INVITATION TO BID CBD 1

BID NUMBER	RFQ AP6672
CLOSING DATE AND TIME	MONDAY, 11 MAY 2026 STRICTLY AT 12:00PM
DESCRIPTION	GENADENDAL: BAVIAANS RIVER REHABILITATION PLANTING & STABILIZATION WORK
NAME OF TENDERER/BIDDER	
CSD NUMBER	
TOTAL BID PRICE (VAT INCLUDED)	
VALIDITY PERIOD OF BID	90 DAYS

SUBMISSION OF RFQ
All RFQ documents to be uploaded onto the Casidra RFQ/Tender portal. No e-mailed or hard copy documents will be accepted.

NOTE TO BIDDERS:
Bidders are required to ensure that electronic bid submissions are done at least a day before the closing date to prevent issues which they may encounter due to their internet speed, bandwidth or the size of number of uploads they are submitting. Please do not wait for the last minute to submit. A bidder can upload 30MB and up to 10 documents per upload and multiple uploads are permitted.

FAILURE TO PROVIDE ANY OF THE COMPULSORY DOCUMENTATION AND PARTICULARS MAY RENDER THE BID INVALID.

PLEASE NOTE:
Documents must be bound as Casidra will not take responsibility for any information that is lost due to unbound submissions of tenders.

THE FOLLOWING RETURNABLE DOCUMENTS (INCLUDING THE CBD FORMS AS PART OF THE BID) MUST BE VALID FOR A PERIOD OF 90 CALENDER DAYS AFTER CLOSURE OF THE BID AND SUBMITTED AS PART OF THE BID PACKET

Document	Description	Compulsory	Comment
CBD 1	Invitation to bid	✓	
CBD 2	Conditions to submit bid	✓	
CBD 3	Terms of Reference	✓	
CBD 4	Pricing schedule	✓	

CBD 5	**Supply Chain – Preferential Procurement Regulations 2022 and Codes of good practice**	✓	

Name of bidder	
Postal address	
Street address	
Telephone number (code and number)	
Cell phone number	
Faxcimilie number (code and number)	
E-mail address	
VAT registration number	

SARS TCC attached (Foreign suppliers with no tax obligation in South Africa must complete the SBD1 form that will be submitted to SARS for verification and issuing of a Confirmation of Tax Obligation letter.)		**YES**	☐	**NO**	☐
Originally certified B-BBEE status level certificate/Original Sworn Affidavit (A B-BBEE status level verification certificate must be delivered to Casidra SOC Ltd, 22 Louws Avenue, Paarl, in order to qualify for preference points for B-BBEE)		**YES**	☐	**NO**	☐
COIDA	**Number:**	**YES**	☐	**NO**	☐

I, _____

as the authorised representative of the company / CC / business hereby declare that, to the best of my knowledge the information submitted is true and correct and that I am duly authorized as a signatory of this bid. On behalf of my business, I accept the terms and conditions as set out in this document. I will supply documentary proof of any information supplied herein on request and to the satisfaction of **Casidra**.

In terms of the POPI Act I further give consent that my contact and company details as will be captured on the **Casidra** database may be shared with the role players/funders involved in the project and be used by **Casidra** for the purpose of further procurement.

Signature of bidder		**Date**	
Capacity under which this bid is signed			

FOR OFFICE USE ONLY – TO BE COMPLETED AT BSC MEETING

PLEASE INDICATE TYPE OF WORKS	
Infrastructure/construction (includes animal husbandry, building, greenhouses, sheds and storerooms, civil and building works including stores, engineering and electrical engineering works)	☐
Training	☐
Catering services	☐
Production inputs (includes feed, fertilizers, packing material, seeds and plants, transport, soil preparation)	☐
Professional services (Engineers, consulting engineers, Veterinarians and services, Legal Practitioners, Industrial Consultants or Recruitment Agencies, Training service providers, Subject matter specialists acting as consultants, etc.)	☐
Mechanisation (Vehicles, farming implements/equipment)	☐
OTHER (PLEASE SPECIFY) LANDSCAPING IN THE FORM OF RIVER REHABILITATION	☒

PROCUREMENT STRATEGY **(Please indicate by choosing either YES or NO and click on the box.)**	Yes	No
1. Advertising on e-tender	☐	☒
2. ADVERTISING ON CASIDRA PORTAL	☒	☐
3. RFQ	☒	☐
4. OPEN TENDER PROCESS	☒	☐
5. CONTRACT ADMINISTRATION SHEET COMPLETED	☒	☐
6. PROCURE PLAN SHEET COMPLETED	☒	☐

7. **ADVERTISE PERIOD (2 WEEKS)** ***NOTE IF BID DOCUMENT AND ADVERTISEMENT PERIOD IS LESS THAN 14 DAYS, ATTACH CEO APPROVAL.***	☒	☐

SUPPORTING DOCUMENTATION		
Project managers to indicate what supporting documentation MUST form part of the tender. If marked YES, then it must be provided to SCM:	**Yes**	**No**
BASELINE RISK ASSESSMENT	☒	☐
HEALTH & SAFETY PLAN	☒	☐
DRAWINGS / SKETCHES Baviaans standard landscaping and rev Baviaans rivier layout plan.pdf	☒	☐
COMPULSORY DOCUMENTATION NEEDED TO BE SUBMITTED AS PART OF THIS BID:		
COIDA – LETTER OF GOOD STANDING	☒	☐
COMPANY PROFILE – DETAILED COMPANY PROFILE INCLUDING BUT NOT WITHSTANDING CORE BUSINESS ACTIVITIES, BACKGROUND, RESOURCES, ETC.	☒	☐
ACCREDITED AND REGISTERED PEST CONTROL OPERATOR (PCO) – PROVIDE PROOF OF REGISTRATION WITH THE DEPARTMENT OF AGRICULTURE, LAND REFORM AND RURAL DEVELOPMENT (DALRRD).	☒	☐

1. BID SUBMISSION:

1.1. Bids must be delivered by the stipulated time to the correct address. **LATE BIDS WILL NOT BE ACCEPTED**.
1.2. All bids must be submitted on the official forms provided (not to be re-typed).
1.3. Bidders must be registered on the Central Supplier Database (CSD).
1.4. Original Sworn Affidavit and originally certified B-BBEE certificates must be submitted to bidding institution to qualify for preference points for B-BBEE.
1.5. Bids are subject to the **Casidra** SOC Ltd Financial Regulations, Preferential Procurement Policy Framework Act and the Preferential Procurement Regulations, 2022, the General Conditions of contract (GCC) where applicable, and if applicable other special conditions of contract.

2. TAX COMPLIANCE REQUIREMENTS

2.1. Bidders must ensure compliance with their tax obligations.
2.2. If a discrepancy exists between CSD and SARS, a printed version of the Tax Clearance Certificate (TCC) must be supplied by the supplier and the e-Filing PIN number for verification of authentication by **Casidra** SOC Ltd.
2.3. Foreign suppliers with no tax obligation in South Africa must complete SBD1 that will be submitted to SARS for verification and the issuing of a Confirmation of Tax Obligation letter.
2.4. Consortia/joint ventures/sub-contractors must each submit a separate TCC.

3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

3.1. Is the bidder a resident of the Republic of South Africa (RSA)	Yes ☐	No ☐
3.2. Does the bidder have a branch in RSA?	Yes ☐	No ☐
3.3. Does the bidder have a permanent establishment in the RSA?	Yes ☐	No ☐
3.4. Does the bidder have any source of income in the RSA?	Yes ☐	No ☐

IF THE ASWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO OBTAIN A TAX COMPLIANCE STATUS/TAX COMPLIANCE SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.

4. TENDER CONDITIONS

CASIDRA reserves the right to:

- disregard any bids where the declaration has not been signed;
- accept parts of the bid items or split bids based upon item prices;
- disclose the results of the points awarded on request;
- evaluate and award points according to the documentation supplied and evaluate functionality at its own discretion;
- award the bid to the qualifying bidder with the highest number of points scored, unless the prices are not market related or on the basis of objective criteria stated in the tender documents, and
- to award the bid to a bidder which does not necessarily have the lowest price.

The bid may be cancelled if:

- all the bid offers received are higher than R50 million;
- circumstances change and there is no longer a requirement for this service;
- funds are no longer available or if there are insufficient funds available in the budget for the work;
- no acceptable bids and/or market related prices are received;
- there is a material irregularity in the tender process (administrative non-compliance of prescribed legislation);
- false information was supplied by the bidder;
- Cancellation of bid will be placed in the same media as initially advertised.

Other notes:

- Final points scored will be rounded off to the nearest 2 decimal places.
- In the event of equal scores, the offer with the highest B-BBEE score will be successful. If scores are still equal, and where functionality is part of the bid, the offer with the highest functionality score will be successful. If the scores are still equal, the drawing of lots will determine the outcome.
- **Casidra** SOC Ltd retains the right to amend financial/accounting calculations and to accept the amended amount as the new bid amount.

TERMS OF REFERENCE CBD 3

PROJECT: GENADENDAL: BAVIAANS RIVER REHABILITATION PLANTING & STABILIZATION WORK

GENERAL REQUIREMENTS

The works, as described, are situated in the Baviaans River for a length of approximately 3 kilometers, running through town of Genadendal in the Western Cape. The quoted amount will be a lump bid and must include labour, material and machinery. The successful bidder must have the capacity to start the works within 7 (seven) days of appointment

Conditions that may pose a risk:

Working on the banks of a river is the foremost risk at this specific site.

The requirements of the Occupational Health and Safety Act will be strictly enforced.

The contractor must put all necessary precautions in place to work under these conditions. A detailed risk management plan and Occupational Health & Safety specification is provided.

Security for materials and equipment must be supplied. The Contractor must put all necessary precautions in place to work under these conditions and prepare the site with the correct falls.

CONTRACT PERIOD	The completion period of this service is **(TWELVE) 12 MONTHS** starting from the day of appointment**.**
RETENTION	None
PENALTY CLAUSE	The penalty **R 550.00** per calendar day will be applied for late completion of works.
COMPULSORY SITE MEETING	A compulsory site and information meeting will take place at the old site meeting next to the Baviaans River. Coordinates: 34°3'2.71"S 19°33'36.42"E **DATE AND TIME: TUESDAY; 05 MAY 2026 AT 12H00PM.** Prospective bidders that arrive 20 minutes or more after the advertised time the meeting started will not be allowed to attend the meeting or to sign the attendance register. **BIDDERS (including all partners of a Joint Venture) WHO DID NOT ATTEND THE COMPULSORY SITE AND INFORMATION MEETING AND SUBMIT A BID, WILL BE SEEN AS SUBMITTING A NON-RESPONSIVE BID.**

FUNCTIONAL REQUIREMENTS

Functional refers to: A service or product that is designed to be practical, useful, working or operating, taking into account factors like quality, reliability, viability, and durability and the technical capacity (time and resources) and ability (knowledge and skills) of the bidder to execute the works.

Bids that fail to meet the minimum score, for individual criteria and total for functional criteria as stipulated in the tender document, will be an unacceptable tender.

This bid is subject to the evaluation of functional requirements.

The following criteria will be used for evaluation:

No	Evaluation criteria	Weight (A)	Score (B)	Minimum score required	Total (A x B)
1	**Experience of similar work**	**50%**	For office use	**3**	For office use
2	**References of previous work**	**50%**	For office use	**4**	For office use
TOTAL SCORE - A minimum score of **70%** is required for functional requirements for this bid to be considered for further evaluation				**% = Total / 5**	For office use

Functional Item	1 Poor: Non-compliant	2	3	4	5 Excellent: Fully compliant
Experience of similar work. **Provide written proof of monetary value with appointment letter of awards. One proof is minimum requirement.**	Has no work experience	Has Limited exposer to work at hand. Has done rehabilitation work.	Has experience in vegetation rehabilitation relating to rivers (Work done to value of R500 000.00).	Has experience in vegetation rehabilitation relating to rivers (work done to value of between R500 000.00 and R1mil)	Has vast experience in vegetation rehabilitation relating to rivers (Work done above value of R 1mil).
References from clients on similar nature related previous work **Written proof of reference**	No references	Very poor rapport by all three different references	Some minor problems experienced by all three different references	Recommended by all three different references	Highly recommended by all three different references

letters from clients will be preferred.						

LABOUR LOG SHEETS

One of Casidra's agreed mandate with the Western Cape Department of Agriculture is to report on jobs created for the individual projects. To assist Casidra with accurate reporting it is a condition of this bid document that the successful bidder will have to submit labour log sheets with all required information properly completed.

Documentation **MUST be submitted with every payment claim** from the Contractor on a monthly basis. Failure to submit this information will result in default by the contractor and may affect payment certificates being issued.

Documentation will consist of excel spreadsheet combined total person days, weekly log timesheet & relevant copies of South African ID Documents of workers claimed for under person days. This documentation will be emailed to the successful bidder. Weekly log sheet MUST be signed by workers on the site. The person days claimed for workers must have South African citizenship.

The Protection of Personal Information Act 4 of 2013 (also known as POPIA), regulates and controls the processing, usage and storage of personal information. In order to be compliant with POPIA, Casidra commits not to share your information with any third party outside Provincial & National Departments of Agriculture, project management agencies, co-workers and associates / partners as per our business approval and evaluation, and reporting processes.

SCOPE OF WORKS

THIS PROJECT CONSISTS OF THE FOLLOWING ELEMENTS:

- **INVASIVE PLANT ERADICATION AND RE-ESTABLISHMENT OF INDIGENOUS PLANT SPECIES:**
- **WORKING IN WET AREA - RIVER**
- **WORKING OUTDOORS**
- **WORKING WITHIN A LOCAL COMMUNITY – WITH AN APPOINTED CLO**

GENERAL CONDITIONS

SITE ACCESS:

The movement of vehicles on the site should be confined to demarcated access routes and existing roads should be used where approved by the Project Manager. Any deviation should first be approved by the Project Manager in consultation with the Landowner. The Contractor should ensure that vehicles leaving the site are clean and, wherever possible do not deposit mud and any other earth material on road surfaces. Please note to make allowance for removing security fencing panels and reinstatement in the tender pricing to gain access using the mechanized plant.

STORAGE NURSERY FOR MATERIALS:

The Contractor shall provide for the supply, erection and maintenance and removal on completion of the works, of a temporary nursery for the proper storage of plants and equipment

TEMPORARY LATRINES:

The contractor shall provide for the supply and erection of proper temporary latrines for the use of his employees. Latrines are to be maintained in a thoroughly clean and orderly condition and adopt such precautions to prevent the soil from being contaminated/polluted and remove such latrines after the works.

FIRE PREVENTION MEASURES:

No unauthorized fires may be allowed inside the construction area.
(Please see the baseline risk assessment and the health and safety specification).
The Contractor shall pay damages and the costs incurred to organizations called to put out any fires started by him. The Contractor shall also pay any costs incurred to reinstate/rehabilitate burnt areas as deemed necessary by the Project Manager.

SECURITY:

The successful bidder is responsible for the security of his/her plant, facilities, resources, etc for the duration of the contract.

SITE CLEAN UP:

The Contractor shall ensure that all litter, equipment, materials, and facilities used or created on-site for or during construction activities are removed to the satisfaction of the Project Manager once the project has been completed. All roads to be repaired to at least its original condition. All damage to the site's infrastructure or land production must be repaired or rehabilitated before completion of the project.

NOISE AND NUISANCE CONTROL:

Operations shall be conducted in such a manner that nuisance shall not be caused to the general public, adjoining residents and users of adjacent buildings. If such nuisance is being caused the Contractor shall immediately make such arrangements that will prevent a recurrence of the same and indemnify the Employer against any claims arising therefrom.

RESTRICTIONS ON WORKMEN:

Ensure that workmen confine their activities to the area in which the Contract Works are being carried out. Smoking will not be allowed on site.

Any transgressions of the above may lead to permanent dismissal from site. All workmen shall be identifiable by suitable ID cards and uniform work clothing.

PLACING OF ORDERS:

The contractor shall place all orders for plants and materials as early as possible, as he/she will be held responsible for any delay in the delivery thereof.

EXISTING SERVICES:

If the contractor encounters any existing services such as cables, pipes or sewers during the execution of the works, he must immediately notify the Project Manager, halting all work in the vicinity thereof, until instructions to proceed have been given by the Project Manager

Electric wires, telephone wires, pipes, etc. will not be interfered with during the course of the contract but if it should be necessary to disconnect or cut any such wires or pipes, the Project Manager will be advised thereof and his instruction awaited

THE SCOPE OF WORKS:

Community Liaison Officer

A Community Liaison Officer to be appointed as a go-between with the contractor and community. The appointment a Community Liaison Officer is compulsory. The monthly salary and cost of the cell phone contract are included in the Bill of Quantities. The successful bidder must ensure there is successful communication between all parties before work commencement on an ongoing basis.

INVASIVE ALIEN PLANT (IAP) REMOVAL & CONTROL

All IAP's to be removed from the riverine area (approximately 30m from the river bank). A species list will be supplied as a guide and identified on site before the commencement of the project.

