.O. may require the Contractor to replace any machinery that to his discretion is emitting excessive noise.

b) The Contractor shall comply with the general recommendations set out in DoE Interim Planning Guidelines for Construction Noise together with any specific requirements described in the Contract.

c) The Contractor shall indemnify and keep indemnified the Government, S.O. and the S.O.'s Representatives against any liability for damages on account of noise or other disturbances created while or in carrying out of the works and from and against all claims, demands, proceedings, damages, costs charges and expenses whatsoever in regard or in relation to such liability.

4.7.3 Air Quality

a) Open burning of cleared vegetation, debris and construction waste etc, shall not be allowed unless prior approval is obtained from the Director General of the Department of Environment.

b) The Contractor shall provide suitable spraying equipment for regular spraying of water over the existing roads, tracks and access roads, near settlements, completed as well as incomplete road and other barren areas of the site used by the contractor especially during the dry season or as and when directed by the S.O.

c) When the Contractor's trucks or equipment utilises public or private roadways, all dirt and materials shall be removed from the trucks/ equipments by hosing, lorry wash-trough, etc. before leaving the site.

d) The Contractor shall provide for the prompt removal of all dirt and other materials spilled from his or his sub-contractor's vehicles on public or private roadways.

e) For Contractor's trucks carrying sand, aggregates, earth and other loose construction materials liable to spillage, tarpaulin must be used to cover such open trucks when passing through villages and settlements or on all roadways.

f) The Contractor shall also ensure dust control at quarry / batching plant (if any) complies with environmental requirement as stipulated in the Environmental Quality (Clean Air) Regulations, 1978.

4.7.4 Vibration control

a) All works shall be carried out with least vibration disturbance. The Contractor shall ensure that at any time, the vibration levels resulting from his works at or across real property boundary should not exceed the Recommended Limit as Specified in Table 2 of this document. No person unless duly authorized by law or carrying our legitimate duties shall use explosives or results in explosions which create a vibration disturbance across a real property boundary or on a public space or right of way.

b) The Contractor shall comply with the general recommendations set out in DOE Interim Planning Guidelines for Vibration Limits and Control in the Environment together with any specific requirements described in the Contract.

b) The Contractor shall indemnify and keep indemnified the Government, S.O. and the S.O.'s Representatives against any liability for damages on account of vibration disturbance created while or in carrying out of the works and from and against all claims, demands, proceedings, damages, costs charges and expenses whatsoever in regard or in relation to such liability.

Table 2: Environmental Quality Standards to be complied with by the Contractor

Aspects	Parameter	JKR EMS Set Target	Third Schedule, Environment Quality Act, 1974, Environment Quality (Sewage and Industrial Effluents) Regulations, 1979.		Interim National Water Quality Standards (INWQS)	
			Standard A	Standard B	Class IIA	Class IIB
Water	Turbidity	≤ 200 NTU	-	-	≤ 50 NTU	≤ 50 NTU
	Suspended Solid	≤ 100 mg/l	≤ 50 mg/l	≤ 100 mg/l	≤ 50 mg/l	≤ 50 mg/l
	Biological Oxygen Demand $_5$ @ 20°C $(BOD)_5$	≤ 50 mg/l	≤ 20 mg/l	≤ 50 mg/l	≤ 3 mg/l	≤ 3 mg/l
	Chemical Oxygen Demand (COD)	≤ 100 mg/l	≤ 50 mg/l	≤ 100 mg/l	-	-
	pH	5.5 – 9	6 – 9	5.5 – 9	6.5-9.5	6-9
	E-Coli	≤ 400 counts / 100 ml	-	-	≤ 100 counts / 100ml	≤ 400 counts / 100ml
	Dissolved Oxygen (DO)	≥ 4 mg/l	-	-	5-7	5-7
	Oil and Grease	≤ 10 mg/l	ND	10 mg/l	-	-
	Ammoniacal Nitrogen	-	-	-	≤ 0.3 mg/l	≤ 0.3 mg/l
Air	Total Suspended Particulate (TSP)		≤260 µg/m^3/day			
Noise	Equivalent Noise Level (L_{eq})		Day time (7am–10pm) L_{eq}≤65dB(A) Night time (10pm–7am) L_{eq}≤55dB(A) Sensitive: L_{eq}+5dB(A) Commercial: L_{eq}+10dB(A)			
Vibration	Vertical Vibration Peak Velocity (mm/s)		Not more than 3 mm/s at receiver location or across real property boundary			

