

**MOKOLO AND CROCODILE  
WATER AUGMENTATION PROJECT  
PHASE 2 (MCWAP-2)**

**TENDER NO 054/2024/PMID/MCWAP2/RFB**

**PART C3.1  
SPECIFICATION**

**SECTION 47**

**LANDSCAPING AND REHABILITATION**

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**SECTION 47**  
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## SECTION 47

### LANDSCAPING AND REHABILITATION

#### 47.1 SCOPE OF WORK

This Section deals with the work required for both the temporary (for the purposes of temporary erosion control) and permanent landscaping and rehabilitation of areas disturbed as a result of the construction activities. This includes all parts of the working areas, temporary and permanent works, as well any additional areas that may be instructed by the Engineer.

Rehabilitation shall be undertaken at the earliest opportunity during the course of the Works to ensure that areas can be completed and returned to landowners. However, rehabilitation work shall only be carried out during periods likely to produce acceptable results.

#### 47.2 DEFINITIONS

For the purposes of this Specification the following definitions shall apply:

- a) **“Acceptable cover”** means that not less than 80% of the planted area sown, hydro-seeded or planted shall be covered with live plants of the specified species measured as canopy cover, and that there shall not be any bare patches larger than 500 mm maximum in diameter. The Contractor, in agreement with the Engineer, shall determine the areas or portions of land that shall be assessed for acceptable cover, and these shall then remain fixed for the purposes of maintenance and final hand over. Acceptable cover shall be measured as canopy cover using the “Daubenmire Method”, a procedure that would generally include randomly selecting 0.1 m<sup>2</sup> square plots covering the entire Site to be assessed, assessing if the cover meets the criteria above, and then statically determining acceptability or not, over the entire area assessed. In areas where the area to be rehabilitated traverses rocky outcrops this requirement will not be applicable. In these cases, the cover on the area shall be acceptable if all the requirements of this Chapter have been executed.
- b) **“Alien species”** means a species that is not an indigenous species; or an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention in National Environmental Management: Biodiversity Act (No.10 of 2004).
- c) **“Establishment period”** means the period that commences from the time of actual seeding, planting or placing of vegetation until the achievement of acceptable cover or when plants are self-sufficient, or a minimum of six months after seeding, planting or placing of vegetation.
- d) **“Existing vegetation”** means all existing species, indigenous or otherwise, of trees, shrubs, groundcover, grasses and all other plants found growing on the site at commencement of the construction activities.
- e) **“Hydroseeding”** means mixing the specified seed mix into a slurry with water and other materials, such as anti-erosion compound, mulch and fertiliser and applying this mixture by means of a spraying device onto the prepared ground areas to be seeded.
- f) **“Invasive species”** means any species whose establishment and spread outside of its natural distribution range- (a) threaten ecosystems, habitats or other species or have demonstrable potential (b) may result in economic or environmental harm or harm to human health in the National Environmental Management: Biodiversity Act (No.10 of 2004).

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- g) **“Maintenance period”** means the period after the establishment period during which the Contractor shall be responsible for maintaining the grass cover to the standard of acceptable cover. This maintenance period shall not be less than one year, shall include one growing season and may extend, as may be appropriate, beyond the expiry of the Defects Notification Period for the other Sections of the Works.
- h) **“Organic material”** shall, unless another type is approved by the Engineer, be "kraal" manure free from soil, or other objectionable material. It shall not contain particles that would be retained on a 50 mm size screen, and shall be approved by the Engineer before being delivered to the Site.
- i) **“Reasonable”** means, unless the context indicates otherwise, reasonable in the opinion of the Engineer after he has consulted with a person, suitably experienced in rehabilitation practices.
- j) **“Ripping”** means loosening the in-situ and backfilled soil in areas to be rehabilitated to a depth of at least 600 mm. Ripping is done to mitigate compaction resulting from construction activities, and is done prior to placing topsoil.
- k) **“Scarifying”** means loosening the soil in areas which have become hard and compacted after ripping was done, and which need to be loosened in order to facilitate re-vegetation. Scarifying is done to a depth of at least 150 mm. Scarifying may also be required on topsoil that has form a crust in order to create a seedbed suitable for seeding.
- l) **“Sensitive area”** means any area that is denoted as sensitive by the Specification, Section 4 – Integrated Environmental Management or Engineer due to its particularly attributes, which could include the presence of rare or endangered vegetation, the presence of heritage resources (e.g. archaeological artefact or graves), the presence of a unique natural feature and the presence of a watercourse or water body etc.
- m) **“Shaping”** means finishing all slopes which do not form part of the Permanent Works so that they blend with the existing adjacent landforms and such that resultant slopes do not exceed a maximum gradient of 1:5 (V:H), unless otherwise directed by the Engineer.
- n) **“Stored plants”** means any rescued plant material stored and maintained in the on-site nursery.
- o) **“Topsoil”** means topsoil from stockpile previously stripped by the Contractor from the areas of the Works in terms of Section 7 – Clearing Site.
- p) **“Transplanted plants”** means any rescued plant material that will be immediately replanted in an approved location following its removal from the working area.
- q) **“Trimming”** means bringing the existing or previously shaped ground to a smoothly flowing surface with the final levels generally following the original topography, and to blend in with the landform around permanent structures.
- r) **“Weeds”** means all plants listed as “declared weeds” in the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983).