Contractor thus required to do the following under Invasive Alien Plant removal: -

- Removal of aliens from the riparian zone, approximately 30 metres up the bank and neatly stacked above the high water / flood line.
- Foliar spraying of species such as Bramble and water weeds as required.
- Hand clearing and chemically treating (as required) of alien plants within the riparian zone.
- Picking up and removal of all litter. Local Disposal Site is free of charge.
- Islands are included in issued contracts but working these is dependent on risk, water levels can fluctuate making work on the islands difficult – contractor is then advised to return and complete this work once safe to do so, water levels will subside. This must be done with prior agreement with the Project Manager – would be advisable to record reasons for not being able to work islands – take photographs as portfolio of evidence.

Manual Clearing Definition:

- Manual non-mechanical clearing is done through the use of hand tools such as loppers, Slashers, bow-saws, pruning scissors.
- Manual mechanical clearing is done through the use of brush cutters and handheld chainsaws.
- All combustible deadwoods, refuse, litter and other verified fire hazards shall be removed. Biomass material to be neatly stacked above the high-water mark.

General principles

- Prioritise areas to be controlled:

- Areas requiring follow up treatment take precedence over areas which still require initial clearing. Follow up treatment is essential to curb the further growth and spread of the alien vegetation which has already had time and money spent on it.

- Start with young less dense trees to arrest the invasion and prevent the build-up of seed banks. Starting with less dense areas also requires less resources and these areas will also be easier to carry out follow up treatment in.

- Dense mature stands should ideally be left for last, as they most probably won't increase in density or pose a greater threat than they are at the moment. Starting to clear dense areas also means that you have to be dedicated to expensive follow up treatments thereafter.

- One should always consider the natural gradient of the area being cleared, all operations should follow the gradient of the e.g. the slope or drainage lines.

- The Contractor shall under no circumstances damage indigenous vegetation or soil around trees.

- The Contractor shall not make any cuts, roads or tracks. Only existing roads, paths and tracks to be used.

- No manual clearing of roots shall occur on steep slopes, especially where dense stands occur.

- Contractor to bag and remove all litter within their working areas. Any litter must be removed from site by the Contractor daily. Waybills must be submitted for all refuse that is disposed of off-site.

- All previously felled material is to be cut, de-branched and neatly stockpiled above the high-water mark.

- The Contractor is to ensure that the supervisors have the knowledge and experience to identify indigenous vegetation. All means possible to ensure indigenous vegetation is not damaged.

- It will be the responsibility of the Contractor to ensure that he or she is fully informed of the extent of all alien vegetation to be cleared.

- The Contractor must provide ablution facilities for all staff, including the staff members of any of his/her sub-contractors (1 for every 15 people).

- No open fires will be allowed on site

Clearing operations

A: Manual removal using hand tools

Manual removal using hand tools such as cane knives, tree loppers, bow saws, silky saws and slasher's can be used to remove aliens.
Methods of removing the plants include:

Hand Pulling:

The most effective and requires no herbicide as long as the roots are removed entirely while pulling. In the softer and wet soils this is the preferred method – weeds such as Echium should be hand pulled, their roots are shallow they often grow in the more sandy soils where it is easy to pull by hand. Young trees depending on their size should also ideally be hand pulled – ergonomics is to be considered as we do not want injury being caused through repetitive movement.

Just remember it is always better to bend the legs rather than the back – good ergonomics! Tree poppers can also be used and are highly effective.

Cut-stumping:
Plants with a stem/ trunk diameter larger than 10mm can be cut as low to the ground as possible (no higher than 50mm and as flat as possible) with a saw or cane knife. Herbicide, if required, should be applied to the cut surface immediately after cutting.

Slashing:
The seed stalks/branches of annuals (plants that die each year after they set seed) can be slashed with a cane knife, mattock, bill hook or slasher before the seeds have matured. This is an effective method significantly reducing the presence of viable seeds that will germinate in the new season. Costs are generally low for controlling annuals in this way, as no herbicide is required. Slashing requires the stems to be cut as flat as possible in order to limit the dangers of sharp stems being left behind.

B: Manual removal using mechanised tools
A variety of mechanised tools can be used for manual AC clearing.
They include:

Brush-cutter:
Heavy duty motorised brush-cutters that are usually powered by a small two-stroke engine are popular for controlling low-growing thickets of IAPs. Importantly, a suitable blade must be fitted to the brush-cutter. Herbicide application to the cut stems should follow immediately after cutting. This would be beneficial when treating Giant Spanish Reed (Arundo donax).

Chainsaw
A chainsaw is ideal for felling large trees and can be used to cut logs and branches into shorter lengths. Common target species for felling include large specimens of Syringa, Pine, Gum and Wattle. Training for chainsaw operators is essential. Operators need to understand the techniques of felling, i.e. ensuring that the tree falls in the desired direction. Each operator must also understand and be able to apply the necessary safety precautions during the felling process. Understanding the effective use and operation of the chainsaw itself is critical. The operator should also have the means and knowledge to undertake any required onsite servicing of the motor and sharpening of the chain. Daily maintenance schedule must be in place and up to date and will be included in the required payment documents to be submitted on completion of the work.

Herbicide application:
The contractor must apply herbicide to the stumps within 20 minutes of sawing the trees.
Note if trees are cut above the minimum height of 50mm for an initial cut, herbicide must still be applied within the 20 minutes. Thereafter upon cut number 2 to reach specified height, herbicide must be applied again.

The correct herbicide and application methods will be used. No herbicide mixing close to vineyards and water streams (50 (fifty) metres away) will take place and herbicides will be mixed on a tarpaulin or blanket. Contractor must apply the herbicide applicable for the selected alien.

Note that the herbicide and mixing ratios will vary for each alien species. Method of application will be noted on the herbicide label.

All herbicides, Actipron and dye must be within its expiry date.

The Contractor must provide proof that they have an accredited and registered Pest Control Operator (PCO) on site when dealing with herbicide.

Use of herbicide and fuel

- Herbicide may only be stored in suitable UV containers and only approved spray bottles may be used as applicators.
- Decanting or dumping of herbicide in the areas is an offence and may result in prosecution and termination of contract. Herbicide spillage must be avoided and all herbicide (when not in immediate use) must be stored in a spill proof and secure lockable container/ vehicle.
- Spill kit to be kept on site including absorbent material such as saw dust or sand, plastic spade (some herbicides and fuel are flammable) and bags in order to collect contaminated saw dust or sand.

- Fuel may only be stored in suitable & marked Fuel cans and must be placed on a drip tray when not in use. Fuel spillage must be reported immediately.

Herbicide management

- Only use herbicides that are registered for use on the specific species to be treated.
- Herbicide must be supplied by the successful bidder. All herbicide specifications MUST be sent to Casidra for prior approval before it may be applied on site.
- Herbicide cannot be applied to plants, stumps or stems that are above shoulder height.
- Herbicide may not be applied when the wind is more than 10km/hr.
- Do not apply herbicide if the temperature exceeds 28 degrees Celsius.
- Do not spray wet plants
- Do not spray or apply herbicide if it is about to rain – within 2 hours of predicted rainfall.
- Ideally spray plants during the active growing period and immediately after being cut, lopped or felled. Within a minimum of 20 minutes of the stem being cut.
- Do not apply herbicide in extremely hot or cold conditions.

Herbicide should not be applied during wet conditions, before or after rain. If it rains after application, it is important to monitor the effect as one may need to re-apply.

Carefully read and understand the instructions on the label prior to initiating chemical control. Always store herbicides in the original container and in secure storage areas out of reach of children and animals.

All persons must wear the required personal protective equipment when working with herbicides.

- Avoid skin contact with herbicides and avoid breathing in the vapour.
- Herbicide should always be applied immediately after the selected mechanical control method. Once the stem has dried it will not absorb the herbicide.
- Keep herbicide in the shade at the work site to keep it cool.
- To avoid spills, keep herbicide containers on a waterproof tarpaulin, or inside a big plastic bucket. When mixing herbicides, ensure that you use a funnel to avoid spilling. Should you spill the herbicide, it can be poured back into the container from the plastic bucket.
- Containers containing mixed herbicide should be clearly marked (e.g. 'glyphosate mix').
- Likewise, containers filled with water to be used for mixing herbicide should also be clearly marked to ensure that people do not drink from them.
    - Always use a measuring jug to measure the correct quantity required.

- To mix herbicides, half fill the appropriate size container with water, and then add the herbicide using the measuring jug. Secondly, close the container and shake, and then fill the rest of the container with water.
- Keep the herbicide away from food.

REVEGETATION

Identifying And Sourcing of Indigenous Plants for the Revegetation Work.
A localized indigenous species list will be supplied and identified on site before the commencement of the project. Plants must be sourced along the banks of the river, without causing damage to the existing flora. Additional plants must be purchased from local nurseries to adhere to planting specifications and instructions.

- **Plant species**
  A basic localised, indigenous species list will be supplied and identified on site before the commencement of the project.
- **Plant sourcing**
  Where there are sufficiently large populations of indigenous plants available, selective harvesting must take place, without detriment to the original plant population and planted within the three zones.

  Bidders to note that Palmiet can be sourced on site at lower area of site. This will be pointed out upon compulsory site meeting.

Temporary Nursey

To be read in conjunction with "*WWF community nursery guide web update dec19"*

A temporary nursery is preferred on site and below specifications are guideline for nursery specifications**.** The CLO in conjunction with the community & successful bidder will agree upon the location of the said nursery.

A temporary nursery can be used to house salvaged or on-site sourced indigenous. This on-site nursery will enable the propagation and protection of local species—often called "eco-sourcing"—which ensures higher survival rates during re-planting.

Key Components and Best Practices for a Temporary Nursery

Location and Setup:

- Drainage and Slope: Position the nursery on a slight slope (2 to 5 degrees) to allow for natural drainage of excess water, preventing waterlogged roots.
- Shelter: Site the nursery in an area protected from prevailing winds. If necessary, create artificial shelter.
- Surface: Use weed matting to cover the ground to maintain hygiene.
- Proximity: Locate the nursery near a reliable water source (borehole, river, or water tank) and with easy road access for transporting materials and plants.

Infrastructure

- Shade-house: A 50% green shade cloth is recommended to cover native plants, particularly for the first few weeks, to improve survival rates.

- Stand-out Area: An open, sunny area to "harden off" plants for 4–8 weeks before replanting.
- Potting Station: A covered, well-ventilated space with work benches (approximately 2m of space per person).

On-site Plant Management:

- Hardening Off: All plants must spend 4–8 weeks in the open to harden off prior to planting.
- Watering Regime: Maintain consistent moisture without soaking, ensuring the nursery is properly irrigated.
- Planting Density: Place plants of similar ages and water requirements together.
- Hygiene: Keep the nursery clean and weed-free to prevent disease.

Specific Considerations for Indigenous Species

- Propagating Material: Use seeds or cuttings from healthy plants, ideally sourced from the same area intended for restoration.
- Soil Mixture: Use a clean, well-drained medium suited to the specific plant species.
- Growth Stage: Only remove plants from the nursery for final installation when they are robust enough to handle field conditions.
- Labelling: Label all containers with the plant name, propagator, and date for tracking purposes.

Specification for Sourcing and Planting On-site

- Identify Local Species: Survey existing indigenous species on-site, such as Arctotheca prostrata, Moraea species, Cotula turbinata, and Zantedeschia aethiopica (Arum lily), to determine what grows best.
- Responsible Harvesting: When collecting seeds or cuttings, obtain necessary permissions (e.g., from CapeNature in South Africa) to ensure legal and ecological compliance.
- Propagation & Timing: Plant during the rainy season—early winter (May/June) is often recommended for South African fynbos—to maximize survival rates.
- Soil and Site Prep: Remove invasive alien species first, ensuring they are cleared from the area to allow new plants to thrive.
- Planting Tips:
    - Place plants in the ground immediately after sourcing to avoid root disturbance.
    - Group plants together to mimic their natural, wild, and bushy environment.
    - Apply a layer of mulch (5-10cm of woodchips) to keep roots cool and retain moisture

Watering

Planting of on site sourced indigenous plants will require watering depending on species planted. See below specifications regarding watering: -

- Establishment Phase: While drought-resistant, new plants require regular watering until their root systems are established.
- Deep, Infrequent Watering: Instead of light, daily watering, apply 2 to 3 cm of water deeply once or twice a week. This technique encourages roots to grow deeper, creating more drought-resistant "plant athletes".
- Timing: Water in the early morning or late evening (before 09:00 or after 18:00) to minimize evaporation.

Planting density guideline and zones

- **River bank Zones *(Annexure 1)***
  ***Note*:** *Local residents allow their cattle to graze next to the river (mostly on one side) and as such, sufficient measures must be put in place to protect planted areas from the grazing activities along the river's edge.*
  - River bed – wet zone
    Plants in this zone grow in the river and in the wet areas next to the river bank.
    Quantity per 200m river frontage (1 500)
    Palmiet to be planted (1 meter apart) in three rows through zones A & B into zone C, in strips 30-40m apart.
    See plant list for guidance.
  - Primary Terrace
    Plants in this zone grow in the moist areas next to the river bank.
    Quantity per 200m river frontage (1000)
    Palmiet to be planted (1 meter apart) in three rows through zones A &B into zone C, in strips 30-40m apart.
    See plant list for guidance.
  - Secondary Terrace
    Plants in this zone grow in the dry areas next to the river bank. This zone will require irrigation over a period on one (1) year after planting to ensure maximum survival rate.
    Quantity per 200m river frontage (500)
    Palmiet to be planted (1 meter apart) in three rows through zones A &B into zone C, in strips 30-40m apart.
    See plant list for guidance.

River Rehabilitation Species Planting Guide

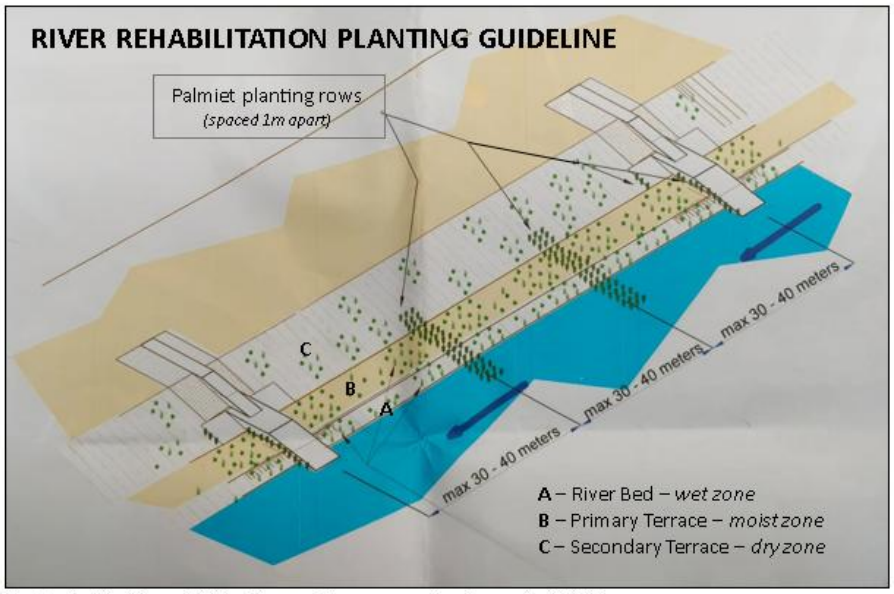
Plant species will vary from river to river, depending on the species found growing there.

RIVER BANK LEVEL	SPECIES TO BE PLANTED		Zone	POSITIONING	NOTES
	COMMON NAME	SIENTIFIC NAME			
RIVER BED – wet zone	Palmiet	*Prionium serratum*	A&B	3 x Rows of 1 x1m spacing	Deep roots, ideal
	Papyrus / mat sedge	*Cyperus textilis*	A&B	Wet zone to top of bank	Tends to dominate
	Besembos	*Elegia capensis*	A&B	Wet zone to top of bank	Provided there is enough moisture to establish
	Cliffortia	*Cliffortia strobilifera*	A	Lies flat during flooding	Close to water to top of the bank
	Swamp grass	*Cladium mariscus*	A&B	Lower bank	Strong clumps
PRIMARY TERRACE	Vleibiesie	*Carpha glomertata*	B&C	Not erosion resisting	Close to water to top of the bank
	Wachendorfia	*Wachendorfia thyrsidiora*	A&B	Lies flat during flooding	Stops surface erosion
SECONDARY TERRACE	Bracken fern	*Pteridium aquilinum*	B&C	Drier parts of wetland	Stops surface erosion
	Watsonia	*Watsonia borbonica*	B&C	Drier parts of wetland	Stops surface erosion

200m River Frontage
Zone A: 800 palmiet plants & other wetland plants
Zone B: 1800 Elegia/Restio/Cliffortia type plants
Zone C: 1400 Watsonia/Wachendorfia type plants

- 4,000 plants/200m river frontage

This sketch (A) is to be read, together with the Scope of Works as a guideline for planting.



Sketch A: Planting guideline through three zones for river rehabilitation

For every 500m of the waterfrontage and 20m back from the waterfrontage will equal one (1) hectare.

This MUST be a combination of plants and seedlings. Planting MUST be at least 4 or more different species.

Plants

Harvesting of plants are to be done on site as far as possible, without damaging the local flora. Additional plants may be sourced from approved indigenous nurseries – requests to be in advance to give nurseries time to source plants. Palmiet will be the most important species planted.

The above-mentioned only serves as a guideline and prospective Tenderers shall acquaint themselves with the nature of the conditions on-site.