Reference:

1) Third Schedule, Environmental Quality Act, 1974, Environmental Quality (Sewage and Industrial Effluent) Regulations, 1979.
   Standard A: For location with downstream water intake
   Standard B : For location with no downstream water intake

2) Interim National Water Quality Standards for Malaysia
   Class IIA : Water Supply II – conventional treatment required
   Fishery II – sensitive aquatic species
   Class IIB : Recreational use with body contact

3) Recommended Malaysian Guidelines on Ambient Air Quality

4) JKR EMS Set Target for Noise

5) Planning Guidelines for Vibration Limits and Control of the Environment (Department of Environment, 2004)

Note: N – No visible floatable materials or debris or no objectionable odour, or no objectionable taste.

4.8 PRESERVATION OF FLORA AND FAUNA

4.8.1 Flora

a) Prior to site clearing, the forester and/or botanist engaged by JKR or Contractor shall assist the surveyor to identify any trees of rare, endemic or endangered species which need to be conserved or relocated. Trees which are classified as rare, endemic and endangered shall be conserved and marked (crossed) red. Similarly, trees having girth of 800mm and above shall be conserved and marked (crossed) red. Trees which are rare, endemic or endangered and required to be relocated shall be marked (crossed) white. Should relocation be required, trees shall have girth of 300mm and below.

b) The Contractor shall be responsible for the transportation of trees to nearby sites, arboretum or other alternatives, as advised by the forester. The Contractor shall ensure all relocated trees are well kept.

c) The botanist/ forester shall produce a report on the effectiveness of the tree conservation, preservation and action plan as proposed in the EMP as directed by the S.O. The report shall also cover aspects of new findings not covered during the earlier investigation and proposal of any rectification plan required.

d) The felling of trees shall be confined within the construction limit.

e) The Contractor shall prohibit all his and his sub-contractor's employees from destroying, removing or clearing trees, timber, shrub and other flora to any extent greater than that approved by the S.O. as being necessary for the execution of the contract.

f) The Contractor is prohibited from disposing waste materials amongst vegetation within or outside the work site.

4.8.2 Fauna (Wildlife)

a) The Contractor and his employees are prohibited from the following:

   i. hunting, disturbing, capturing, endangering or destroying such wildlife by any means (e.g poison, baits, birdline or net) as may be protected by relevant statutes including removing or damaging bird nests and eggs.

   ii. housing, confining or breeding any wildlife

4.9 REQUIREMENTS IN RELATION TO WATERWAYS

a) The Contractor and/or JKR shall seek approval from Jabatan Pengaliran & Saliran (JPS) for any works related to natural waterways including diversions, modifications replacements and/or relocation of rivers, watercourses and related structures during execution of the works.

b) The Contractor shall coordinate all operations and make adjustments to his programme resulting from JPS requirements pertaining to changes made to the natural waterways.

c) The Contractor shall ensure that temporary diversions of rivers and/or waterways shall be capable of sustaining flows throughout the year as specified by the JPS.

4.10 PERMANENT WORKS

4.10.1 Drainage

a) The Contractor shall immediately construct all permanent drainage and ancillary works upon reaching earthwork formation/finished levels in order to mitigate surface erosion.

b) The Contractor shall maintain the drainage system from clogging and silting throughout the contract period.