### 47.3 MATERIALS

#### 47.3.1 Fertiliser

The Contractor shall take representative soil samples, in accordance with the requirements of the analysing laboratory, from the areas to be rehabilitated as agreed with the Engineer, and have these samples tested by an approved laboratory to determine the appropriate fertiliser mixture and application rates and timing for the establishment of vegetation as specified. Particular attention shall be paid to establishing the organic carbon requirements.

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The nominal application rates for Tender purposes of potential fertilisers are as follows:

**TABLE 47/1  
APPLICATION RATES OF POTENTIAL FERTILISERS**

<b>FERTILISER</b>	<b>NOMINAL APPLICATION RATE</b>
Agricultural lime (calcitic or dolomitic)	1 000 kg/ha
Superphosphate	350 kg/ha
Limestone ammonium-nitrate	250 kg/ha
2:3:2 (22) Zn	400 kg/ha
Monophosphate	250 kg/ha
3:2:1 (22)	250 kg/ha
3:2:1 (25)	250 kg/ha
2:3:4 (30)	250 kg/ha
Manure / organic material	50 m <sup>3</sup> /ha

The fertiliser shall be uniform in composition, free-flowing and suitable for application with approved equipment. It shall be delivered to the site in bags or other convenient containers, each of which shall be fully labelled and bear a clear indication of the contents, the trade name or trade mark, the producer's name and a warranty by the producer with regard to the contents. Care shall be taken to ensure that fertilizers are stored such that it does not pose a threat to the environment.

Manure shall be pure dry kraal manure or equivalent free from any harmful elements.

#### **47.3.2 Grass Seed Mixes**

All seed used for rehabilitation purposes shall be obtained from commercial sources or suppliers approved by the Engineer or Environmental Manager.

The seed mix for the permanent re-vegetation of areas shall be as follows:

**TABLE 47/2  
SEED MIX FOR THE PERMANENT RE-VEGETATION OF AREAS**

<b>SPECIES</b>	<b>APPLICATION RATE (KG/HA)</b>
<i>Antheophora pubescens</i>	1.0
<i>Cenchrus ciliaris</i>	1.0
<i>Chloris gayana</i>	10.0
<i>Cynodon dactylon</i>	3.0
<i>Digitaria eriantha</i>	12.0
<i>Enneapogon chenchroides</i>	1.0
<i>Eragrostis curvula</i>	2.0
<i>Eragrostis lehmanniana</i>	0.5
<i>Eragrostis tef</i>	3.0

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SPECIES	APPLICATION RATE (KG/HA)
<i>Heteropogon contortus</i>	3.0
<i>Panicum maximum</i>	3.5
<i>Pogonarthria squarrosa</i>	1.0
<b>Total</b>	<b>40.0</b>

Temporary re-vegetation shall only be undertaken at the instruction of the Engineer, using *Eragrotis teff* at a rate of 5 kg/ha.

The Contractor should plant legumes in agricultural fields to bring back organic and other nutrients. When legumes are harvested, excess nitrogen from the nodules is left in the soil. The excess organic nitrogen can be used by other plants the following growing season.

Only good-quality fresh seed shall be used. All seed shall be germination tested by a government (Department of Agriculture) approved laboratory, and copies of test certificates as attached to the bags, submitted to the Engineer prior to the use of the seed.

Seed mixtures shall not be delivered to Site pre-mixed, but seed from sealed bags shall be mixed on Site in the required proportions under supervision of the Engineer.

#### 47.3.3 Plant Material

Only plant material obtained during search and rescue operations as per Clause 47.4.2 and maintained in the on-site nursery shall be used for rehabilitation. The species shall depend on those that were collected during the search and rescue.

All rescued plants shall be fully maintained during the maintenance period defined in Clause 47.8, including watering, fertilising and weeding, and any losses of plants due to lack of maintenance, including diseases developed during the Contract period and the period of maintenance, shall be replaced at the Contractor's expense.