END OF WORK TO BE DONE

TIMELINE

ACTION	START DATE	END DATE	DURATION (WEEKS)
Administrative and tender preparation	*2026/04/16*	*2026/04/21*	*5*
Tender runtime/sourcing of quotes	*2026/04/24*	*2026/05/11*	*17*
Adjudication and award of bid	*2026/04/12*	*2026/04/15*	*3*
Time to activate delivery	*2026/04/18*	*2026/06/30*	*73*
Construction time/delivery completed			*0*
		Total duration	*98*

BID CONDITIONS

Measured

These documents are for a measured bid for all labour and material as set out in the Scope of Works. For the purposes of variation orders, the hourly or unit rates rate of the services should also be given if requested on the form **CBD 4.**

No unit rate price adjustment of whatever nature, except for decreases or increases in the Value-Added Tax (VAT) and / or Variation Orders, will be applicable in this contract. The bidder shall make provision in his bid price for possible fluctuations in costs.

Premises in Occupation

The premises for the works **will** be in occupation during the contract period. Approval to access the premises must be obtained from the land owner.

Fixed Price Bids

No contract price adjustment of whatever nature, except for decreases or increases in the Value-added Tax (VAT) and / or Variation Orders, shall be applicable in this contract. The Contractor will make provision in his bid for possible fluctuations in costs.

If the instruction / appointment for the construction of certain phases is done after the validity of the bid has expired, prices may, on request, be updated or re-negotiated within the reasonable norms of escalation.

Expenses in Preparation of Bid

The Client will not be responsible for, subject to the Preferential procurement regulations, nor pay any expenses for losses which the bidder may incur in preparation of this bid.

Inspection of Site

Bidders must familiarise themselves with the local conditions, the accessibility of the site, the full extent and nature of the work to be done and the conditions affecting the execution and pricing of the bid. Claims on the grounds of lack of knowledge in such respects or otherwise will not be entertained.

If a site meeting is held, notice of attendance must be forwarded to the contact person.

Only information given in writing to the Contractor by the Project Manager during the tender period will be regarded as binding on the Contract. Verbal information, given during the site inspection or at any other time prior to the award of the Contract, will not be regarded as binding on the Contract.

Site

The site to be occupied will be clearly pointed out to the Contractor at the site handover. The Contractor will not be allowed to extend his operations beyond the boundaries of the site.

Water for the Works

The Contractor may use if available. He will obtain permission from the Land Owner before any connection to or extension of the existing supply is made, which will be executed, removed and made good on completion of the works at the Contractor's own expense.

Accounts and Payments

Payment of accounts received by the Client in terms of the works completed, shall be affected within 30 days after receipt of a correctly completed and approved invoice for the work module. The Client does not accept responsibility for delays in payment due to faulty accounts or paperwork.

Payments will be done maximum on a fortnight basis and will only be made for work done/completed. Payment will be based upon a completed payment schedule which will be completed by bidder on award of tender. Payments will only be made upon physical inspection and sign off of completed work. Please allow timeous notice for inspections so that the necessary travel arrangements can be made.

Wage rates

Be responsible for all the sub-Contractors appointed by him to complete the works. A minimum **of 75%** of local labour must be incorporated in the project and all workers must be SA citizens.

The area for which local labour is to be sourced is in a 50km radius from site.

The following guidelines should be considered when setting rates of pay for workers:

- The rate set should take into account wages paid for comparable unskilled work in the local area per sector, if necessary.
- The rate should be an appropriate wage to offer an incentive for work, to reward effort provided and to ensure a reasonable quality of work.
- It should not be more than the average local rate to ensure people are not recruited away from other employment and jobs with longer-term prospects.
- Men, women, disabled persons and the aged must receive the same pay for work of equal value.
- Provision should be made in the tender for value for payment of UIF and COIDA statutory levies.

PRICING SCHEDULE **CBD 4**

Please read notes on next page.	
NAME OF BIDDDER	
BID NUMBER	

Are you registered in terms of sections 23(1) of 23(3) of the Value-Added Tax Act 1999 (Act no 89 of 1991)?[1]	**Yes** ☐	**No** ☐
If yes to above, provide your VAT number		
Bill of quantities (if yes, it will be attached separately)	**Yes** ☐	**No** ☒

Item no	Quantity	Description	Bid price (RSA currency) (see 3a)
		PLEASE COMPLETE ATTACHED BOQ	
		SUB TOTAL	
		VAT	
		GRAND TOTAL	

Signature of bidder	

[1] https://www.gov.za/sites/default/files/gcis_document/201505/act-89-1991s.pdf

Date	

NOTES (applicable where indicated)

A. PRICE (where applicable)

1. FIRM PRICES

a. Only firm prices will be accepted.
b. No non-firm prices will be considered.
c. All delivery cost must be included in the bid price for delivery at prescribed destination.
d. In cases where different delivery points influence the pricing, a separate pricing schedule must be submitted for each delivery point.

2. NON-FIRM PRICES

a. In cases of period contracts, non-firm prices will be adjusted (loaded) with the assessed contract price adjustments implicit in non-firm prices when calculated the comparative prices.
b. Price adjustments will be allowed at periods and times specified in the bidding documents.
c. In cases where different delivery points influence the pricing, a separate pricing schedule must be submitted for each delivery point.
d. The quantities are given as a guideline for a bid and for the purposes of unit rates and in no way be used as a measured bid.

3. PROFESIONAL SERVICES

a. All applicable taxes include value-added tax, pay as you earn, income tax, unemployment insurance contributions and skills development levies.

B. CONSTRUCTION (applicable to construction only)

1. The total price for the service must include all labour and material required for the proper execution of the work as described in the Scope of Works and as per Engineers drawings (where applicable).
2. The tender will be evaluated on the criteria for a market related price.
3. The contractor must attach a **detailed and comprehensive** proof of competency of a construction manager in terms of Construction Regulations 2014, Clause 8 including experience regarding construction health & safety regulations.
4. The contractor **must** attach the proof of CIBD grading as specified in the scope of works.
5. The contractor **must** be in possession of a valid COIDA letter of good standing and it must be attached.
6. Where applicable, the contractor **must** attach valid proof or registration with the Department of Labour for the installation of the main electrical supply.

C. OTHER NOTES (applicable to all bids)

1. The tender will be evaluated on the criteria for a market related price.
2. The full cost of the service and/or works must be indicated and may not be discounted or cross subsidised against another service, project, transaction or sale of goods. Such contributions against the total project cost must be specified, itemised, costed and clearly indicated in the bid.
3. The prices must be **VALID FOR A PERIOD OF 90 DAYS** from date of closure of the bid to allow for evaluation and appointment.
4. **Casidra** SOC Ltd retains the right to amend financial/accounting calculations and to accept the amended amount as the new bid amount.

D. COMPANY PROFILE (applicable when requested)

1. The contractor must attach a **detailed and comprehensive** company profile including **core competencies of personnel.** The company profile must summarize information about the organisation.
2. The company profile must include the following:
   a. Company core business activities (describe products and services and markets in which it operates).
   b. Company background (state number of years in business, location, history of company etc.)
   c. Company resources (number of employees, core competencies of personnel, structure of company)

E. WARRANTY (applicable when requested)

1. Where requested, the bidder must attach proof of warranty offered on the letterhead of the bidder.

F. BROCHURE (applicable when requested)

1. Bidder must provide detailed brochure and technical specifications of products where requested.
2. Bidder must be able to provide proof of service location within applicable radius as specified in CBD 3 (Scope of works).

G. AFTER SALES SERVICES AGREEMENT (applicable when requested)

1. Where applicable, the bidder must sign and submit the after sales agreement.
H. APPOINTMENT (applicable to construction and professional services)
1. The successful contractor will be given notification in writing by means of an appointment letter 2. The successful contract must sign the **CBD 8**, together with this document, which will form the contract.

PROJECT: GENADENDAL: BAVIAANS RIVER REHABILITATION PLANTING & STABILIZATION WORK

BILL OF QUANTITIES

Description	Quantity	Unit	R Value each	Total Value
PRELIMINARIES - FIXED				
Site establishment -Incl	1,00	each		
Establishment of Temporay Nursery	1,00	each		
Temporary water & electrical connections	1,00	each		
PRELIMINARIES - MONTHLY				
Contract administration - (Timesheets-progress reports-monthly meetings- office staff - H&S staff)	12,00	month		
Ablution facilities	12,00	month		
Running of Nursery - (Maintenance - Fertiliser - Potting plants - etc)	12,00	month		
Client Liason Officer	**12,00**	**month**	**R 3 500,00**	**R 42 000,00**
REHABILITATION WORK				
Harvesting of palmiet - cost per day - based on team of 10	20,00	days		
Initial alien clearing - Once off	7,40	ha		
Planting as per specification	14,50	ha		
MONTHLY SUPERVISION / MAINTENANCE				
Weekly maintenance (After planting) Based on ? Meters one day a week - 4 weks in month over 8 month period	32,00	day	R -	R -
Light infestation alien clearing	14,50	ha		
De-establishment of site	1,00	each		
SUB-TOTAL				
10% CONTINGENCY				
SUB-TOTAL				**R -**
VAT			**15%**	**R -**
GRAND TOTAL				**R -**

For office use only	Version no: 3	Date: November 2025
To be initialled by bidder		*Initial here*

CHANGES MADE BY BIDDER	
If the bidder wishes to make any changes to any of the bid conditions or specifications, or wishes to qualify this bid in any way, it must be clearly set out below. Any changes made and not listed, will disqualify a bid. **Any changes made by the bidder outside the scope of works, resulting in not meeting pre-qualifying conditions or compulsory subcontracting, may influence the functionality of the end product and may result in the bid being disqualified.**	
Item	**Suggested change**

PROOF OF RELEVANT EXPERIENCE AND REFERENCES
The following must be completed in detail by bidder. 1. Supply at least **THREE (3)** different references from **THREE (3)** different companies with contact numbers. **2. References to either complete the scoresheet which must be submitted with the bid document or provide the bidder with a reference of which a copy must be attached to the bid document.** 3. Description of work must be relevant to nature of this contract. **Do not list work if it does not fall within the scope of works.** 4. Elaborate on project under Description by being specific at to the works executed in the contract to support relevant experience.

REFERENCES PROVIDED BY TENDERER

BIDDER IS NOT TO SIGN THESE DOCUMENTS. THE REFERENCE FORM MUST BE SIGNED BY PERSON SUBMITTING THE REFERENCE

Reference company name					
Contact information					
Description of work					
Value of work					
Completed					
Performance of the contractor according below criteria:					
	Poor/bad	**Done**	**Average**	**Good quality**	**Excellent**
Quality of work					
Project time frame					
Completed within budget					
Overall management of works					
Signed by (Name)					
Signature of company reference					
Date					

REFERENCES PROVIDED BY TENDERER

BIDDER IS NOT TO SIGN THESE DOCUMENTS. THE REFERENCE FORM MUST BE SIGNED BY PERSON SUBMITTING THE REFERENCE

Reference company name					
Contact information					
Description of work					
Value of work					
Completed					
Performance of the contractor according below criteria:					
	Poor/bad	**Done**	**Average**	**Good quality**	**Excellent**
Quality of work					
Project time frame					
Completed within budget					
Overall management of works					
Signed by (Name)					
Signature of company reference					
Date					

REFERENCES PROVIDED BY TENDERER

BIDDER IS NOT TO SIGN THESE DOCUMENTS. THE REFERENCE FORM MUST BE SIGNED BY PERSON SUBMITTING THE REFERENCE

Reference company name					
Contact information					
Description of work					
Value of work					
Completed					
Performance of the contractor according below criteria:					
	Poor/bad	**Done**	**Average**	**Good quality**	**Excellent**
Quality of work					
Project time frame					
Completed within budget					
Overall management of works					
Signed by (Name)					
Signature of company reference					
Date					

COIDA LETTER OF GOOD STANDING

The contractor must attach to this page a copy of the current letter of good standing

SCHEDULE: DETAILED COMPANY PROFILE

The contractor must attach to this page a **DETAILED & COMPREHENSIVE** company profile including core competencies of personnel. The company profile must summarize information about your organisation.
In order for a company profile to be compliant for this bid, the following detail MUST be included in the company profile.

- Company core business activities – Describe your products and services and markets in which you operate

- Company background – State number of years in business, location, history of company, etc

- Company resources – Number of employees, core competencies of personnel, structure of company – organogram

ACCREDITED AND REGISTERED PEST CONTROL OPERATOR (PCO)

The contractor must attach to this page a copy of the current registered **PCO**

SUPPLY CHAIN MANAGEMENT

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022 AND CODES OF GOOD PRACTICE

Only for use of bids from R2 000 to maximum of R50 million

Casidra, as a Schedule 3D development and implementation agent for the Western Cape Provincial Government underwrites, and complies with the Provincial and National developmental initiatives and administers funds on behalf of donors. Within this context, and because of the specific requirements of the donors for the application of the funds, the awarding of bids is dependent on the special evaluation criteria as set out in the policies of **Casidra**. The evaluation criteria of this Preferential Procurement Policy are based on the "**Preferential Procurement Policy Framework (Act 5 of 2000)**" and related Regulations.

Awarding of the bid is dependent on preferential points system, and every presentation is measured against the specific evaluation criteria as shown. **The completion and signature of the document is thus a pre-requisite to qualify as a service provider.**

This preference form must form part of all bids invited. It contains general information and serves as aclaim form for preference points for Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution.

BEFORE COMPLETING THIS FORM, BIDDERS MUST MAKE SURE OF THE CONTENTS OF THE BROAD BASED BLACK ECONOMIC EMPOWERMENT ACT AND THE CODES OF GOOD PRACTICE WHICH CAN BE FOUND ON:

http://www.thedtic.gov.za/financial-and-non-financial-support/b-bbee/broad-based-black-economic-empowerment/

https://www.gov.za/documents/broad-based-black-economic-empowerment-act

https://www.bbbeecommission.co.za/

DEFINITIONS

1.1 **"affidavit"** is a type of verified statement or showing, or in other words, it contains a verification, meaning itis under oath or penalty of perjury, and this serves as evidence to its veracity and is required for court proceedings;

1.2 **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black

Economic Empowerment Act;

1.3 "**B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice of Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

1.4 **"EME"** is an Exempted Micro Enterprise with an annual total revenue of R10 million or less;

1.5 **"Large Enterprise"** is any enterprise with an annual total revenue above R50 million;

1.6 **QSE** is a Qualifying Small Enterprise with an annual total revenue between R10 million and R50 million;

1.7 **"the Act"** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000);

1.8 "**the Regulations**" means the Preferential Procurement Regulations, 2011 and 2022;

1.9 **"consortium or joint venture"** means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract;

1.10 **"person"** includes a juristic person;

1.11 **"sub-contract"** means the primary contractor's assigning, leasing, making out work to, or employing, another person to support such primary contractor in the execution of part of a project in terms of the contract;

1.12 **"trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and

1.13 **"trustee"** means any person, including the founder of a trust, to whom property is bequeathed inorder for such property to be administered for the benefit of another person;

1.14 **"original sworn affidavit"** means the initial document which was not photocopied or electronically reproduced;

1.15 **"original certified B-BBEE certificate"** means the certification of a copy of the B-BBEE certificate confirming the validity of the original document. The stamp of the notary must be **ORIGINAL**.

GENERAL CONDITIONS

1.1 The value of this bid is estimated to **not exceed R50 million** (all applicable taxes included) and therefore the 80/20 points system shall be applicable.

1.2 Preference points for this bid shall be awarded for:

(a) Price; and

(b) B-BBEE Status Level of Contribution.

1.3 The maximum points for this bid are allocated as follows:

	POINTS
PRICE	**80**
B-BBEE STATUS LEVEL OF CONTRIBUTION	**20**
Total points for Price and B-BBEE	**100**

1.4 Failure on the part of a bidder to fill in, sign this form and submit in the circumstances prescribed in the Codes of Good Practice either a B-BBEE Verification Certificate form issued by a Verification Agency accredited by the South African Accreditation System (SANAS) or by a Registered Auditor approved by theIndependent Regulatory Board of Auditors (IRBA) or an affidavit confirming annual total revenue and level of black ownership together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.5 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

1.6 The bidder is responsible to provide **Casidra** SOC Ltd with (refer to 2.2 under POINTS AWARDED FOR PRICE:

1.6.1. An **original sworn affidavit**

1.6.2. An **originally certified B-BBEE certificate.**

ADJUDICATION USING A POINT SYSTEM

1.1 Subject to Regulation 7 of the **Casidra** SOC Ltd Financial Regulations and PPR 2022, the bidder obtaining the highest number of total points will beawarded the contract.

1.2 Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts.

1.3 Points scored must be rounded off to the nearest 2 decimal places.

1.4 In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the

highest number of preference points for B-BBEE.

1.5 However, where functionality criterion forms part of the bid and is part of the evaluation process, and two or more bids have scored equal points including equal preference points for B-BBEE, the successful bid must be the one scoring the highest scorefor functionality.