4.10.2 Noise Barrier

a) Noise barrier shall be provided in sensitive areas such as housing, schools and hospitals situated beside busy roads or highways.

b) The type of noise barrier used shall be either absorptive, reflective, dispersive or mixed depending upon the noise level survey conducted or recommendations made by the relevant Consultant.

c) The Contractor shall supply and install noise barrier including maintenance during the contract period.

d) For concrete noise barrier, creepers shall be planted and maintained to cover the said noise barrier until the expiry of the defects liability period.

4.11 EROSION AND SEDIMENT CONTROL

4.11.1 Erosion Control

a) Natural

i. Bioengineering

Vetiver

The plant, *Vetiver Zizanioodes* (Rumput Wangi) shall be non-seeding types tillers derived from tissue culture or micro propagation method. The plantlets to be supplied shall be at least an aggregate of 5 plantlets with roots at least 3 cm long.

The Contractor shall plant *Vetiver Zizanioodes* in rows as specified in the drawings or as directed by the S.O. In difficult soil types, borrowed topsoil may be required to refill trenches for planting the vetiver. The Contractor shall ensure and maintain the growth of the vetiver.

Creepers

The Contractor shall plant creepers either through seeds or saplings. Commonly used creepers are of the species *Centrusemo pubscens*, *Ficus pumila* and *Parthenocissus himalayana. Ficus pumila* and *Parthenocissus himalayana* are suitable on concrete/gunited slopes and rock surfaces.

Creepers shall be planted into a planter bed previously prepared with drainage layer/weep holes and topsoil. Creepers should be planted individually immediately at the toe of wall/slopes at approximately 0.3m centre to centre.

Hydroseeding/Turfing

Taken from From Section 2.2.8 – Protective Vegetation for Erosion Control of Standard Specification for Roadworks JKR/ SPJ/1988:-

Topsoil

Topsoil stockpiled for the Works in accordance with Sub- Sections 2.1.1.3 and 2.1.2.3 (of Section 2.2.8 – Protective Vegetation for Erosion Control of Standard Specification for Roadworks JKR/ SPJ/1988) shall be spread and lightly compacted to an even thickness of 50 mm as directed by the S.O. in areas to be turfed and/or seeded, or used as the S.O. shall otherwise direct for tree planting and other purposes.

Turfing

i. Turfing shall be carried out as soon as practicable on all earth slopes and other areas as shown on the Drawings and/or where directed by the S.O.

ii. The type of turf shall be as indicated on the Drawings or other alternative type as pproved by the S.O. and shall be free of 'lalang' and essentially free of weeds.

iii. Turf shall be obtained in unbroken sods with a substantial amount of topsoil and shall be approximately 250 mm x 250 mm in size and 100 mm thick, from an approved source, and shall be placed in position as soon as practicable after cutting.

iv. Turf sods shall be stacked and watered when they cannot be laid immediately after cutting. The surfaces to be turfed shall be trimmed and thoroughly wetted. The turf shall then be carefully laid to form a complete and uniform cover as shown on the Drawings.

v. Turf laid on slopes steeper than 1 (vertical) and 3 (horizontal) shall be pegged down with bamboo stakes approximately 250 mm in length.

vi. Approved fertiliser shall be applied after lacing of turf at suitable times and at rates of application approved by the S.O. All turf shall be regularly watered and fertilised to the satisfaction of the S.O. until the vegetation is satisfactorily established.

vii. Any dead turf shall be replaced with new turf at the Contractor's own expense.

Seeding

Seeding or hydroseeding shall be carried out as soon as practicable on slopes and other areas as shown on the Drawings and/or directed by the S.O. The contractor shall submit to the S.O. for his consideration and approval, at least four (4) weeks in advance of the proposed work, full details of his proposed method of seeding or hydroseeding. The information submitted shall include, but not necessarily be limited to, a full description of the following aspects of the work :-

i. The preparation of the areas to be seeded or hydroseeded, including if appropriate the amount of top soil to be used and its method of application;

ii. The details and results of investigations to determine which types of grass and legume are compatible with the soil in the areas to be seeded;