#### 47.3.4 Anti-Erosion Compounds

Anti-erosion compounds shall consist of a soil binding agent in suspension, which is sprayed on the soil as part of the hydroseeding mix to bind the soil and protect it against erosion, such as "Hydropam" or a similar compound approved by the Engineer. Anti-erosion compound shall be used at an application rate of 6 kg/ha.

#### 47.3.5 Topsoil

Topsoil shall be topsoil from stockpile previously stripped by the Contractor from the areas of the Works. As far as practically possible, topsoil shall be replaced on the area from where it was removed. Topsoil shall be free from deleterious matter such as large roots, large rocks, refuse, stiff or heavy clays and excessive amounts of noxious seeds, which would adversely affect its suitability for re-vegetation.

Where the importation of topsoil is instructed by the Engineer, topsoil shall consist of soil, selected from areas showing a good coverage of natural vegetation, preferably grasses and the source shall be agreed with the Engineer.

Topsoil shall not be compacted in any way, especially by vehicles riding over it. Where it is essential to drive a vehicle over placed topsoil, as approved by the Engineer, the contact pressure shall not be greater than 1 500 kg/m<sup>2</sup>.

#### **47.3.6 Mulch**

Mulch shall consist of natural seed-free, dried fibres of hay, chaff or tall grass clippings of various lengths between 50 mm and 400 mm, delivered to Site in bales or bags, and shall be applied by hand to the areas immediately after seeding or may be mixed with water as part of the hydroseeding mix.

### **47.4 PROCUREMENT AND MAINTENANCE OF PLANT MATERIAL**

#### **47.4.1 Procurement of Plant Material**

Only plant material obtained during search and rescue operations and maintained in the on-site nursery shall be used for re-vegetation. Unless agreed by the Engineer, no shrubs and trees shall be procured from commercial sources.

#### **47.4.2 Search and Rescue**

Prior to the commencement of construction activities within any areas in which natural vegetation occurs, a search and rescue operation shall be undertaken by the Contractor, in consultation with the Engineer to collect the plant material identified for use in the rehabilitation of the working area. The extent of, and rate for removal shall be determined in consultation with the Engineer.

When plant material is rescued, the Contractor shall accept full responsibility for maintaining the plants in good condition. The plants shall either be transplanted to the location(s) indicated by the Engineer or shall be fully maintained in an on-site nursery until they are utilised for rehabilitation. Maintenance of stored plants shall include regular watering, and any plant losses due to lack of maintenance, including diseases developed during construction and the Defects Notification Period, shall be replaced at the Contractor's expense.

Each plant shall be handled and packed in the approved manner for that species or variety, and all necessary precautions shall be taken to ensure that plants arrive at the on-site nursery or transplant location(s) in a condition for successful growth. Vehicles used for transporting plants shall be equipped with covers to protect plants from windburn. Containers shall be in a good condition.

#### **47.4.3 On-Site Nursery**

On-site nursery facilities shall be established for the holding and maintenance of rescued plant material for rehabilitation. The location of the nursery shall be to the approval of the Engineer. The Contractor shall provide adequate labour, staff experienced in the running of a nursery, shade, water, plant bags of appropriate sizes, stakes, insecticides, fertilisers and all things necessary to sustain the plants in the nursery for the duration of the Contract.

A record of stock relevant to the Contract that is held in the nursery shall be provided to the Engineer on a monthly basis.



## **47.5 TIMING OF LANDSCAPING AND REHABILITATION**

The planting of grass and other rehabilitation works shall be carried out during periods most likely to produce beneficial growth results viz., during the period mid-October of any particular year to mid-January of the following year. The Contractor shall programme his operations in such a manner to accommodate this requirement. Since vegetation is the most effective control against surface erosion, the landscaping and rehabilitation of disturbed areas shall occur as soon as practically possible following the completion of the work in a specific area. In this regard the Contractor's Works Programme shall clearly indicate that the rehabilitation process will immediately be executed, per phase, upon the completion of the work within a specific area.

## **47.6 REPARATION OF AREAS FOR REHABILITATION**

### **47.6.1 Preparation of Ground Surfaces**

Prior to landscaping and rehabilitation of an area, the Contractor shall demolish and remove from that area everything not forming part of the Permanent Works, including but not limited to temporary services and facilities (including foundations), temporary fences (excluding the construction servitude fencing which will be removed after acceptable cover has been attained and the Defects Notification Period is complete), temporary access routes and all fill or wearing coarse material used for routes, watercourse diversions, protective works, dewatering systems and settlement ponds. All material generated from the demolition and removal of structures from site shall be appropriately disposed of. In this regard building rubble and soil can be disposed of at the spoil sites, whilst the remaining waste shall be dealt with as per the solid waste management system (Section 4 – Environmental Management).