POINTS AWARDED FOR PRICE

THE 80/20 PREFERENCE POINT SYSTEM

1. A maximum of 80 points is allocated for price on the following basis:

$$Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where
Ps = Points scored for price of tender under consideration

Pt = Rand value of offer tender consideration

Pmin = Rand value of lowest acceptable tender

2. A maximum of 20 points will be awarded for B-BBEE status level of contribution:

2.1. In terms of Regulations 5(2) of the Regulations preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level on Contributor	Number of points	Points awarded (for office use only)	BEE recognition level
1	20	EME & QSE 100% Black owned	135%
2	18	EME & QSE 51% + Black	125%
3	14		110%
4	12	EME 51% < Black owned	100%
5	8		80%
6	6		60%
7	4		50%
8	2		10%
Non-compliant contributor	0		0%

2.2. B-BBEE requirements:

An ***EME*** must submit a valid, fully completed, **original, certified, dated and signed sworn affidavit** (no photostat copies of certification allowed) confirming annual turnover and level of black ownership or an affidavit issued by Companies Intellectual Property Commission (accounting officer for a Closed Corporation).

If a **startup EME,** a **clear**, **originally certified copy**, of B-BBEE certificate issued by the CIPC for EME's only is accepted.

A ***QSE that is less than 51% (50% or less) black owned*** must be verified in terms of the QSE scorecard issued via Government Gazette and submit a **clear, valid, originally certified copy** of a B-BBEE Verification Certificate issued by SANAS.

A ***QSE that is at least 51% black owned (51% or higher)*** must submit an **original, certified, dated and signed sworn affidavit** confirming turnover and level of black ownership as well as declare its empowering status or an affidavit issued by Companies Intellectual Property Commission.

A ***large enterprise*** must submit a **clear, valid, originally certified copy** of a B-BBEE Verification Certificate issued by a verification agency accredited by SANAS.

A **trust, consortium or joint venture**, will qualify for points for their B-BBEE status level as a legal entity, provided that the entity submits their B-BBEE status level certificate.

A **trust, consortium or joint venture** (including unincorporated consortia and joint ventures) must submit a consolidated B-BBEE status level verification certificate for every separate tender.

Tertiary institutions and public entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.

3. Bids of non-compliant contributors (where no certificate was submitted) will be considered but no points will be awarded for B-BBEE status.

DECLARATION

Bidders who claim points in respect of B-BBEE status level of contribution **MUST** complete the following:

1. B-BBEE status level of contributor claimed in terms of paragraph 1 and 2 above:

B-BBEE status level of contributor:

2. SUB-CONTRACTING

2.1. Will any portion of the contract be sub-contracted: **(*Tick applicable box)***	Yes ☐	No ☐
2.2. If YES, INDICATE:		
a. What percentage of contract will be subcontracted?		
b. The name of the subcontractor		
c. B-BBEE status level of the sub-contractor		
d. Is sub-contractor EME or QSE	Yes ☐	No ☐
e. Attach the **originally certified** B-BBEE certificate/**original** sworn affidavit as proof.		

MARKET RELATED PRICING

If a bidder, whose tender is compliant and received the highest overall points, do not offer a market related price, the offer may be negotiated with that bidder to be market related.

Are you willing to negotiate your offer?	Yes ☐	No ☐

SUPPLY CHAIN PERFORMANCE MEASUREMENT

In order for **Casidra** to measure its supply chain efficiency and effectiveness, please assist us by answering the following questions:

- **What were the source that made you became aware of this bid being available.**

Personal Email invite to bid:	☐
Via a friend or business partner:	☐
National Government E-Tender website:	☐
Local Newspapers:	☐
Casidra own website:	☐
CIDB website	☐
Other (specify) ……	☐

- **Was the time allowed to date of closure sufficient for you to compile an offer?**

No – too short ☐	Yes – Sufficient ☐	No - Too long ☐

I, _____

as the authorised representative of the company / CC / business hereby declare that, to the best of my knowledge the abovementioned information is true and correct and that I am duly authorized as a signatory of this bid. On behalf of my business, I accept the terms and conditions as set out in this document. I will supply documentary proof of any information supplied herein on request and to the satisfaction of **Casidra**.

In terms of the POPI Act I further give consent that my contact and company details as will be captured on the **Casidra** database may be shared with the role players/funders involved in the project and be used by **Casidra** for the purpose of further procurement.

Signature	

Date	

DECLARATION OF INTERESTS, BIDDERS' PAST SCM PRACTICIES AND INDEPENDENT BID DETERMINATION

1. **To give effect to the requirements of the Western Cape Provincial Treasury Instructions, 2019: Supply Chain Management (Goods and Services), Practice Note 4 of 2006 Declaration of Bidders Past SCM Practices-(SDB8), Instruction note Enhancing Compliance Monitoring and Improving Transparency and Accountability in Supply Chain Management SBD 4 Declaration of Interest, Practice Note 2010 Prohibition of Restrictive practices SBD9, Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998 as amended together with its associated regulations, the Prevention and Combating of Corrupt Activities Act No 12 of 2004 and regulations pertaining to the tender defaulters register, Paragraph 16A9 of the National Treasury Regulations and/or any other applicable legislation.**

2. **All prospective bidders intending to do business with this institution must be registered on the central supplier database.**

3. **Definitions:**

   "Bid" includes a price quotation, advertised competitive bid, limited bid or proposal

   "Bid rigging (or collusive bidding)" occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors

   ''business interest'' means —
   (a) a right or entitlement to share in profits, revenue or assets of an entity;
   (b) a real or personal right in property;
   (c) a right to remuneration or any other private gain or benefit, and includes any interest contemplated in paragraphs (a), (b) or (c) acquired through an intermediary and any potential interest in terms of any of those paragraphs;

   "Consortium or Joint Venture" means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract;

   "employee" means a person employed by the Provincial Government, a provincial public entity or a business enterprise, whether permanently or temporarily, including –
   a) an employee as contemplated in section 8 of the Public Service Act, 1994 (Proclamation 103 of 1994);
   b) a person appointed in terms of section 12A of the Public Service Act;
   c) a person transferred or seconded to the Provincial Government or a provincial public entity in terms of section 15 of the Public Service Act; and
   d) an educator as defined in the Employment of Educators Act, 1998 (Act 76 of 1998), and includes a member of the board or other controlling body of a provincial public entity;

   ''entity'' means any —
   a) association of persons, whether or not incorporated or registered in terms of any law, including a company, corporation, trust, partnership, close corporation, joint venture or consortium; or
   b) sole proprietorship;

''entity conducting business with the Institution'' means an entity that contracts or applies or tenders for the sale, lease or supply of goods or services to the Province;

"Family member" means a person's —
- **a) spouse; or**
- **b) child, parent, brother or sister, whether such a relationship results from birth, marriage or adoption.**

''intermediary'' means a person through whom an interest is acquired, and includes—
- **a) a person to whom is granted or from whom is received a general power of attorney; and**
- **b) a representative or agent;**

"Institution" in this regard means — Casidra SOC Ltd

"Provincial Government Western Cape (PGWC)" means the Institution of the Western Cape, and a provincial public entity;

''spouse'' means a person's:
- **a) partner in marriage;**
- **b) partner in a customary union according to indigenous law; or**
- **c) partner in a relationship in which the parties live together in a manner resembling a marital partnership or customary union;**

4. **Regulation 13(c) of the Public Service, 2016, effective 1 February 2017, prohibits any employee from conducting business with an organ of state, or holding a directorship in a public or private company doing business with an organ of state unless the employee is a director (in an official capacity) of a company listed in schedules 2 and 3 of the Public Finance Management Act.**

5. **The bid of any bidder may be disregarded if that bidder or any of its directors have abused the institution's supply chain management system; committed fraud or any other improper conduct in relation to such system; or failed to perform on any previous contract.**

6. **Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging). Collusive bidding is a per se prohibition meaning that it cannot be justified under any grounds.**

7. **Communication between partners in a joint venture or consortium will not be construed as collusive bidding.**

8. **In addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.**

SECTION A: DETAILS OF THE ENTITY		
A1.	**Name of the Entity**	
A2.	**Entity registration Number (where applicable)**	

A3.	**Entity Type**	
A4.	**Tax Reference Number**	

A5. Full details of directors, shareholder, member, partner, trustee, sole proprietor or any persons with a right or entitlement to share in profits, revenue or assets of an entity, of the entity should be disclosed in the Table A below.

TABLE A

FULL NAME	DESIGNATION (Where a director is a shareholder, both should be confirmed.)	IDENTITY NUMBER	PERSONAL TAX REFERENCE NO.	PERCENTAGE INTEREST IN THE ENTITY

SECTION B: DECLARATION OF THE BIDDER'S INTEREST

The supply chain management system of an institution must, irrespective of the procurement process followed, prohibit any award to an employee of the state, who either individually or as a director of a public or private company or a member of a close corporation, seek to conduct business with the WCG, unless such employee is in an official capacity a director of a company listed in Schedule 2 or 3 of the PFMA as prescribed by the Public Service Regulation 13(c). Furthermore, an employee employed by an organ of state conducting remunerative work outside of the employee's employment should first obtain the necessary approval by the delegated authority (RWOEE), failure to submit proof of such authority, where applicable, may result in disciplinary action.

		YES	NO
B1.	Are any persons listed in Table A employees of the Institution? (If yes, complete Table B and attach "RWOP")	☐	☐
B2.	Are any employees of the entity also employees of the Institution? (If yes complete Table B and attach "RWOP")	☐	☐
B3.	Are any family members of the persons listed in Table A employees of the Institution? (If yes complete Table B)	☐	☐

TABLE B

Details of persons connected with the bidder who are employees of the Institution as defined should be disclosed in Table B below.

FULL NAME OF INSTITUTION EMPLOYEE	IDENTITY NUMBER	PROVINCIAL DEPARTMENT/ ENTITY OF EMPLOYMENT	DESIGNATION / RELATIONSHIP TO BIDDER**	INSTITUTION EMPLOYEE NO./PERSAL NO. (Indicate if not known)

SECTION C: PERFORMANCE MANAGEMENT AND BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES
To enable the prospective bidder to provide evidence of past and current performance with the Institution.

		YES	NO
C1.	Did the entity conduct business with the Institution in the last twelve months? (If yes complete Table C)	☐	☐

C2. Table C

Complete the below table to the maximum of the last 5 contracts.

NAME OF CONTRACTOR	PROVINCIAL DEPARTMENT OR PROVINCIAL ENTITY	TYPE OF SERVICES OR COMMODITY	CONTRACT / ORDER NUMBER	PERIOD OF CONTRACT	VALUE OF CONTRACT

C3.	Is the entity or its principals listed on the National Database as companies or persons prohibited from doing business with the public sector?	NO	YES
C4.	Is the entity or its principals listed on the National Treasury Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No. 12 of 2004)? (To access this Register, enter the National Treasury's website, www.treasury.gov.za, click on the icon "Register for Tender Defaulters" or submit your written request for a hard copy of the Register to facsimile number (012) 3265445.)	NO	YES

C5.	**If yes to C3 or C4, were you informed in writing about the listing on the database of restricted suppliers or Register for Tender Defaulters by National Treasury?**	**NO**	**YES**
C6.	**Was the entity or persons listed in Table A convicted for fraud or corruption during the past five years in a court of law (including a court outside the Republic of South Africa)?**	**NO**	**YES**

SECTION D: DULY AUTHORISED REPRESENTATIVE TO DEPOSE TO AFFIDAVIT
The form should be signed by a duly authorized representative of the entity before a commissioner of oaths.

I, ... hereby swear/affirm;

i. **that the information disclosed above is true and accurate;**
ii. **that I understand the content of the document;**
iii. **that I have arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor In addition, that there will be no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to the Institution.;**
iv. **that there have been no consultations, communications, agreements or arrangements made with any official of the procuring institution in relation to this procurement process prior to and during the bidding process except to provide clarification o the bid submitted where so required by the institution; and that my entity was not involved in the drafting of the specifications or terms of reference for this bid;**
v. **that I or the representative of the company are aware of and undertakes not to disclose the terms of any bid, formal or informal, directly or indirectly, to any competitor, prior to the awarding of the contract.**

_____

DULY AUTHORISED REPRESENTATIVE'S SIGNATURE

I certify that before administering the oath/affirmation I asked the deponent the following questions and wrote down his/her answers in his/her presence:

1.1. Do you know and understand the contents of the declaration?
ANSWER: .....

1.2. Do you have any objection to taking the prescribed oath?
ANSWER: .....

1.3. Do you consider the prescribed oath to be binding on your conscience?
ANSWER: .....

1.4. Do you want to make an affirmation?
ANSWER: .....

I certify that the deponent has acknowledged that he/she knows and understands the contents of this declaration, which was sworn to/affirmed before me and the deponent's signature/thumbprint/mark was place thereon in my presence.

.....
SIGNATURE and FULL NAMES

Commissioner of Oaths

Designation (rank) **ex officio: Republic of South Africa**

	Date: ……Place …… **Business Address: ……**

If you know of any corrupt, fraudulent or collusive actions in the Institution, please report it by *submitting the REPORT FRAUD on the* ***Casidra*** *SOC Ltd website https://casidra.co.za/report-fraud/.*

This registration form must be completed annually. Should the information herein declared change in the course of the year or before the next renewal or in relation to any bid, quotation or contract, it is the entity's responsibility to advise the Institution in writing of the change in such details.

GENADENDAL: BAVIAANS RIVER REHABILITATION PLANTING & STABILIZATION WORK

In terms of the Construction Regulations 2014 Regulation 5, a baseline risk assessment for the intended works is required to be done by the Client for each specific construction site.

This risk assessment will inform the site-specific Occupational Health and Safety specifications that must be supplied to the designer, who will supply any design specifications to be added and then supplied to the prospective Contractor (Bidder) as part of the tender documents. This specification must be translated into actions and preventative risk management measures by the Contractor that will form part the Occupational Health and Safety Plan of the Contractor.

This specification forms an integral part of the contract, and the Contractor is required to use it at pre-tender phase to make sufficient provision for related costs for risk management and after award of tender for the purpose of drawing up its project-specific construction phase health and safety plan.

It is the responsibility of the Contractor in the bidding process to:

- ensure that he include adequate provision for the cost for health and safety measures in his bid and
- Provide proof and include in his cost the necessary competencies and resources to perform the work safely.

The risks for the above project which have been identified, evaluated and resulted in the following specifications that are highlighted under the following categories:

This specification does not replace the requirement of the Contractor to comply with all relevant legislation and the regulations of the Occupational Health and Safety Act, but just highlight the specific identified and relevant risk factors that need special mention and attention by the Contractor in his bid.

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Signature for **Casidra**		Signature for Contractor	

1. General administrative requirements

DESIGNATION	NAME	CONTACT NO's	ADDRESS	RESPONSIBLE PERSON
Project Client				
Department of Labour				
Municipality				
Project Funder				

2. Scope of work (what is being built?)

The scope of works entails the river rehabilitation in the Baviaans River over an approximate distance of approximately **3km**.

This project consists of the following elements:

- Invasive plant eradication and re-establishment of indigenous plant species:
- Working in wet Area - river
- Working outdoors
- Working within a local community – with an appointed CLO

3. Location of site and elements specific to the location (municipal by-laws, weather factors, geographical factors)

What is the risk?	Heat and rain
Hazard Identification?	High temperatures together with high humidity.
Who will be injured & mechanism of injury?	All personnel working on site. Possible injury will vary from heat exhaustion and or broken ankles from muddy soil.

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
• Monitor weather for worsening soil conditions on daily basis. When conditions underfoot do not assist with mechanical and/or personnel, call site off until conditions improve	Risk reduction/ control

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• Ensure for shade and sufficient water onsite for high temperatures. • Ensure temperature is monitored and call site off with WGT of 40 and higher	

What is the risk?	Cold and rain
Hazard Identification?	Low temperatures together with high wind factor.
Who will be injured & mechanism of injury?	All personnel working on site. Possible injury will vary from pneumonia and or broken ankles from muddy soil.
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
• Monitor weather for worsening soil conditions on daily basis. When conditions underfoot do not assist with mechanical and/or personnel, call site off until conditions improve • Ensure for enclosures and shelters onsite for lower temperatures. • Ensure temperature is monitored and call site off with WGT of 40 and higher	Risk reduction/ control

4. Geo- technical risks (conditions of the soil, raise any concerns that may hinder the project progress)

What is the risk?	Soil conditions
Hazard Identification?	Difficult terrain
Who will be injured & mechanism of injury?	Infrastructure damage, damage to earthmoving equipment and personnel injury will vary from dislocation, broken bones to death
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
This is specialized work that requires competent human resources that are adequately skilled in working with heavy and dangerous machinery in aquatic and undulating conditions.	Risk control

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Guidelines and practical advice to all work operations to ensure effective and Proper management of high-risk areas must be in place. The contractor is hereby directed to the Casidra website to gain access to Working for Water Health & Safety Plan. This must be implemented as part of the contractors Health & Safety plan. The document name is: • WfW Health & Safety Doc on website www.casidra.co.za	

5. Environmental risks (This is the actual or potential threat of adverse effects on living organisms and environment by effluents, emissions, wastes, resource depletion, etc involved in the construction phase)

What is the risk?	Dust pollution
Hazard Identification?	Dust affects neighbour's crops
Who will be injured & mechanism of injury?	Farmers infrastructures resources and both farm workers and personnel working on farm and site
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
The Contractor is to take appropriate measures to minimise the generation of dust as a result of construction works, to the satisfaction of the Project Manager. A water truck must be on standby at all times to assist with this operation. Daily liaison must be done with the landowner to discuss vehicle movements in relation to dust pollution on crops.	Risk reduction

What is the risk?	Indigenous plants
Hazard Identification?	Risk of damage to environment
Who will be injured & mechanism of injury?	Plants trees, shrubs can be damaged and destroyed by mechanical equipment
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Due to the sensitive biodiversity within the riparian zone of the Berg River, the	Risk avoidance

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use of any equipment which has the potential to cause extensive damage to the river banks and indigenous flora may not be used. No firewood or plant material to be collected from natural veld.	