iii. The types of grass and legume (if any) and strains of seed to be used, and the function, root and growth characteristics of each type;

iv. The rates of application of the grass and legume seeds;

v. The composition of fertiliser to be used at the time of seeding and its rate of application;

vi. The composition of fertiliser to be used after seeding, the times of application after seeding, and the rates of application;

vii. The type of mulch to be used and its method and rate of application;

viii. The amounts of lime or other chemicals (if any) to be applied to improve the soil before, during and/or after seeding;

ix. The type and amounts of binding agent to be applied with the seeds, mulch, fertiliser, etc.,as appropriate;

x. The proportions and methods of preparation of the seeding mix;

xi. The equipment and methods to be used in preparing and placing the seeding mix and other materials;

xii. The cultivation and after-care of the seeded areas, including rates and frequencies of watering, fertilising, grass cutting and general maintenance for at least 1 year after seeding;

xiii. The time after seeding required for establishing permanent, dense growth of grasses, which will require minimal maintenance;

xiv. Guarantees of the success of the seeding work. All grass shall be regularly watered until the vegetation is satisfactorily established to the satisfaction of the S.O. Any dead grass shall be replaced at the Contractor's own expense.

ii Mulching

Mulch is a protective cover placed over the soil to protect soil from rain, preserve moisture and slows runoff velocity. A variety of materials can be used as mulch such as grass clippings, leaves, hay, straw, shredded bark, sawdust, wood chips, shredded newspaper, cardboard and wool.

b) Proprietary products

The Contractor may also use proprietary or any man-made products available in the market to control erosion on slopes, subject to JKR's approval. The suitability of the products used shall follow the

manufacturer's specifications including method of installation and maintenance. Examples of propriety products are geotubes, ENKA mat, geocells/geooweb, fibromat and coir logs.

4.11.2 Sediment Control

The specification as described under this Section shall be read together with other related sections of the Standard Specification for Road Works or Standard Specification for Buildings and the drawings shall refer to the Chapter 8 - Standard Drawings of this document.

a) Silt Fence

Silt fence shall consist of geotextile supported by poles at regular interval. The geotextile shall be made of non-woven material with minimum properties of 200 g/m² or tensile strength 15 kN/m.

The fence shall be inspected after every rain. The silt accumulated behind the fence shall be removed when it has reached 2/3 of the fence filter height and disposed at designated site. The geotextile shall be checked for rips, tears and other types of deterioration and replaced as needed.

b) Silt Trap/Sediment Basin

Silt trap/sediment basin comprises rocks in gabions, shall be constructed in respective catchment area to collect and store sediment prior to entering natural waterways.

The silt traps/sediment basins shall be inspected regularly especially after heavy rain and any damages shall be rectified. The sediment accumulated in the silt traps/sediment basins shall be removed when it has reached 2/3 of its depth and disposed at designated site.

c) Gabion Wall

A gabion wall which comprises rocks in gabions but of smaller nature compared to silt trap, shall be constructed in difficult terrains such as on slopes and narrow valleys for the purpose of collecting and storing sediment prior to entering natural waterways.

d) Check Dam

A check dam which is a small, temporary or permanent dam shall be constructed across a drainage ditch, swale or channel for the purpose of lowering the speed of concentrated flows.

The check dams shall be inspected regularly especially after heavy rain and any damages shall be rectified. The sediment accumulated behind the check dams shall be removed when it has reached 2/3 of its height and disposed at designated site. The height of the check dam shall be maintained to be the same at all time.

e) Silt Curtain

Silt curtain shall be used to mitigate sediments by confining sediments and prevent dispersal and contamination of the water body especially in lakes and riverbanks. Silt curtain shall also be used as a divider to prevent sediment laden-water from migrating to the rest of the water body.