Excavated surfaces that will remain permanently exposed on completion of the Works shall be cleared of all loose material, pieces of rock, debris, rubbish and the like and left neat and tidy. If required for subsequent grassing or for the establishment of natural vegetation, the final surface of excavations shall not be absolutely smooth, but shall have a slightly rough surface.

### **47.6.2 Shaping**

All slopes which do not form part of the Permanent Works shall be graded so that no slope exceeds a maximum gradient of 1:5 or as otherwise directed by the Engineer. Contour drains, as per Clause 47.8.6, shall be provided to control erosion where instructed by the Engineer.

Excavation and fills for Temporary Works and spoil areas shall be formed in such a manner that the final profile shall appear as a natural extension to the adjacent, undisturbed ground profiles.

Appropriate level control measures shall be implemented to ensure that final shaped profiles match the pre-construction landform as far as possible.

### **47.6.3 Ripping**

All soil to be rehabilitated shall be ripped with a mechanical ripper to a depth of 600 mm or as agreed by the Engineer. All agricultural land shall be ripped with a mechanical ripper to a depth of 600 mm or as agreed by the Engineer. No section of ground shall remain undisturbed after ripping.

**47.6.4 Trimming**

Trimming shall consist of bringing the existing or previously shaped and ripped ground to a smoothly flowing surface with the final levels generally following the original surface after shaping as directed by the Engineer. Both mechanical and hand trimming could be undertaken.

Trimming shall be done in such a way that, after cultivation and application of topsoil, the finished surface of the area shall be approximately 25 mm below the top of adjacent kerbing, channelling or pavement.

**47.6.5 Scarifying**

Prior to the application of topsoil, the ground surface shall be scarified by hand, plough or a mechanical ripper to a depth of approximately 150 mm to breakdown soil clods. Where topsoil has been placed, and a crust has formed, scarifying shall be repeated to break the crust prior to establishing vegetation.

**47.6.6 Removal of Rock, Stones and Roots**

All rocks and stones larger than 100 mm maximum dimension, roots and other material with maximum dimension of 300 mm brought to the surface by shaping, ripping, trimming or scarifying, shall be removed prior to placing of topsoil as agreed by the Engineer.

**47.6.7 Topsoiling**

Before placing topsoil, the Contractor shall remove all visible weeds from the placement area and from the topsoil. Topsoil shall generally be spread evenly over the prepared surface to a depth of 150 mm on flat ground or to a minimum of 75 mm on slopes of 1:5 or steeper, or to the depth it was stripped, and as agreed by the Engineer.

Topsoil shall be replaced in the same area from which it was stripped. However, if there is insufficient topsoil available from a particular area topsoil of similar type and quality may be brought from other areas of similar quality, subject to the approval of the Engineer.

After spreading of topsoil, all rocks and stones larger than 100 mm in maximum dimension left on the surface after topsoil placement shall be removed prior to seeding.

Topsoiling shall only be implemented after shaping, ripping, trimming and scarification has been carried out to the satisfaction of the Engineer.

**47.6.8 Fertilising**

The Contractor shall arrange for topsoil (up to 150 mm) and the subsoil (up to 300 mm) of prepared surfaces, at specific areas for rehabilitation to be tested at an accredited laboratory recognised for providing soil analysis and fertiliser recommendations, to determine the amount and type of fertiliser required for establishing proper growth conditions for the vegetation. Particular attention shall be paid to maintenance of the organic material of the soil. The fertiliser mix and rate and frequency of application of the specified fertilisers shall be submitted to the Engineer for consent.

Where hydroseeding is not done, a third of the fertiliser shall be incorporated uniformly into the topsoil to a depth of at least 100 mm. The remaining two thirds of the fertiliser shall be applied at the specified rate in conjunction with the seeding or planting operations, by hand.

Where hydroseeding is done, the fertiliser shall be included in the hydroseeding mix.

## **47.7 RE-VEGETATION**

### **47.7.1 Hand seeding**

Prior to hand seeding, the soil shall be prepared by forming furrows 50 mm deep in rows approximately 150 mm apart running parallel to the contour of the finished surface. After mixing, the seed mixture shall be divided in half and applied evenly in two successive applications, one after the other, by means of an approved hand seeding machine (known colloquially as a "tefsaaier"). The two halves of the seed mixtures shall be applied perpendicularly to each other, across the entire area. During seeding, the seed mixture shall be regularly mixed by hand in order to prevent the separation of smaller and larger seeds in the mixture.