What is the risk?	Soil contamination
Hazard Identification?	Risk of pollution to ground and river by its contaminants
Who will be injured & mechanism of injury?	Environment and this invariably falls over to communities, which then in affect the members of the public
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Maintenance and service areas should be demarcated during site establishment and all maintenance and service activities contained so as to avoid any contamination of soil and / or water. All vehicles, equipment, fuel and petroleum services and tanks should be maintained in a good condition that prevents leakage and possible contamination of soil or water supplies. Refueling areas should be bunded and lined to prevent spilled fuels and oils from contaminating the ground or water. It is suggested that as a minimum, sandbags should be placed surrounding the bulk fuel supply tank. The floor of the area is to be lined with plastic and a layer of sand of approximately 50mm is placed on top of the plastic. Automatic shut-off nozzles are recommended on all dispensing units. The park and service area should be treated with a suitable hydrocarbon absorption or remediation product. Absorbent spill mop-up products should to be on hand. All servicing should be done with a drip tray present to prevent accidental spillage of oils and fuels. A suitable leak proof container for the storage of oiled equipment (filters, drip tray contents and oil changes, etc.) should be established. All spills to be immediately contained, reported to the Project Manager, and dealt with.	Risk control/ reduction

What is the risk?	Snakes
Hazard Identification?	Being bitten by snakes
Who will be injured & mechanism of injury?	Personnel working on site
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**

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As the work entails working in dense brush and biomass areas, the risk of disturbing a snake is very high. Make sure that all personnel are made aware of the increased risk of the presence of snakes. Wear proper protective clothing to protect against snake bites. An increased awareness and alertness is the best protection, the snake will not be looking for you, so watch for it. If a snake is seen or reported on site, note the area of the snake and work in this area stops until the hazard is removed. DO NOT approach, attack or otherwise provoke the snake as 95% of those bitten have done this. REMEMBER - IF PROVOKED IT WILL STRIKE. If bitten, the following procedures should apply: 1. Immediately apply a broad firm bandage around the limb and on the bitten area. It should be as tight as one would bind a sprained ankle. As much of the limb should be bandaged as possible. Bind from below upwards. Crepe bandages are ideal, but any flexible material can be used, e.g. tear up clothing or old towels into strips. Panty hose is satisfactory. 2. Keep the limb and the victim as still as possible. Splint the limb. 3. Bring transport to the victim if possible. 4. Leave the bandage and splint on until medical care is reached. Don't cut or excise the bitten area. Don't apply an arterial tourniquet. Don't wash the bitten area. The snake involved may be identified by the detection of venom on the skin.	Risk reduction/control/ avoidance

What is the risk?	Bees	
Hazard Identification?	Being stung by bees	
Who will be injured & mechanism of injury?	Personnel working on site	
Preventative action recommended		
Description		**Category: Reduction/transfer/ control/avoidance**
Upon finding a bee hive/nest, do not try to get rid of the nest or hive yourself. Each type of insect or situation will likely need different removal methods. It is		Risk avoidance/control/reduction/transfer

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best to call pest control professionals for this service.

Upon being stung, most people experience local effects like pain, swelling, itching, and redness around the sting site. In rare cases, a **severe allergic reaction** can occur. This situation is serious and can cause "**anaphylaxis**" or anaphylactic shock. Symptoms of anaphylaxis can appear immediately (within minutes) or up to 30 minutes later. Symptoms to watch for include:

- hives, itching and swelling in areas other than the sting site,
- swollen eyes and eyelids,
- wheezing,
- tightness in the chest and difficulty breathing,
- hoarse voice or swelling of the tongue,
- dizziness or sharp drop in blood pressure,
- shock,
- Unconsciousness or cardiac arrest.

Although most deaths result from severe allergic reactions, some are caused by direct toxicity of the insect venom. Of those who die from a severe allergic reaction to a sting, half die within 30 minutes, and three-quarters within 45 minutes. If you see any signs of reaction, or even if you are not sure, call or have a co-worker call the emergency medical services right away. Also, get medical help if the sting is near the eyes, nose or throat. People who have been stung multiple times (such as when fleeing from a swarm or nest) can sometimes suffer serious health effects. While rare, death may occur.

Employers should be notified if a worker, especially one who works outdoors, has allergies to insect stings. Co-workers should be trained in emergency first aid, be aware of the signs of a severe reaction, and know how to use the bee sting kit (self-injectable epinephrine). Always carry a cellular phone in case you need emergency medical help.

The best way to prevent stings is to avoid the insects. Leave the area, if possible. If there is a travelling swarm, they will likely leave within a few days.

Note that insect repellent ("bug spray") does not affect these stinging insects. Avoidance and awareness are the keys to not being stung.

Before working at a site:

- Take a look around. Check to see if there are any visible signs of activity or a hive or nest. If you see a number of insects flying around, check to see if they

are entering and exiting from the same hole or place. If so, it is likely a nest or a source of food. • Wear long sleeve shirts, and long pants. If you cannot avoid working near bees or wasps, wear a bee-keepers style hat with netting to cover your head, neck and shoulders. Tape your pant legs to your boots/socks, and your sleeves to your gloves. You may also wish to wear an extra layer of clothing since wasp stings are long enough to reach through one layer of clothing. • Power tools such as lawnmowers, weed eaters and chainsaws will aggravate the insects. When using these tools, be aware that the tools may provoke the insects or in some cases, cause the insects to swarm. If you find you are working near stinging insects, here are some tips. • Most bees and wasps will not sting unless they are startled or attacked. Do not swat at them or make fast movements. The best option is to let the insects fly away on their own. If you must, walk away slowly, or gently "blow" them away. The only exception is if you have disturbed a nest and hear "wild" buzzing. Protect your face with your hands and run from the area immediately. • Wear light coloured clothes such as khakis, beige, or blue. Avoid brightly coloured, patterned, or black clothing. • Tie back long hair to avoid bees or wasps from getting entangled in your hair. • Be careful when shaking out clothing or towels as the insects could be inside the folds. • If you find a bee or wasp in your car, take a thick cloth and cover the insect before it gets frightened. Carefully, let the insect back outside through an open window. DO NOT • Do not wear perfumes, colognes, scented soaps, or powders as they contain fragrances that are attractive. • Do not go barefoot or wear sandals, especially in	

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areas where there is clover or other flowering plants that attract bees.	

6. Risk assessments based on scope of work (Is this a high rise building in a built up area? Is it working in a flood plain and/or river with eroded soil conditions?)

What is the risk?	Water
Hazard Identification?	Dangerous medium to work both in/on with mechanized equipment & personnel
Who will be injured & mechanism of injury?	Damage to equipment and personnel injury will vary from dislocation, drowning, broken bones to death

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
As with all work activities, working over, on, or near water needs to be carried out in a safe and healthy manner adopting appropriate control measures to minimize risks and mitigate the effects of any incident. General controls that may need to be adopted when work is carried out over, on, or near water include provision of appropriate platforms and gangways; safety nets and safety harnesses; illumination; first aid equipment; personal protective equipment and clothing, including personal buoyancy equipment; suitable means of access to and egress from the location; and suitable rescue equipment and procedures. No river work should be carried out by someone working alone. Inspections from the bank may be permitted, but lone working procedures should apply with a short call-in period to the monitoring base. A frequent check that a good telephone signal is available should be made, and the monitoring base should be informed of the location (including which bank) and the direction of travel of any lone worker. A buoyancy aid should be worn. In determining the risk at each site, it is important to: • Assess how quickly water levels can rise; • Prepare an evacuation procedure that will ensure that all personnel – if	Risk reduction/control

not equipment – are out of the river before conditions become hazardous.	

What is the risk?	Access to Biomass
Hazard Identification?	Environmental impacts
Who will be injured & mechanism of injury?	Infrastructure

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Site access should be monitored and controlled and all access routes should be clearly demarcated in order to minimise environmental impacts. A constant regard must be taken to safety and dangerous areas and should be adequately cordoned off to prevent accidental injury	Risk avoidance

What is the risk?	Access to site / movement
Hazard Identification?	A construction is a dangerous environment regarding vehicles, materials and constant flow of traffic/material and personnel
Who will be injured & mechanism of injury?	Public will be injured and/or killed

Preventative action recommended	
Description	**Category: Reduction/transfer/control/avoidance**
Construction work should be fenced off and suitably signed. This will protect people from site dangers and the site from vandalism and theft. Site access should be monitored and controlled and all access routes should be clearly demarcated. A constant regard must be taken to safety and dangerous areas and should be adequately cordoned off to prevent accidental injury. Temporary fencing/hoarding with appropriate warning signs must be in place. Make sure there is a system to ensure necessary precautions are kept	Risk control

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in place during working hours and that night-time and weekend protection is put in place as required before the site closes	

7. Material Risks

What is the risk?	Herbicide material
Hazard Identification?	Working with toxic/hazardous material
Who will be injured & mechanism of injury?	Personnel working with herbicide and surrounding eco environment

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Personal injury, spillage, wastage and defective equipment can cause serious damage if not managed properly. Guidelines and practical advice to work operations to ensure effective and proper management of herbicide must be in place. The contractor is hereby directed to the Casidra website to gain access to Working for Water Health & Safety Plan. This must be implemented as part of the contractors Health & Safety plan. The document name is:- • WfW Health & Safety Doc on website www.casidra.co.za	Risk control

What is the risk?	Flammable material
Hazard Identification?	Dangerous to work with and store for prevention of fires
Who will be injured & mechanism of injury?	Infrastructure damage and injury or death to all persons

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Fuels and flammable materials should be stored in suitably equipped storage areas demarcated within the Contractor's camp. These areas must comply with general fire safety requirements. No fuel may be stored within drainage lines or areas. Impervious lining materials should be	Risk control

used in these storage areas to prevent contamination of the ground in the event of spillages or leaks, and automatic shut-off nozzles should be used on all dispensing units. Quantities of fuels and flammable/hazardous materials stored on site should be appropriate to the requirement for these substances on site. Fuels and oils should be safely located out of harm's way from the elements. No fuel / oil containers may be left unattended within drainage areas. All open containers containing used oil, etc., should be kept under roof or have adequate water tight lids. All spills to be immediately contained, reported to the Project Manager and dealt with. Adequate fire fighting equipment should be available on site, in good working order, and according to the fire hazard present during construction activities of at least one type ABC all-purpose 12.5kg extinguisher and a water cart with a minimum capacity of 1000 litres for the duration of the contract. Any welding, gas cutting or cutting of metal should only be permitted inside the demarcated working areas for this purpose and these areas should be approved by the Project Manager.	

8. Ergonomic Risks (Ergonomic hazards refer to workplace conditions that pose the risk of injury to the musculoskeletal system of the worker).

What is the risk?	Drowning, Asphyxiation & felling
Hazard Identification?	On-site injuries due to physical alien biomass clearing taking place
Who will be injured & mechanism of injury?	Personnel injury will vary from dislocation, broken bones to death

Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Guidelines and practical advice to all work operations to ensure effective and proper management of high risk areas must be in place. The contractor is hereby directed to the Casidra website to gain access to Working for Water Health & Safety Plan. This must be implemented as part of the contractors Health & Safety plan. The document name is:- • WfW Health & Safety Doc on website www.casidra.co.zsa	Risk reduction/transfer/ control/avoidance

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9. Controls specific to client requirements (two day induction, pink overalls, entrance to existing premises, etc.)

What is the risk?	Data Collection
Hazard Identification?	Inaccurate or incomplete data
Who will be injured & mechanism of injury?	Project will suffer as information is needed for budgeting for future projects and reporting against job creation
Preventative action recommended	
Description	**Category: Reduction/transfer/ control/avoidance**
Ensure that all data records are kept on site in a file, and that information is distributed on a weekly basis so as to ensure that the capturing is done and that on-site activities are measured.	Risk control

10. Personal Protective Equipment (PPE) and Clothing

The principal contractor and other contractors shall ensure that all workers are issued with protective clothing free of charge and make use of the equipment and protection provided such as to wear hard hats, protective footwear, overalls, etc. The Principal Contractor and all Contractors shall make provision and keep adequate quantities of SABS approved PPE on site at all times. The Principal Contractor shall clearly outline procedures to follow when PPE or Clothing is:

- Lost or stolen;
- Worn out or damaged

The above procedure applies to Contractors and their Sub-contractors, as they are all employers in their own right, as per section 37 (2) of the Act.

(The general PPE requirements are attached under Annexure A to this document as well as an additional list of PPE for biomass removal is also attached as Addendum B to this specification).

11. Occupational Health and Safety signage

The Contractor shall provide and maintain adequate on-site OHS signage. Including but not limited to: 'no unauthorised entry', 'report to site office', 'beware of overhead work', 'hard hats, overalls, safety boots, respirators, etc.'. Signage shall be posted up at all entrances to site as well as on site in strategic locations e.g. access routes, stairways, entrances to structures and buildings, scaffolding, and other potential risk areas/operations

12. Fences and access

Construction sites in built-up areas or adjacent to public roads must be suitable and sufficiently fenced off and provided with controlled access points to prevent the entry of unauthorised persons.

13. Admittance to site

A notice must be posted up at every entrance to a building site prohibiting the entry of unauthorised persons to such workplace and no person shall enter such a site without the permission of the employer or user as the case may be. In no circumstances may the wording "Enter at Own Risk" be used

14. Speed Restrictions, construction vehicles and Protection

The Principal Contractor shall ensure that all persons in its employment, all Contractors, and all those that are visiting the site are aware and comply with the site speed restriction(s) and route identification for construction vehicles only. Separate vehicle and pedestrian access routes shall be provided, maintained, controlled, and enforced.

15. Hazardous Chemical Substances (HCS)

The Principal Contractor and other relevant Contractors shall provide the necessary training and information regarding the use, transport, and storage of HCS. The Principal Contractor shall ensure that the use, transport, and storage of HCS is carried out as prescribed by the HCS Regulations. The Contractor shall ensure that all hazardous chemicals on site have a Material Safety Data Sheet (MSDS) on site and the users are made aware of the hazards and precautions that need to be taken when using the chemicals. The First Aiders must be made aware of the MSDS and how to treat HCS incidents appropriately.

The below acts are relevant regarding the transporting, storage and application of these agricultural chemicals:

- Fertilizers, farm feeds, agricultural remedies and stock remedies act, 1947 (Act no. 36 of 1947)
- Hazardous Substances Amendment Act, No. 53 of 1992
- The South African National Pesticide registration authority registrar: Act no. 36 of 1947

16. Public and Site Visitor Health and Safety

The Principal Contractor shall ensure that every person working on or visiting the site, as well as the public in general, shall be made aware of the dangers likely to arise from site activities, including the precautions to be taken to avoid or minimise those dangers. Appropriate health and safety notices and signs shall be posted up, but shall not be the only measure taken.

The Principal Contractor has a duty in terms of the OHS Act 85/1993 to do all that is reasonably practicable to prevent members of the public and site visitors from being affected by the construction activities.

Site visitors must be briefed on the hazards and risks they may be exposed to and what measures are in place or should be taken to control these hazards and risks. A record of these 'inductions' must be kept on site in accordance with the Construction Regulations.

17. Occupational Hygiene

Exposure of workers to occupational health hazards and risks is very common in any work environment, especially in construction. Occupational exposure is a major problem and all contractors must ensure that proper health and hygiene measures are put in place to prevent exposure to these hazards. Prevent inhalation, ingestion, absorption, and noise induction.

Contractor must identify site-specific health risks for construction. e.g., cement dust, wet cement, wood-dust, noise, etc.

18. Welfare Facilities

The Principal Contractor must supply the following clean, hygienic and maintained facilities:

- Shower facilities, after consultation with employees or employee representative (1 shower for every 15 persons).
- Sufficient toilets (1 toilet per 30 workers) and hand washing facilities. Separate toilets needed for both males and females. Toilet paper must be provided.
- Changing facilities for each sex
- Sheltered eating areas
- Waste bins must be strategically placed and emptied regularly.

Workers who are far removed from their homes, reasonable and suitable living accommodation for the workers must be provided and adequate transportation between sites and homes where suitable living accommodation is not available.

19. Alcohol and other Drugs

No alcohol and other drugs will be allowed on site. No person may be under the influence of alcohol or any other drugs while on the construction site. Any person on prescription drugs must inform his/her superior, who shall in turn report this to the Principal Contractor forthwith.
Any person suffering from any illness/condition that may have a negative effect on his/her safety performance must report this to his/her superior, who shall in turn report this to the Principal Contractor forthwith. Any person suspected of being under the influence of alcohol
or other drugs must be sent home immediately, to report back the next day for a preliminary inquiry. A full disciplinary procedure must be followed by the Contractor concerned and a copy of the disciplinary action must be forwarded to the Principal Contractor for his records.