Silt curtain shall be checked for rips, tears and other types of deterioration and replaced as needed. The suspended sediments trapped behind silt curtain shall be allowed to settle for a minimum of 24 hours, prior to removal of the silt curtain.

f) Sand bag barrier

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbag barriers pond sheet flow runoff, allowing sediment to settle out.
Sandbag barriers are suitable as a linear sediment control measure which includes below the toe of slopes and erodible slopes, as sediment traps at culvert/pipe outlets, down slope of exposed soil areas, around temporary stockpiles and spoil areas, as check dams across mildly sloped construction roads and parallel to a roadway to keep sediment off paved areas.
Sand bag barrier shall be checked daily before and after rain events, In addition, sandbags exposed to sunlight will cause degradation and need to be replaced immediately. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height and disposed at designated site.

NOTES : Other items not specified above shall be referred to the Standard Specification for Road Works JKR/SPJ/1988 of Section 1 – General, Section 2 – Earthworks and Section 3 – Drainage Works

Taken from **Standard Specifications For Building Works (2005 Edition):-**

SECTION A – Preliminaries and General Conditions

22. Drainage of Site and Erosion Control

22.1 The Contractor shall make proper provision for the drainage of surface water from the work site including rainwater from surrounding areas which drain on to the Site.

22.2 The Contractor shall at his own cost, provide, form, fix and maintain such pumps, chutes, walls, drains, bunds and other temporary works necessary for the proper drainage of the Site so that no flooding or other damage or disturbance is caused to areas surrounding the Works or to the Works throughout the duration of the Contract.

22.3 Silt trap shall be constructed as shown in the Drawings. The silt trap shall be maintained regularly throughout the contract period, including desilting when full or as directed by the S.O and making good of any damaged portions during the course of the Works. The desilted material shall be transported to disposal site approved by the S.O.

22.4 The Contractor shall, if and where directed by the S.O, install silt fences as shown in the Drawings for trapping silt and sediment from disturbed area during construction. The silt fence shall be constructed of a vertical barrier of geotextile supported by poles at regular intervals. The geotextile shall be made of non-woven material with minimum weight of 200g/m2 and tensile strength 15 kN/m. The fence shall be inspected after every rain and when a sediment accumulation of approximately two third ( ) of the fence height is observed, the silt shall be removed and disposed of properly. The geotextile shall be checked for rips, tears and other types of deterioration and replaced as needed.

22.5 The Contractor shall, if and where directed by the S.O, construct gabion walls which shall consist of layers of gabion as shown in the Drawings for trapping sediments in catchment area.

22.6 The Contractor shall, if and where directed by the S.O, construct sediment pond or basin as shown in the Drawings for collecting and trapping sediments before the water leaves the Site. The sediment basin shall be maintained such that the silt shall be removed when a sediment accumulation of approximately one third ( ) the basin depth is observed.

SECTION C: Excavations and Earthworks;

16. **Temporary Drainage Channels and Bunds**

16.1 As earthwork progresses, the Contractor shall provide and maintain efficient drainage of the Site as specified under SECTION A: PRELIMINARIES AND GENERAL CONDITIONS, until such time as the permanent surface water drainage is installed.

17. **Clearing of Existing Ditches, Drains, Rivers, etc.**

17.1 During the execution of the earthwork, the Contractor shall take all necessary precautions to prevent blockage or obstruction, and to ensure free-flow of existing drains, ditches, streams and the like.

18. **Protection and Maintenance of Earthworks**

18.1 The Contractor shall provide all necessary protection and maintenance of earthwork, particularly from the damaging effects of water entering the works from rainfall, runoff, springs, rivers or streams. Damage to finished or partly completed work arising from the lack of such protection and maintenance work, shall be made good by the Contractor at his own cost and expense.

18.2 Where turfing is required for slope protection, they shall be planted immediately after the embankment is formed. The turfing shall be executed as specified hereinafter under SECTION N.4: LANDSCAPING AND TURFING.

18.3 If due to unforeseen circumstances turfing cannot be carried out immediately, temporary protection/cover (eg. plastic sheets or equivalent) shall be laid on exposed slopes by the Contractor.