Where hand seeding is done, seeds shall be mixed before placement with either chopped straw, sawdust or sand in order to prevent the separation of seeds of different size, weight and shape. Prior to seeding, trials shall be conducted to determine which of these materials is most effective in preventing the separation of seeds. If required in the fertiliser recommendation, 2:3:2 fertiliser shall be added to the seed mixture prior to seeding.

On completion of the seeding, the surface shall be lightly raked parallel to the contours to cover the seed with no more than 5 mm of soil and mulch shall be applied at a rate of 0.5 kg/m<sup>2</sup>. During raking care shall be taken to prevent the redistribution or removal of seed from any area.

### **47.7.2 Hydroseeding**

Prior to hydroseeding, the surface to be seeded shall be prepared by forming furrows 50 mm deep in rows approximately 150 mm apart running parallel to the contours of the finished surface. Mulch shall be added to the hydroseed mix at a rate of 2.5 tonne/ha. Anti-erosion compound shall be mixed with the hydroseeding mixture before application.

Hydroseeding shall be carried out using an approved hydroseeding machine. The hydroseeding mix shall be applied to the areas to be re-vegetated at a rate of not less than 20 kilolitres of water per hectare.

The hydroseeder shall be capable of pumping the specified seed mix, fertilizer and anti-erosion compound (mixed in water) at the specified rates over the areas to be seeded. The slurry distribution lines shall be large enough to prevent stoppage, and the discharge line shall be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the areas to be seeded. The mixture shall be kept uniform during the seeding operation by means of a power-driven agitator.

No mixing of seed or hydroseeding mixes shall be done without the approval and supervision of the Engineer.

### **47.7.3 Transplanting of Stored Rescued Plants**

The transplanting of stored small trees (1 to 1.5 m height) and stored small shrubs (0.15 to 1 m height) shall be done as follows:

- a) Trees and shrubs shall only be transplanted between the months April and September. Deciduous trees and shrubs shall be transplanted only when they are in a leafless condition;
- b) Holes for transplanting trees and shrubs shall be dug before these plants are removed from nursery or from its position if directly transplanted. Trees shall be planted in holes of 1 m x 1 m x 1 m and shrubs shall be transplanted in holes of 600 mm x 600 mm x 600 mm;
- c) Trees and shrubs shall be planted so that their stems or trunks are at the same depth as in their original location. The orientation of the transplanted plants must be the same as in their original location (i.e. the north facing side of the plant must remain north facing after it has been transplanted); and
- d) Transplanted plants shall be watered once a week for 5 weeks and thereafter once every 2 weeks (the planting hole shall be filled with water at each occurrence) for the duration of the establishment period. In winter the watering frequency may be reduced as agreed with the Engineer.

The transplanting of aloes, succulents and bulbous plants shall be done as follows:

- a) Aloes, succulents and evergreen bulbous plants may be transplanted at any time of the year. Deciduous bulbous plants shall be transplanted when they are leafless;
- b) Aloes and bulbous plants shall be planted in similar soil conditions and to the same depth as they were before removal; and
- c) Transplanted aloes and bulbs shall be watered once directly after transplanting to settle the soil.

In all cases the soil around the roots of the plants being planted shall not be disturbed. Topsoil and subsoil from the hole shall be stored nearby to be replaced to the same depth intervals from which it was originally removed.

The topsoil shall be mixed with the required amount of fertiliser and with a water-retaining admixture before being replaced around the plant.

The plants shall be watered, as necessary, weeded and kept free of diseases and pests until the end of the Defects Notification Period.

Plants that die before the end of the Defects Notification Period shall be replaced as soon as they die.

### **47.7.4 Immediate Transplanting of Rescued Plants**

Rescued plants identified for transplanting, shall be replanted in accordance with the procedures indicated in Clause 47.7.3 in the approved location(s) immediately upon removal. Topsoil and subsoil from holes excavated for the transplanting shall be stored nearby to be replaced to the same depth intervals from which it was originally removed. Plants shall be carefully transplanted into holes. It should be noted that some of these positions may be outside the Site, and may require special arrangements for maintenance.

### **47.7.5 Temporary Re-Vegetation**

During the construction phase, there may be a need to temporarily rehabilitate or re-vegetate certain areas to assist with erosion control, to limit run-off and to mitigate dust generation. Areas requiring temporary re-vegetation would include but are not be limited to topsoil stockpiles, areas for which the final landscaping and rehabilitation will be delayed and areas that will be subject to further construction activities at a later stage. This temporary re-vegetation shall be undertaken on the instruction of the Engineer and shall be established using either hand seeding or hydroseeding.