20. Other compliance requirements

Notwithstanding the Occupational Health & Safety Act, the contractor must also confirm to the following acts:

- Basic conditions of employment act 75 of 1997
- National Road Traffic Act 93 of 1996
- National Environmental Management: Biodiversity Act, no 10 of 2004
- National Veld and Forest Fire Act, no 101 of 1998.
- Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Amendment act

21. Management control measures and review

Risk assessment of the site must be reviewed at least every 30 days. Based on the effectiveness of the existing measures, the safety plan must be adjusted to meet the new or existing identified deficiencies.

22. Electrical Safety

All persons who carry out or arrange for work of any description for **Casidra** in connection with electrical apparatus shall make themselves acquainted with the Occupational Health and Safety Act

(Act 85 1993) with particular reference to the Electrical Machinery Regulations, Regulations 1 to 23 inclusive.

The works performed under this contract shall comply in every respect with the latest relevant rules and regulations including following:

- Occupational Safety and Health Act (OSH Act)
- The South African Bureau of Standards Code of Practice SANS 10142
- Normal requirements laid down by Eskom.
- The latest requirements of the IEC and the British Standard Institute, where no SANS codes of practice exist.
- All rules and regulations issued by local and other authorities having jurisdiction over the contract.

NOTE:
The Electrical Installation Regulations clause 6 (2) require electrical contractors to register annually.

"(2) Any person who does electrical installation work as an electrical contractor shall register annually in the form of Annexure 3 with the chief inspector or a person appointed by the chief inspector "

In terms of the OHS Act Electrical Installation Regulations, a Certificate of Compliance (CoC) must be issued by a registered person, defined as "a person registered as an electrical tester for single phase, an installation electrician, or a master installation electrician". Registered persons may be the owners or employees of electrical contractors. They must be currently registered with the Department of Labour (DoL), and registrations must be renewed annually, bi-annually or every three years depending on the application. No company may do electrical contracting work unless they have a permanently employed registered person as part of the company.

Department of Labour stating the certification as either 'single phase tester", "installation electrician" or "master installation electrician" with a unique licence number

Safety equipment
The following equipment required for working on electrical installations and distribution systems, must be maintained in good order and repair and must be made available:

Safety belt, overalls, hard hat, safety shoes or boots, rubber gloves, "Men Working" notice boards, locks for locking off switches, buss bar shutters in truck-type switchgear, isolators or earthing links, rubber sheet and length of rope with short circuiting earthing-chains, earthing sticks and testing/phasing sticks rated for the voltage of the equipment to be tested.

Under no circumstances shall work be carried out on electrical apparatus unless the proper safety equipment is used

With regard to overhead linesmen, no work shall be carried out unless use is made of a non-metallic ladder and the appropriate safety belt, rubber gloves, overalls, hardhat and safety shoes or boots are worn. The buddy system must also be implemented.

Earthing
Always safety test before applying earths

Risk assessment of the site must be reviewed at least every 30 days. Based on the effectiveness of the existing measures, the safety plan must be adjusted to meet the new or existing.

At completion of the electrical installation work in the tender, a test as required must be performed to ensure safe operation of the equipment and a signed original CoC be supplied to the client.

23. Asbestos

Under no circumstances shall any work of any nature whatsoever on any **ASBESTOS** material be undertaken unless the work is entrusted and mandated to a "**REGISTERED ASBESTOS CONTRACTOR**" in terms of the Asbestos Regulations

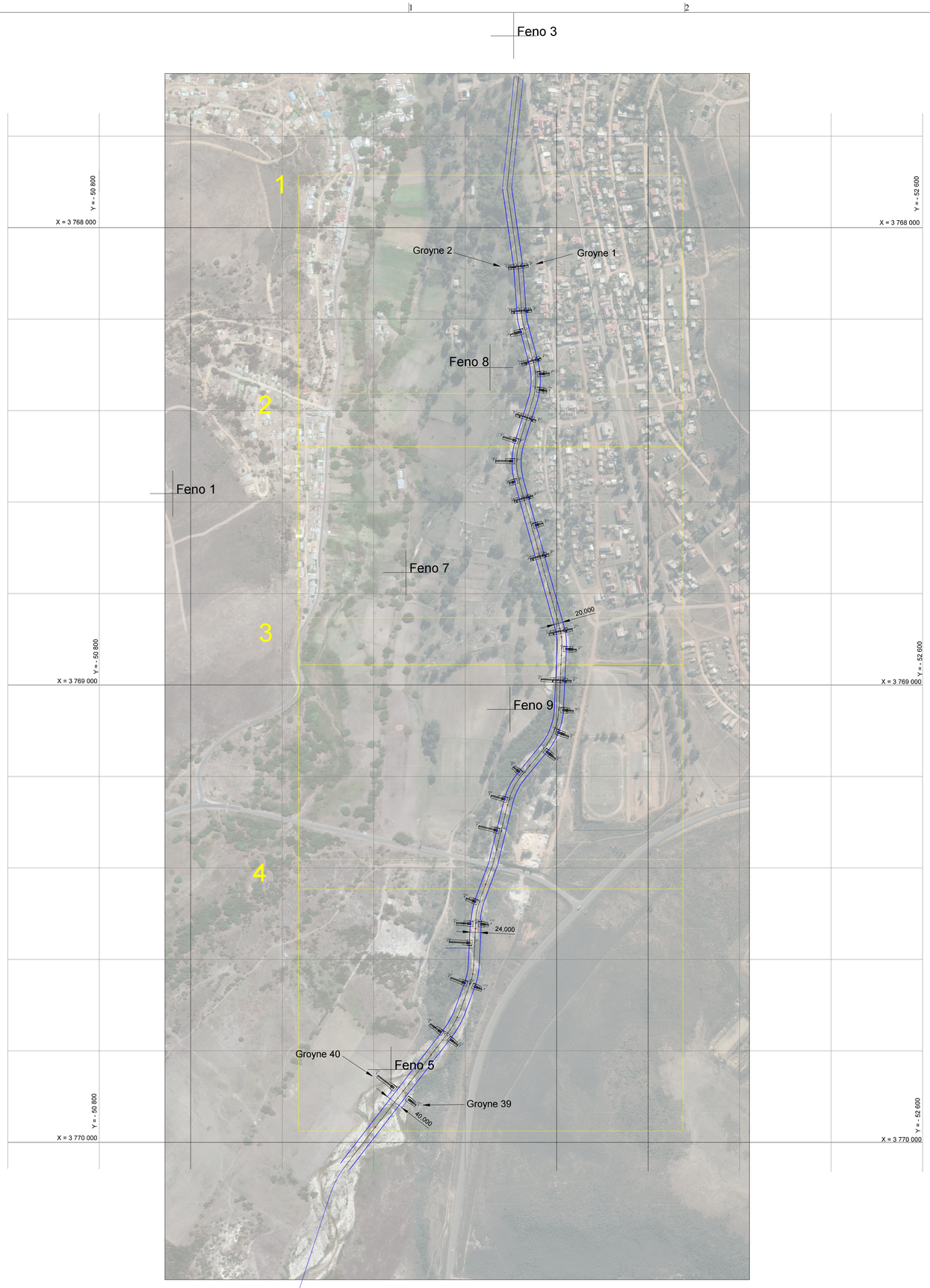
ADDENDUM A – GENERAL MINIMUM PPE REQUIREMENTS

Subject	Requirement
*PPE needs analysis	Need for PPE identified and prescribed in writing. PPE remain property of Employer, not to be removed from premises GSR 2(4)
*Head Protection	All persons on site wearing Safety Helmets including Sub-contractors and Visitors (where prescribed)
*Foot Protection	All employees on site wearing Safety Footwear including Gumboots for concrete / wet work and non-slip shoes for roof work. Visitors to wear same upon request or where prescribed
*Eye and Face Protection	Eye and Face (also Hand and Body) Protection (Goggles, Face Shields, Welding Helmets etc.) used when operating the following: * Jack/ Kango Hammers * Angle / Bench Grinders * Electric Drills (Overhead work into concrete / cement / bricks * Explosive Powered tools * Concrete Vibrators / Pokers * Hammers & Chisels * Cutting / Welding Torches * Cutting Tools and Equipment * Guillotines and Benders * Shears * Sanders and Sanding Machines * CO2 and Arc Welding Equipment * Skill / Bench Saws * Spray Painting Equipment etc.
*Hearing Protection	Hearing Protectors (Muffs, plugs etc.) used when operating the following: * Jack / Kango Hammers * Explosive Powered Tools * Wood/Aluminium Working Machines e.g., saws, planers, routers
*Hand Protection	Protective Gloves worn by employees handling / using: * Cement / Bricks / Steel / Chemicals * Welding Equipment * Hammers & Chisels * Jack / Kango Hammers etc.
*Respiratory Protection	Suitable/efficient prescribed Respirators worn correctly by employees handling / using: * Dry cement * Dusty areas * Hazardous chemicals

	* Angle Grinders * Spray Painting etc.
*Fall Prevention Equipment	Suitable Safety Belts / Fall Arrest Equipment correctly used by persons working on / in unguarded, elevated positions e.g.: * Scaffolding * Riggers * Lift shafts * Edge work * Ring beam edges etc. Other methods of fall prevention applied e.g., catch nets
*Protective Clothing	All jobs requiring protective clothing (Overalls, Rain Wear, Welding Aprons etc.) Identified and clothing worn.
*PPE Issue & Control	Identified Equipment issued free of charge. All PPE maintained in good condition. (Regular checks). Workers instructed in the proper use & maintenance of PPE. Commitment obtained from wearer accepting conditions and to wear the PPE. Record of PPE issued kept on H&S File. PPE remain property of Employer, not to be removed from premises GSR 2(4)

ADDENDUM B – WORKING FOR WATER ADDITIONAL PPE REQUIREMENTS

Job Description	Recommended PPE Equipment
DRIVER - LABOUR CARRIER (LDV or MDV with or without a trailer)	Approved hard hat when required, overall / two-piece, raincoat and safety boots / shoes with steel toecap
CHAINSAW OPERATOR	Hard hat with visor and certified earmuffs (SABS or EU), high visibility top, operator gloves, raincoat, FESA approved chainsaw pants (eleven layers) with broad belt or braces, safety boots with steel toecap and bomb bandage.
BRUSH-CUTTER OPERATOR	Hard hat with hearing protectors and visor, thorn proof trousers, high visibility top, overalls, leather gloves, rainwear, leg protectors and safety boots with steel toecap.
HERBICIDE APPLICATOR	**Handling and Mixing of Concentrate** Hard hat, eye protection, elbow length PVC gloves, high visibility clothing, rain suit as per label, waterproof safety boots with steel toecap, respirator / face mask, PVC apron as per label, soap and water. **Application of Diluted Herbicide** Hard hat, eye protection, wrist length PVC gloves, high visibility clothing, rain suit as per label, waterproof safety boots with steel toecap, respirator / face mask as per label and PVC apron as per label. **Hack and Squirt or Inject** Hard hat, eye protection, wrist length PVC gloves, high visibility clothing, rain suit as per label, safety boots with steel toecap, respirator / face mask as per label and leg protection.
FIELD WORKER	**Hand pulling, hoeing** - Hard hat, gloves, high visibility overalls / vest, safety boots with steel toecap. **Cutting, coppice brashing, frilling and ring-barking** – Hardhat, eye protection, high visibility overalls / vest, gloves, safety boots with steel toecap, shin guards, foot guards.
FIRE PROTECTION	Labourers – Approved head protection, eye protection, high visibility overall, gloves, safety boots with steel toecap.
FIRST AID	Latex gloves, eye protection, CPR mouth piece, mask, overalls, high visibility clothing and safety boots with steel toecap (where applicable).



Control pegs (Lo 19 WGS 84)

Name	X	Y	Z	
GENAD_FENO_1	3768581.615	-50960.833	319.604	(at cellphone tower)
GENAD_FENO 2	3766978.657	-51342.493	263.101	(at DWAS weir upstream of town)
GENAD_FENO 3	3767580.672	-51705.858	252.559	(on east bank upstream of bridge)
GENAD_FENO 4	3768739.543	-51501.115	235.167	(probably lost)
GENAD_FENO 5	3769840.735	-51437.781	219.255	
FENO 7	3768754.005	-51470.533	233.51	
FENO 8	3768306.103	-51654.349	240.38	
FENO 9	3769053.541	-5q97.836	230.779	(on east side of track against fence)

Groyne pegs (refer to individual groyne plans)

G1_1	-51710.904	3768085.340
G1_2	-51742.710	3768081.787
G2_1	-51720.843	3768084.230
G2_2	-51689.044	3768087.782
G3_1	-51718.031	3768182.102
G3_2	-51750.002	3768179.757
G4_1	-51727.976	3768181.478
G4_2	-51696.160	3768183.707
G5_1	-51732.024	3768224.981
G5_2	-51693.385	3768235.325
G6_1	-51743.447	3768291.995
G6_2	-51770.101	3768283.954
G7_1	-51753.021	3768289.107
G7_2	-51718.555	3768299.505
G8_1	-51752.761	3768320.768
G8_2	-51788.663	3768318.110
G9_1	-51751.876	3768353.198
G9_2	-51783.551	3768357.750
G10_1	-51730.989	3768413.973
G10_2	-51759.652	3768422.828
G11_1	-51740.543	3768416.925
G11_2	-51706.147	3768406.299
G12_1	-51720.302	3768468.903
G12_2	-51678.262	3768455.918
G13_1	-51713.402	3768510.616
G13_2	-51661.408	3768509.843
G14_1	-51718.497	3768552.588
G14_2	-51691.510	3768560.052
G15_1	-51723.434	3768592.958
G15_2	-51752.352	3768584.959
G16_1	-51733.072	3768590.292
G16_2	-51702.230	3768598.823
G17_1	-51744.317	3768653.449
G17_2	-51775.141	3768644.854
G18_1	-51758.545	3768719.884
G18_2	-51787.459	3768711.886
G19_1	-51768.183	3768717.218
G19_2	-51737.341	3768725.749
G20_1	-51803.699	3768883.358
G20_2	-51838.974	3768876.153
G21_1	-51813.497	3768881.357
G21_2	-51778.228	3768888.561
G22_1	-51810.142	3768920.750
G22_2	-51848.065	3768923.165
G23_1	-51802.870	3768989.454
G23_2	-51836.807	3768991.391
G24_1	-51812.853	3768990.024
G24_2	-51760.928	3768987.061
G25_1	-51803.823	3769054.361
G25_2	-51841.731	3769056.991
G26_1	-51793.760	3769099.638
G26_2	-51830.878	3769114.544
G27_1	-51770.552	3769139.261
G27_2	-51801.370	3769164.762
G28_1	-51725.820	3769196.457
G28_2	-51701.166	3769176.057
G29_1	-51696.791	3769252.888
G29_2	-51652.249	3769240.717
G30_1	-51679.511	3769320.510
G30_2	-51625.093	3769307.291
G31_1	-51631.683	3769477.209
G31_2	-51597.893	3769464.791
G32_1	-51624.217	3769522.351
G32_2	-51655.960	3769524.011
G33_1	-51621.998	3769522.402
G33_2	-51576.050	3769520.226
G34_1	-51620.008	3769564.419
G34_2	-51560.075	3769561.580
G35_1	-51611.022	3769655.917
G35_2	-51641.037	3769667.022
G36_1	-51609.006	3769654.845
G36_2	-51564.017	3769638.525
G37_1	-51560.243	3769769.222
G37_2	-51587.959	3769790.596
G38_1	-51554.700	3769764.948
G38_2	-51519.856	3769738.079
G39_1	-51468.780	3769900.111
G39_2	-51496.496	3769921.484
G40_1	-51451.358	3769886.676
G40_2	-51405.429	3769851.258

LIST OF DRAWINGS IN THIS PROJECT:

Number Nommer	Date Datum	Description Beskrywing

PROVINCIAL ADMINISTRATION : WESTERN CAPE
Department of Agriculture

PROVINSIALE ADMINISTRASIE: WES-KAAP
Departement van Landbou

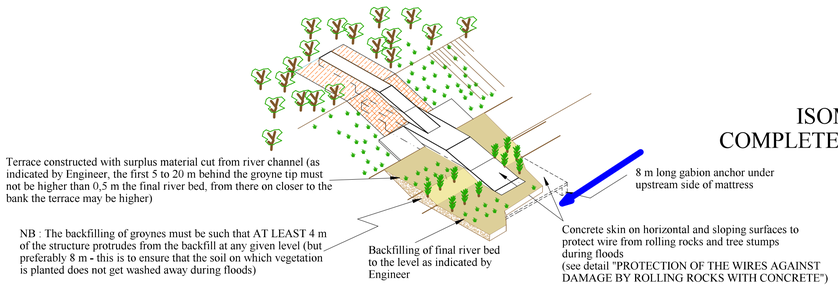
ULAWULO LWEPHONDO: INTSHONA KOLONI
ISebe LwezoLimo