## **47.8 ESTABLISHMENT AND MAINTENANCE OF REVEGETATED AREAS**

### **47.8.1 Responsibility for Establishing an Acceptable Cover**

The establishment of an acceptable cover shall include maintaining the surface to the required slopes and levels without erosion or sedimentation, watering, weeding, fertilising, disease and insect pest control and any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous and healthy growth of the plant material on site.

Notwithstanding the fact that the method of planting, the type of seed or plant used, the rate of application of seed or planting density may be specified or agreed to by the Engineer, the Contractor shall be solely responsible for establishing and maintaining an acceptable plant cover, and for the cost of replanting or re-seeding where acceptable cover is not obtained or maintained.

Where, in the opinion of the Contractor, it is doubtful from the outset whether it will be possible to establish an acceptable cover as defined, typically in areas where the pipeline traverse rock outcrops, he may inform the Engineer of his reasons for this, prior to commencing with the rehabilitation work and the Engineer shall, if he agrees, either adopt another method of re-vegetation or agree to accept whatever cover can be obtained, provided that all reasonable efforts are made to establish a good cover using the method proposed. Any such agreement shall only be valid if given in writing by the Engineer.

### **47.8.2 Maintenance of Vegetation**

The Contractor's liability with regard to the maintenance of the vegetation shall commence when an acceptable cover as defined above has been established, and shall be not less than one year. During this period the Contractor shall maintain the areas through watering, weeding, fertilising, disease and insect pest control, mowing or slashing and any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous and healthy growth of the plant material. In all cases the cover at the end of the Defects Notification Period shall not be less than acceptable cover as defined in above.

### **47.8.3 Watering, Weeding and Replanting**

All re-vegetated areas shall be adequately watered at frequent and regular intervals to ensure proper germination of seeds and growth until the vegetation has established an acceptable cover and thereafter as required to sustain growth. The amount and frequency of watering shall be agreed with the Engineer.

As a guideline, the Contractor shall water all seeded areas after germination once weekly during the first month, and once every two weeks during the second month. The total combined volume of watering per month shall be no less than 5 l/m<sup>2</sup>.

Any bare patches where the vegetation has not taken, or where it has been damaged or has dried up, shall be re-cultivated and re-vegetated without any additional payment.

#### **47.8.4 Weeding of Re-Vegetated Areas**

The re-vegetated areas shall be kept free of weeds and invasive vegetation. Weeds shall be controlled by means of pulling, or any other means approved by the Engineer.

Where chemical control of weeds is implemented, the Contractor shall ensure that the work is carried out by personnel suitably qualified to do this type of work in terms of the relevant legal requirements.

#### **47.8.5 Traffic on Re-Vegetated Areas**

The Contractor shall not undertake any re-vegetation of areas requiring permanent cover until all operations that may require construction equipment to pass over those areas, has been completed. All re-vegetated areas shall be regarded as “no go” areas, and no construction equipment, trucks or water carts (other than those used for watering of established vegetation) shall be allowed on these areas and only equipment required for the preparation of areas, application of fertilizer and spreading of topsoil will be allowed to operate on re-vegetated areas.

In all cases traffic should use the defined maintenance tracks, which will be rehabilitated at the end of the period for which access is required.

#### **47.8.6 Erosion Control**

From the Commencement Date up to the issuing of the Taking-Over Certificate for the Whole of the Works, the Contractor shall protect all areas susceptible to erosion. To this end he shall install and maintain all necessary temporary erosion protection and drainage works as may be necessary.

The permanent erosion control works will be instructed by the Engineer. Where practical, the Contractor shall also install the permanent erosion protection and drainage works as soon as possible and thereafter maintain such works.

Erosion protection berms approximately 200 mm in height, with cross drainage slope of minimum 1% (1:100) to maximum 3% (1:33), and a spacing as indicated below shall be introduced on all disturbed areas to be rehabilitated.

<b>SLOPE</b>	<b>SPACING (m)</b>
< 7% (1:15)	30
7% (1:15) – 25% (1:4)	25
25% (1:4) – 40% (1:2.5)	15
> 40% (1:2.5)	8

Any runnels or erosion channels developing during the re-vegetation period or during the period for which the Contractor is liable, shall be backfilled and consolidated and the areas restored to a proper stable condition. In all cases the cause of the erosion problem shall be identified and rectified. The Contractor shall not allow erosion to develop on a large scale before effecting repairs, and all erosion damage shall be repaired as soon as possible and in any case not later than three

months before the termination of the Defects Notification Period. All topsoil or other material accumulated in side drains shall be removed at the same time. Topsoil washed away shall be replaced.

The Contractor shall ensure that erosion of rehabilitated areas is not caused by pedestrian access, or game tracks.

#### **47.8.7 Fire Control**

The Contractor shall ensure that appropriate fire control measures as per Section 4 – Integrated Environmental Management, are maintained on rehabilitated areas for the duration of the rehabilitation period and the Defects Notification Period.

#### **47.9 LANDOWNER SIGN-OFF**

Appropriately completed and signed Discharge Certificates, as per the proforma in Annexure 47/1, shall be obtained by the Contractor for every land portion that has been rehabilitated.

#### **47.10 MEASUREMENT AND PAYMENT**

The rates tendered under this Section shall not include for the general obligations, Contractor's Equipment and work deemed to be covered by the items provided in Section 1 – General. However, all the general requirements contained in this Section shall be deemed to be included in the rates tendered.

Although these areas shall be rehabilitated by the Contractor, no measurement or payment will be made against any of the following items for the rehabilitation of the Contractor's working and accommodation areas (including the areas designated for the Engineer's use) or for rehabilitation of areas used for temporary roads.

##### **47.001 Shaping**

**Unit: square metre (m<sup>2</sup>)**

Measurement for shaping will be the area shaped on the Engineer's instructions. No shaping within cuts, fills and spoil areas will be measured.

The rate tendered shall include full compensation for shaping the areas as specified, including the moving of material which would be inherent in this process, and the removal of surplus material and stones.

##### **47.002 Ripping**

**Unit: hectare (ha)**

Measurement for ripping will be the area of ground ripped and prepared as specified. Only areas ripped on the written instructions of the Engineer will be measured.

The rate tendered shall include full compensation for ripping removing stones and smoothing off the surface as specified.

**47.003 Trimming****Unit: square metre (m<sup>2</sup>)**

Measurement for trimming will be the area trimmed on the Engineer's instructions. No trimming within cuts, fills and spoil areas will be measured.

The rate tendered shall include full compensation for trimming the areas to the specified finish, including the moving of a small amount of material which would be inherent in this process and the removal of surplus material and stones.

**47.004 Scarifying****Unit: hectare (ha)**

Measurement for scarifying will be the area of ground scarified and prepared as specified. Only areas scarified on the written instructions of the Engineer will be measured.

The rate tendered shall include full compensation for scarifying, removing stones and smoothing off the surface as specified.

**47.005 Topsoiling cut, fill and spoil slopes****Unit: cubic metres (m<sup>3</sup>)**

Measurement will be the volume of topsoil applied at the specified thickness over the area directed by the Engineer. The quantity will be calculated from the net area of the surface topsoil multiplied by the specified thickness of the topsoil but before the application of grass sods. Any topsoil placed in excess of the average thickness specified or ordered will not be measured.

The rate tendered for topsoil obtained from Site stockpiles shall include full compensation for loading the topsoil from stockpile, hauling, roughening the surface to be topsoiled, off-loading, placing and spreading the topsoil to the required thickness, levelling it off to a smooth surface, removing any stones as specified.

**47.006 Topsoiling in horizontal layers in spoil areas and elsewhere****Unit: cubic metres (m<sup>3</sup>)**

Measurement will be the volume of topsoil placed in layers at the specified thickness. The quantity will be calculated from the net area of the layer placed multiplied by the specified thickness.

The rate tendered for topsoil obtained from Site stockpiles shall include full compensation for loading the topsoil, hauling, offloading, placing and spreading the topsoil in alternate layers with spoil material and smoothing the slope face of the spoil dump.

**47.007 Furnishing and applying fertilisers****Unit: kilogram (kg)**

Measurement of fertiliser will be the net mass of each type of fertiliser ordered, supplied and applied.

The rate tendered shall include full compensation for tests of the topsoil, furnishing the fertiliser, transporting it to the point of use, for hydroseeding, or for spreading and mixing it into the scarified soil or topsoil in accordance with the manufacturer's instructions or as agreed by the Engineer.



**47.008 Provision of vegetative material Unit: Provisional Sum (PS)**

A Provisional Sum has been allowed in the Bill of Quantities against which separate items will be provided for the search and rescue of plant material and the purchase of ordered specified plants.

**47.009 Planting of vegetative material Unit: Provisional Sum (PS)**

Planting of trees and shrubs and maintenance areas during the Defects Notification Period will be measured in Dayworks and paid against this Provisional Sum.