Baviaans River
Genadendal
Riverbank erosion protection structures

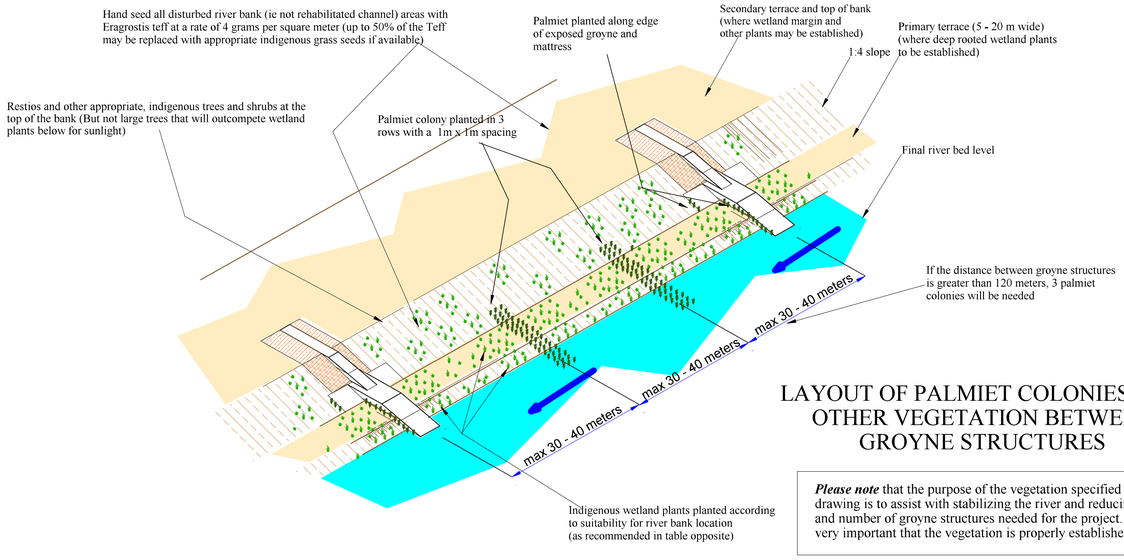
Project layout and setting out details

Contact numbers / Kontak nommers:
Hans King : 082 907 2807

Farm unit / Plaaseenheid	Office / Kantoor: Elsenburg
Magisterial district / Landdrosdistrik: Caledon	Surveyed / Opgemeet: LandCare
Owner / Eienaar: -	Designed / Ontwerp: H E King (Pr Eng)
Work number / Werk nommer: -	Checked / Nagesien: ----
Scale / Skaal: 1:5000	Date / Datum: 2019/02/23
Farm number / Plaasnommer: --- / ---- / ---	Drawing number / Tekeningnommer: GB-Ing 2019-002/ 0

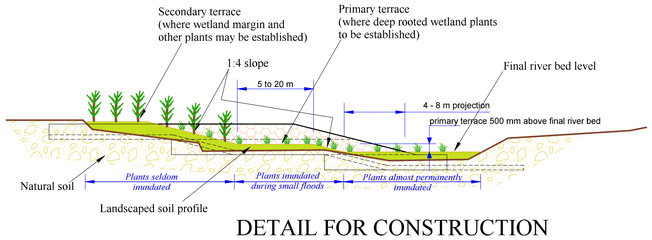


ISOMETRIC VIEW OF COMPLETED GROYNE STRUCTURE



LAYOUT OF PALMIET COLONIES AND OTHER VEGETATION BETWEEN GROYNE STRUCTURES

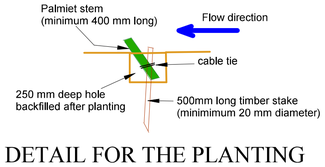
Please note that the purpose of the vegetation specified on this drawing is to assist with stabilizing the river and reducing the size and number of groyne structures needed for the project. It is thus very important that the vegetation is properly established.



DETAIL FOR CONSTRUCTION OF THE PLANTING TERRACES

See also drawing GB-ING 2018-092/0 for details specific to the Meul River project

NOTE
Palmiet is to be planted in "colonies" of 3 rows of plants 1m apart in the row - the rows must start in line with the tips of the groynes and extend 2-4 meters beyond the primary terrace



DETAIL FOR THE PLANTING OF PRIONIUM SERRATUM (Palmiet)

GENERAL NOTES :

1) Alien vegetation such as Spanish Reed, Black Wattle, Beefwood and gum trees must be removed from rivers because they promote conditions that lead to erosion and river instability.

2) There are many plants that are potentially suitable for stabilizingrivers - those which have been commonly used in the Western Cape are shown on this drawing. Many plants are area-specific and the tender documentation should state the plant types required and the number of plants.

3) Plants for stabilizing rivers should be chosen using the following criteria:-
a) they must be indigenous and belong in a wetland
b) the resistance to washing out during floods
c) the ability to lay flat during floods and not create an obstruction in the river
d) the ability to accomodate other indigenous plants and support a wider biodiversity (ie they must not outcompete other plants for sunlight and space etc)
e) plants must be selected according to the characteristics of the river bank zone. In other words certain plants do well in a zone frequently imundated and others not. Some will not survive without water permanently in the root zone and others will.

Many thanks to Dr Liz Day of Freshwater Consulting for giving guidance with this specification

Prionium serratum; *"Palmiet"; Has deep roots and lays flat during floods,highly recommended in rivers where it occurs. Suitable for planting from in the wet zone of the river to the top of the bank providing that there is enough moisture for the palnt to get established.*

Cyperus textilis; *"papyrus", "mat sedge" Has strong root mat and lays flat during floods, highly recommended in rivers where it occurs although like typha it has a tendency to dominate the landscape. Suitable for planting from in the wet zone to the top of the bank.*

Ischyrolepis subverticillata, Elegia Capensis, Restio Paniculatus *: "besembos" ... and many similar species. Has deep roots and lays flat during floods. Highly recommended in rivers where it occurs. Suitable from close to the waters edge to the top of the bank providing enough moisture is available.*

Cliffortia strobilifera; *Stabilizes soil during floods because vegetation lies flat on soil. Suitable from close to waters edge to the top of the bank (providing enough moisture available).*

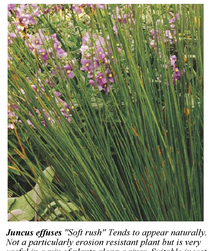
Carpha glomerata; *"vleibiesie", "vleiriet" This is not a particularly remarkable erosion resisting plant but is commonly found in wetlands with other species that are. Suitable from close to the waters edge to the top of the bank providing adequate soil misture is available.*

Elegia tectorum; *"dekriet", "Cape thatching reed" Previously known as "**Chrondropetulatum tectorum**" and similar - a useful plant for the edge of wetlands Very similar to **Thamnochortus insignis** and others. Suitable from close to the waters edge to the top of the bank.*

Wachendorfia Thyrsiflora; *A common West Cape wetland plant. Propogation by the division of rhyzomes.The roots are not exceptionally deep but the vegetation lies flat during floods and assists limiting soil erosion. Suitable from close to the waters edge to top of bank providing that there is adequate mositure.*

Juncus Krausii; *"biesie", "dune slack" This reed is more suited to slightly saline environments and is useful for erosion control. Suitable from close to waters edge to top of bank, but not where flow velocities are too high. Commonly available from nurseries.*

Pteridium aquilinum; *"Bracken fern" DOES NOT OFFER FLOOD STABILITY BUT DOES CREATE GROUNDCOVER THAT ENABLES LARGER SPECIES TO GET ESTABLISHED. More suited to drier parts of wetland, or mid to upper reaches of bank to stop surface erosion*



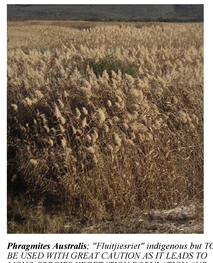
Juncus effusus *"Soft rush" Tends to appear naturally. Not a particularly erosion resistant plant but is very useful in a mix of plants along a river. Suitable in wet margin of river.*

Juncus lomatophyllus; *DOES NOT OFFER FLOOD STABILITY BUT DOES CREATE GROUNDCOVER THAT ENABLES LARGER SPECIES TO GET ESTABLISHED. Tends to appear naturally. Suitable in wet margin of river.*

Cladium Mariscus; *"Swamp grass, saw grass" This is a good lower bank stabilizer. It forms strong clumps and spreads along the river, but not into the river or far up the bank. Suitable in wet margin of river.*

Isolepis prolifera *DOES NOT OFFER FLOOD STABILITY BUT DOES CREATE GROUNDCOVER THAT ENABLES LARGER SPECIES TO GET ESTABLISHED. Tends to appear naturally. Suitable in wet margin of river.*

Typha Capensis; *"Bullrush", "Typha", "Papkuil" Indigenous but TO BE USED WITH GREAT CAUTION AS IT LEADS TO MONO-SPECIES VEGETATION POPULATION AND LOSS OF BIODIVERSITY*



Phragmites Australis; *"Fluitjiesriet" indigenous but TO BE USED WITH GREAT CAUTION AS IT LEADS TO MONO-SPECIES VEGETATION POPULATION AND LOSS OF BIODIVERSITY*

DEPARTMENT OF AGRICULTURE SPECIFICATIONS RELATING TO THIS WORK

The following specifications apply:-

Western Cape Department of Agriculture Specification for Rock Filled Wire Baskets for Constructing Hydraulic Structures : Rev1 April 2016 or as ammended

Western Cape Department of Agriculture Specification for Concrete Abrasion Resistance Coating for Rock Filled Wire Baskets : Rev 3 June 2016 or as ammended

Western Cape Department of Agriculture General Specification for River Rehabilitation Works : Rev 1 April 2016 or as ammended

Number Nommer	Date Datum	Description Beskrywing

PROVINCIAL ADMINISTRATION : WESTERN CAPE
Department of Agriculture

PROVINSIALE ADMINISTRASIE: WES-KAAP
Departement van Landbou

ULAWULO LWEPHONDO: INTSHONA KOLONI
ISebe LwezoLimo

Baviaans River Genadendal Riverbank erosion protection vegetation

Standard re-vegetation details rev1

Contact numbers / Kontak nommers:
Hans King : 082 907 2807

Farm unit / Plaaseenheid		Office / Kantoor	Elsenburg
Magisterial district / Landdrosdistrik	Caledon	Surveyed / Opgemeet	
Owner / Eienaar	-	Designed / Ontwerp	H E King (Pr Eng)
Work number / Werk nommer	-	Checked / Nagesien	----
Scale / Skaal	as shown	Date / Datum	2018/06/26
Farm number / Plaasnommer	--- / ---- / ---	Drawing number / Tekeningnommer	GB-Ing 2019-044/0

WWF

GUIDE

ZA

2019

A PRACTICAL GUIDE FOR COMMUNITY-RUN NURSERIES

Growing indigenous plants for restoration

© VICTORIA WILMAN

Caylot Zide, erica specialist at Kirstenbosch National Botanical Garden, with *Erica irregularis* seedings.

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WWF is one of the world's largest and most experienced independent conservation organisations with over 6 million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.
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SANBI champions the exploration, conservation, sustainable use, appreciation and enjoyment of South Africa's exceptionally rich biodiversity for all people. SANBI leads and coordinates research, monitors and reports on the state of biodiversity in South Africa, and contributes to sustainable development by facilitating access to biodiversity data, generating information and knowledge, building capacity, providing policy advice and showcasing and conserving biodiversity in its national botanical and zoological gardens as 'windows' to South Africa's biodiversity for enjoyment and education.

Nedbank is proud to fund the production of this guide as part of its support for WWF as we work together to safeguard South Africa's water source areas, improve rural livelihoods and promote land stewardship. WWF and Nedbank have been working together in various forms for almost 30 years – a long-term NGO/business partnership that continues to evolve and innovate in finding solutions to complex sustainability challenges in South Africa.

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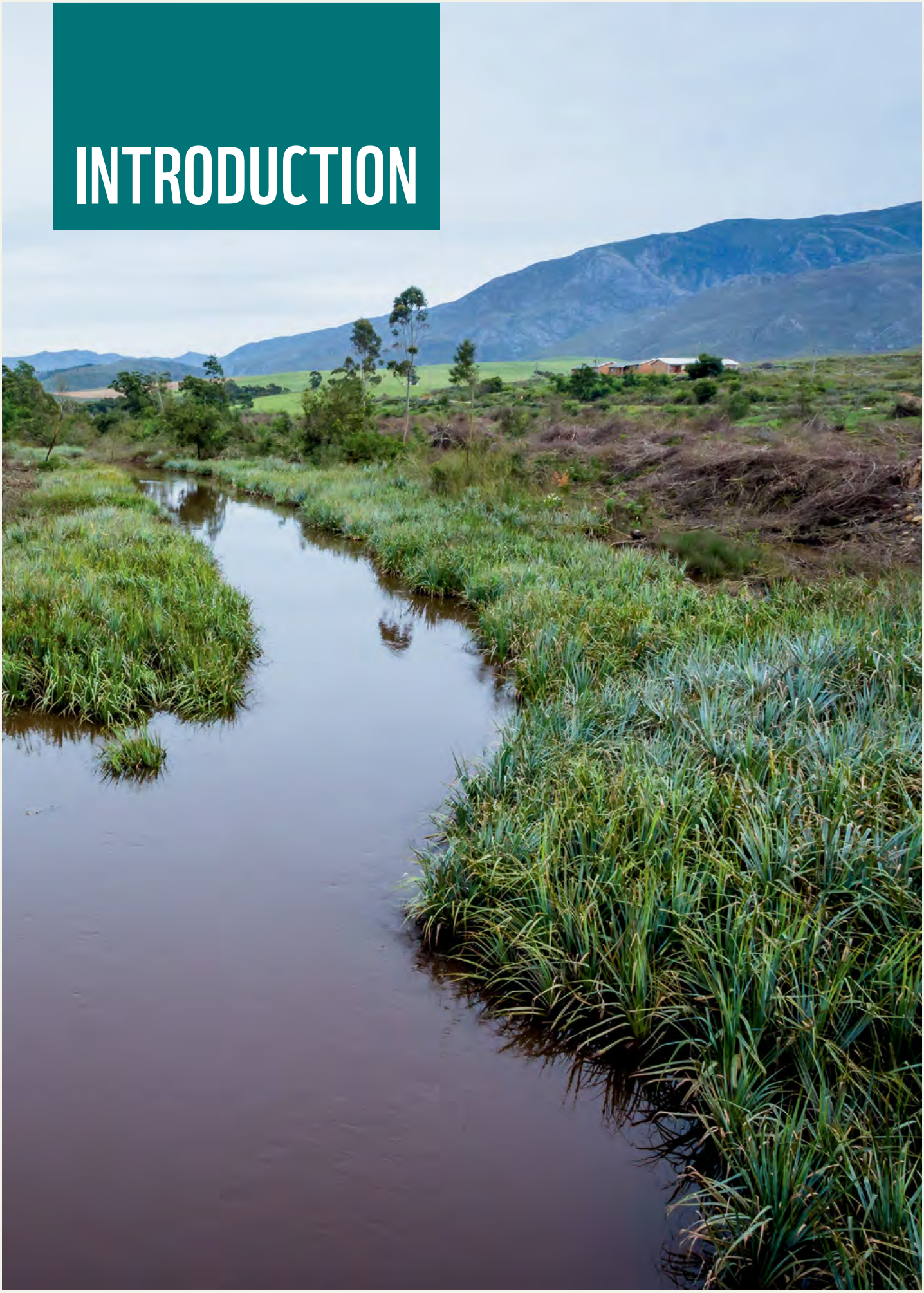
INTRODUCTION



The reed-like plants along this river is known as palmiet, an indigenous wetland ‘superplant’ that prevents flooding and stops sediment from being swept downstream.

A SHARED WATER FUTURE

Only 10% of South Africa's land is responsible for over half of its water supply. That is why we must manage and protect these areas, known as water source areas, in such a way that they can keep providing water for future generations.

WWF believes the best way to achieve this is to establish water source area community-public-private partnerships. These partnerships need to:

	**ENABLE** coordinated governance and effective action on the ground to better manage our water source areas
	**CREATE** opportunities for communities in the water source areas as well as shared benefits for communities living downstream
	**STOP** and prevent degradation of land and water resources in the water source area and ensure sustainable development

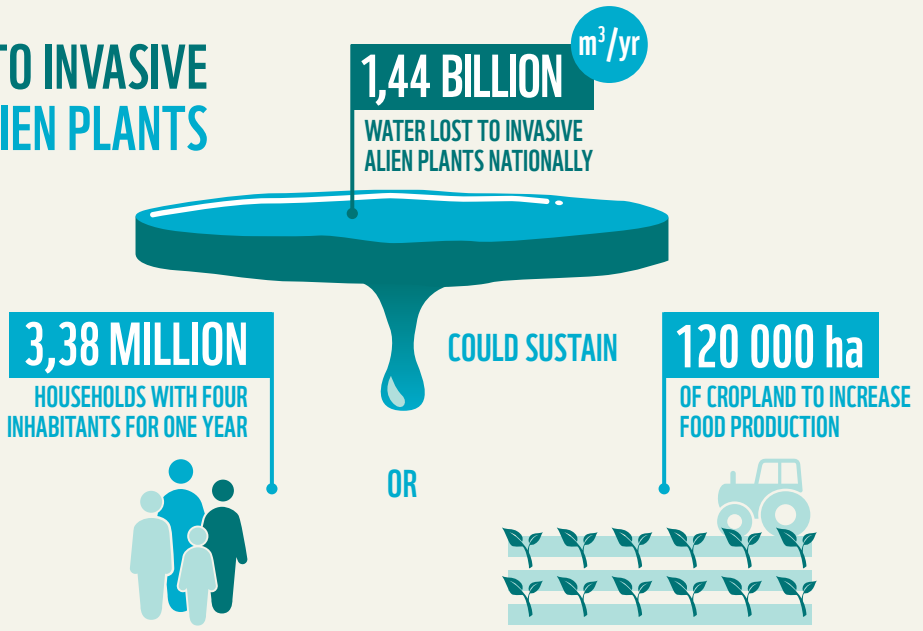
WHAT IS THE PROBLEM?