**47.010 Provision of seed Unit: kilogram (kg)**

Measurement for the provision of seed will be the weight of seed mix type provided and used. Separate payment items will be provided for each permanent cover seed type.

**47.011 Preparing topsoil for seeding Unit: square metre (m<sup>2</sup>)**

Measurement will be the net area of topsoil surface prepared by forming furrows 80 mm deep in rows 150 mm apart to retain seed.

The rate tendered shall include full compensation for all work necessary to form the furrows including the removal of any excess material.

**47.012 Hydroseeding Unit: hectare (ha)**

Measurement for hydroseeding will be the net area of vegetation established by hydroseeding.

The rate tendered shall include full compensation for furnishing mulch and mixing it with the different seed mixes, fertiliser and water and with any anti-erosion compound if required, for applying the mixture, for watering, weeding, disease and insect pest control, mowing or slashing and any other procedure consistent with good horticultural practice, re-hydroseeding bare patches, and for any other work which may be necessary to establish acceptable cover and to maintain the areas during the Defects Notification Period.

**47.013 Hand seeding Unit: hectare (ha)**

Measurement for hand seeding will be the net area of vegetation established by hand seeding.

The rate tendered shall include full compensation for furnishing mulch and mixing it with seed, fertiliser and water and with any anti-erosion compound if required, for applying the mixture, for watering, weeding, disease and insect pest control, mowing or slashing and any other procedure consistent with good horticultural practice, re-hand seeding bare patches, and for any other work which may be necessary to establish acceptable cover and to maintain the areas during the Defects Notification Period.

**47.014 Additional rehabilitation measures Unit: Provisional Sum (PS)**

A Provisional Sum has been allowed against which payment for all other rehabilitation measures instructed by the Engineer will be reimbursed.

**47.015 Temporary re-vegetation Unit: hectare (ha)**

Measurement for temporary re-vegetation will be the net area of vegetation established.

The rate tendered shall include full compensation for furnishing and applying seed and fertiliser in accordance with the Specification. Irrespective of which method is used to establish the temporary re-vegetation (hydroseeding or hand seeding) the rate tendered shall include full compensation for mixing the seed and fertiliser with water (in the case of hydroseeding) for applying the mixture, for watering, weeding, re-seeding of bare patches, and any other work which may be necessary to establish and maintain the temporary re-vegetation.

**47.016 Provision of Temporary Erosion Control Measures Unit: Hectare (ha)**

The rate shall include full compensation for the provision of temporary erosion control measures as determined by the Contractor. The pricing of these temporary measures shall differentiate between the following slopes measured longitudinally along the pipeline route:

- < 7% (1:15)
- 7% (1:15) – 25% (1:4)
- 25% (1:4) – 40% (1:2.5)
- > 40% (1:2.5)

**47.017 Maintenance of the Temporary Erosion Control Measures Unit: Sum**

The rate shall include full compensation for the maintenance of temporary erosion control measures as determined by the Contractor. The provisions regarding Time-Related Charge Items as provided for in Clause 1.15 shall apply mutatis mutandis to measurement and payment for maintenance of the temporary erosion control measures.

**47.018 Maintenance of Vegetation Unit: Sum**

The rate shall include full compensation for the maintenance of vegetation as determined by the Contractor to meet the requirements of the Specification. The provisions regarding Time-Related Charge Items as provided for in Clause 1.15 shall apply mutatis mutandis to measurement and payment for maintenance of vegetation measures.

**ANNEXURE 47/1**  
**PROFORMA DISCHARGE CERTIFICATE**



### MOKOLO CROCODILE WATER AUGMENTATION PROJECT

#### Form – Discharge Certificate

**Contractor:**

**Farm name and Number:**

**Registered Landowner:**

**Authorised Representative\*:**

(\* Certified copy of Delegation of Authority to be attached)

In respect of the above landscaping and rehabilitation conducted on the named land it is hereby certified as follows:

1. The area occupied and used by the Contractor for the purposes of the Contract has been fully landscaped and rehabilitated in accordance with the Contract and to the Employer's satisfaction.
2. The Contractor has concluded his operations, removed his equipment and left the land, access ways and general area of the farm in a state that meets with the full satisfaction of the Registered Landowner.

<p>In respect of 1:</p> <p>.....</p> <p>Employer's Representative</p> <p>Witness 1 .....</p> <p>Witness 2 .....</p> <p>Date .....</p>	<p>In respect of 2:</p> <p>.....</p> <p>Registered Landowner</p> <p>Witness 1 .....</p> <p>Witness 2 .....</p> <p>Date .....</p>
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