TO DATE, 50% OF SOUTH AFRICA'S WETLANDS HAVE ALREADY BEEN LOST

South Africa is a naturally water scarce country. That means there is not enough water in the country to meet everybody's water needs. Almost all the reliable water yields from our natural landscapes (catchments) have already been allocated. The catchments are threatened by inappropriate land-use practices, the climate crisis and wildfires, among other things. To date, 50% of South Africa's wetlands have already been lost, 84% of our freshwater systems are threatened and of those, 44% are critically threatened.

In the Western Cape, a major threat to water yields from many of our water source areas is the ever-spreading problem of alien invasive plants. These are plants that did not naturally occur in South Africa, but which were introduced to the country. Most were originally introduced for a purpose, such as the pulp and paper they can supply because they grow so quickly. But if these plants are not in well-managed plantations, their negative impacts can far outweigh their benefits. With no natural predators (insects or animals) to keep their numbers in check, they spread quickly, often crowding out the indigenous vegetation. They also use more water as they grow quicker and larger than the other plants in the surrounding area.

WATER LOST TO INVASIVE ALIEN PLANTS



WHAT IS THE NEED?

There are many alien clearing initiatives on the go across the country, especially around vital river areas where most water is lost, but this is just one part of the solution. Once infested areas have been cleared, they need to be maintained to keep the alien plants' seeds from sprouting again. Ultimately, the areas need to be restored to their natural state, with naturally occurring plants – especially around river banks.

Restoration, the practice of fixing or restoring damaged or degraded areas in the environment, plays an important role in the invasive alien plant clearing process. One can restore an area **passively** or **actively** to suppress the regrowth of invasive alien plants. If the natural vegetation is restored, it also reduces the ongoing cost of continuously clearing alien vegetation and maintaining the area. Restoration enables the environment to return to a state where everything functions as it should, to benefit people, animals and the planet.

WHAT IS THE OPPORTUNITY?

An important point is that one should use locally occurring indigenous plants when it comes to active restoration (ie. planting plants back into the veld). This is where the opportunity lies.

Restoration not only **stops** further degradation of land and water resources, it also **creates** opportunities for those living in the water source areas to have a sustainable livelihood. This is compatible with a healthy, well-managed environment and contributes to healthy communities.

Often, the cleared sites that require active restoration are in remote, hard-to-reach areas, far away from cities or towns. In these areas there are usually very few jobs or opportunities to make a living for the people in nearby villages or towns.

Operating a community-owned nursery that stocks plants that can be used to restore the veld can be labour intensive. But this is a good thing, because it can provide jobs and create livelihood opportunities for members from the local community.

However, to operate a nursery, one has to know the indigenous plants and how to propagate them, and how to set up and manage a nursery.

This 'how to' guide provides an overview of the skills and knowledge needed to run a community-based nursery to grow indigenous plants that can be planted back into nature. The idea is that it should serve as a reference to which those employed by community nurseries can continually refer.

WHAT IS WWF'S CONTRIBUTION?

WWF South Africa has developed this practical guide because it supports the development of the green economy in South Africa's water source areas. We work with our partners in water source areas to help small and medium-sized enterprises (SMMEs) to restore catchments and create a better life for people and nature.

In the Boland Water Source Area outside Cape Town, WWF has invested in the Genadendal community nursery near Greyton. The aim of this community-run nursery is to rehabilitate and restore tributaries of the Sonderend River (Riviersonderend), which is a major tributary of the Breede River in this water source area.

In the Genadendal nursery, 15 people have been employed and trained to contribute to the healthy restoration of the catchment. At the same time, they are earning a living to support their families.

ABOUT THIS GUIDE

This guide is organised into three sections: Introduction; General principles of propagation and Propagation techniques. Photographs, icons and drawings are used to clarify concepts. We have also included a glossary of terms and a list of useful resources that community nursery owners and staff can consult when growing plants for restoration.

RESTORATION

Ecological restoration is the practice of fixing, renewing and restoring degraded or damaged ecosystems and habitats in the environment by human intervention and action.

WHY RESTORE?

Intact, functioning natural ecosystems, which are called our 'natural infrastructure', provide society with a number of goods and services, such as:

CLEAN AIR	Ecosystems produce oxygen and also purify and detoxify the air
CLEAN WATER	Ecosystems provide us with clean water and store and cycle fresh water
CLIMATE	Ecosystems regulate the climate
HEALTHY SOIL	Ecosystems form topsoil and prevent erosion and flood damage
RAW MATERIALS	Ecosystems produce raw materials, foods and medicines

Most of these ecosystem goods and services cannot be replaced by human technology, at any cost. But when they function properly, these systems reduce the need for built infrastructure, such as filtration plants and dams.

As explained on page 3, the need to tackle the threat of invasive alien plants has been recognised for many years. In 1995, the government established the Working for Water Programme to combat the problem. But it is only more recently that we started to realise what an important role restoration can and should play in the process.

Restoration will ensure that our natural infrastructure can keep producing these ecosystem goods and services for us. By planting back lost or endangered species, we can prevent extinction, maintain biodiversity, reverse the loss of species and help restore the way the natural environment functions.

Restoration can be either passive or active

Passive restoration

Passive restoration means alien plants may have been cleared or activities damaging the ecosystem may have been stopped, and the area is left to recover naturally. The causes of degradation are removed from the system and the system is allowed to repair itself over time.

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Active restoration

Active restoration means there is a need for further actions after the clearing was done or damaging activities were stopped. The area will not be able to recover naturally, it will need some help. For example, species can be reintroduced to the area by planting them back or sowing seeds.

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COMMUNITY NURSERIES

When active restoration is required, community-based nurseries can be set up to propagate and stock the plants that will be required for replanting in the veld.

The plants that will be used for replanting must naturally occur in the area. This is very important for several reasons:

Plants which naturally occur in an area are well adapted or suited to the local conditions. This increases the survival rate and benefits provided by these plants.

By introducing new species to an area – i.e. species that do not naturally occur there – one can unintentionally introduce a new threat to the environment. The new species or plant may outcompete or dominate the local plants and in this way unbalance the ecosystem.

Collecting seeds or plants from the local area or catchment to grow on site in the nursery reduces transport costs and keeps plant genetics local.

Restoration through community-run nurseries creates job opportunities.

SELECTING A SITE FOR THE NURSERY

The site for the nursery must be carefully selected with great attention to detail. Here are some guidelines:

- Know which species you are going to propagate.
- Choose a site close to the restoration site.
- Choose a site that will offer protection from drying winds.
- Plants should be grown where there is a favourable microclimate.
- The site should be relatively level with a very slight slope.
- There must be good drainage.
- There should be good road access for deliveries.
- The site must be close to a clean water source and close to a source of electricity.
- The site must be large enough to hold the number of plants necessary and for potential expansion.

A collection of indigenous plants grown for restoration.

WHAT DO YOU NEED TO SET UP A NURSERY?

In addition to appropriate areas for storage of seed, fungicides and insecticides, as well as staff facilities such as work areas, rest areas, a kitchen and ablutions, you will need the following:

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A seed house for germinating seeds and some hardy cuttings.

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A shade house for hardening off seedlings after transplanting them into bags – it should provide 20–40% shade cover.

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An open growing area for growing and hardening plants before transporting to the field.

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An added option is a cutting house or greenhouse for propagating soft cuttings.

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A work area for propagating plants, with a nearby water point.

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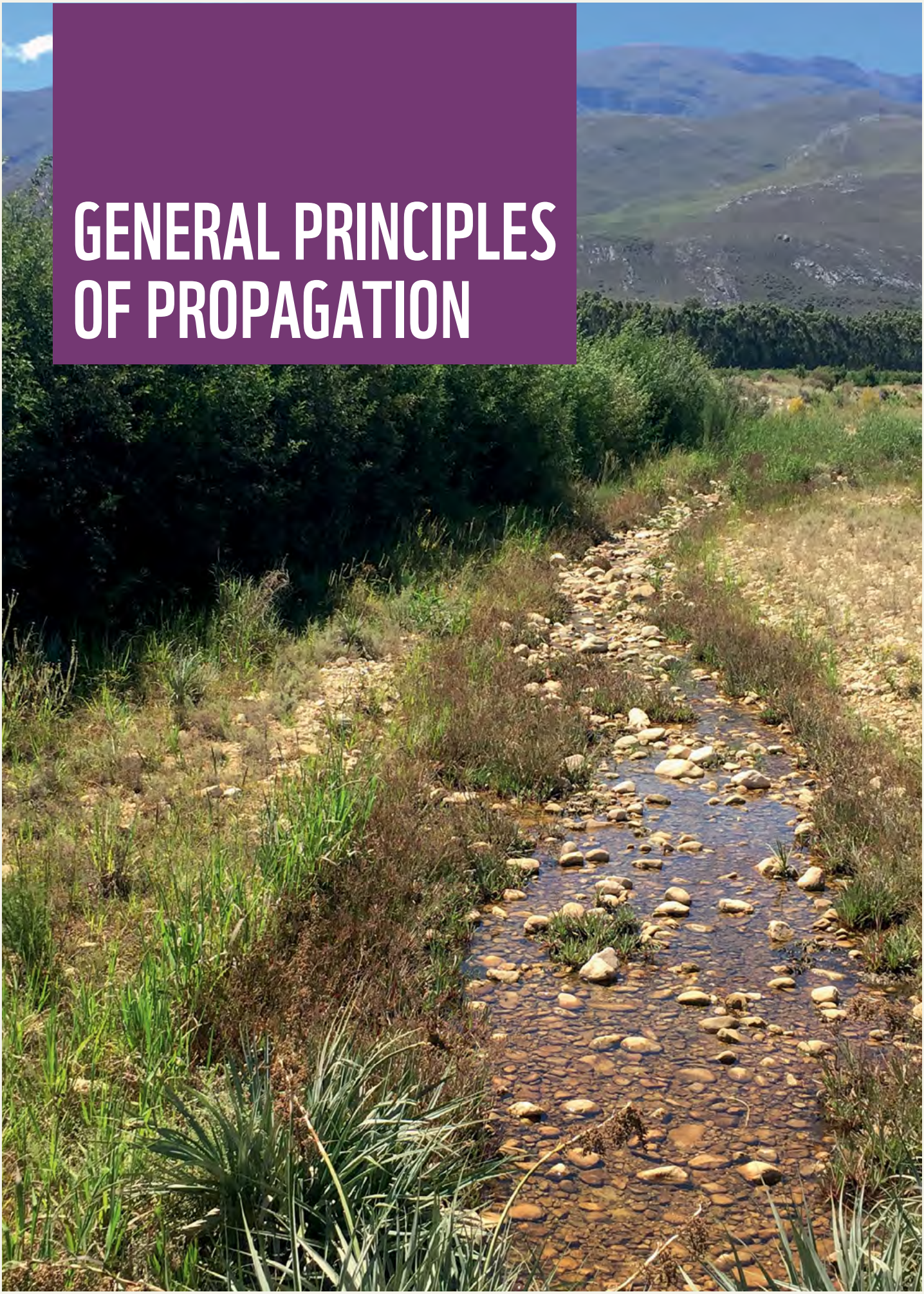
A potting shed for potting plants with storage areas for equipment.

GENERAL PRINCIPLES OF PROPAGATION



As a tributary of the Riviersonderend, the Meul River is an example of a river that has undergone restoration with indigenous plants from the nearby Genadendal nursery.

UNDERSTANDING PROPAGATION

Propagation means to grow new plants. It is the science or art of starting new plants and increasing their numbers.

HOW ARE PLANTS PROPAGATED?

Plants can be propagated in two ways: through sexual or asexual (vegetative) propagation.

Sexual propagation

Reproducing plants through seeds or spores.

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Asexual or vegetative propagation

Reproducing plants through vegetative cells, tissues or organs, e.g. cuttings or leaves.

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Plants propagate naturally by seeds and spores in nature. Less often, they can propagate asexually (vegetatively) by means of ramets, rhizomes, natural layering and offsets.

RAMET

A new plant derived by vegetative reproduction from a single parent plant and often (at least initially) remaining physically connected with it.

RHIZOME

A modified underground plant stem that sends out roots and shoots from its nodes, from which a new plant grows.

LAYERING AND OFFSETS

A horizontal branch from the base of a plant that grows roots and produces a new plant.

WHICH PROPAGATION APPROACH SHOULD A NURSERY USE?

Nurseries can use both of these approaches – sexual and vegetative propagation. Each has its own advantages:

Propagating from seeds (sexual propagation)	Propagating from cuttings (vegetative propagation)
Relies on seed production by the 'mother' plant, according to the season	Can be done all year round
Can be done without specialised equipment and greenhouses	May require a greenhouse
Results in genetically more varied plants, which are often stronger	Results in plant replicas or clones

PROPAGATING FROM SEEDS

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© VICTORIA WILMAN

© VICTORIA WILMAN

PROPAGATING FROM CUTTINGS

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TEN PRINCIPLES OF PROPAGATION

Propagation of plants for restoration need not be difficult or daunting if the basic principles are followed.

1. Collect seeds or cuttings from **healthy plants** from an area close to the restoration project.
2. Study the **plant species in the wild** to understand which propagation technique should be used.
3. Using the **correct propagation technique** for a species will allow the seeds to germinate or the cuttings to root more easily, increasing the young plants' chances of survival.
4. Choose the **medium** for propagation according to the needs of the species – the medium or soil must be clean and well drained but able to hold enough moisture to start the germination or rooting process.
5. Filling **potting** bags to the brim and placing plants of similar ages and water requirements together can save time and labour.
6. Choosing **containers and labelling** plants with the plant name, propagator details and date help with ongoing management.
7. The correct **placement** of seeds or cuttings at the various stages of growth is vital.
8. Plants in the nursery should always be **well maintained and kept weed free.**
9. Proper **hygiene** throughout the nursery is essential.
10. The correct **watering regime** must be maintained throughout the propagation process.

By following these principles, the nursery can maintain quality and plant health from the start of the process – from when the seeds or cuttings are collected – through all the stages of cultivation until plants are replanted in the veld. This will bring about a higher success rate for restoration projects. Each of the principles is discussed in more detail on pages 14 to 23.

1. HEALTHY PLANTS

Collect seeds or cuttings from healthy plants from an area close to the restoration project.

Propagation material (seeds or cuttings) must be collected from a healthy natural habitat close to the area that will be rehabilitated. If seeds or cuttings are collected from nature reserves or conservation areas, the correct permits must be obtained from authorities before starting with collection.

Collecting seeds

When collecting seeds from wild plant populations, not **more than 20%** of the available seed should be collected at one time from each plant. This will ensure the survival of the natural plant population.

Seeds should be collected from **different plants** in the area to ensure a good gene pool in the rehabilitated populations.

Viable healthy seeds should be collected at the **optimum stage of development**, usually when the seeds are dropping naturally. Seeds must be stored correctly in a cool, dry area until sowing.

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Collecting cuttings

Sharp, sterilised secateurs should be used when working with plant material.

Ideally, cuttings should be collected in the **cool, early mornings** from plants that are **disease and pest free**.

Freshly cut material must immediately be placed in **plastic bags** containing a **tiny amount of water** to keep the cuttings moist.

Individual cuttings should be made and placed in the greenhouse as **soon as possible** after collection

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2. WILD PLANTS

Study the plant species in the wild to understand which propagation technique should be used.

Propagation and cultivation will be more successful if one can mimic the conditions in which the plant is growing in the wild. This can include the soil type in which the plant is growing, the climate (temperature and rainfall) and how the plant reproduces in the wild (for example, do the seeds require fire to germinate?). If possible, one should do as much research as possible on the species that will be propagated. If there is no information available, a process of trial and error will be necessary.

BE SURE THE RIGHT SPECIES ARE GROWN AND PLANTED BACK IN NATURE

How are plants named?

Knowing the basic principles of plant naming helps to identify different species and work out how best to propagate them.

It is important to use the correct scientific plant names when growing for restoration to be sure that the right species are cultivated and planted back in nature. When running a nursery, one cannot rely on common plant names because the same common name could be used for different species.

Plants that are similar are part of a **family**. Within each family are a number of **genera** ('genera' is the plural of 'genus'). Within each **genus** are a number of **species**. Let's use the sugarbush protea as an example:

Family: Proteaceae

Genus: *Protea*

Species: *repens*

Scientific plant names consist of two parts, the **genus** and the **species**, e.g. *Protea repens*, and it is written in italics (the family name is not italicised). The genus name is written with a capital letter and the species name with a small letter.

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Tip:

You can make a list of the species occurring near the restoration site.

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Brabejum stellatifolium
(Family Proteaceae)

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Pelargonium peltatum
(Family Geraniaceae)

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Erica abietina
(Family Ericaceae)

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Cyperus textilis
(Family Cyperaceae)

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Berzelia abrotanoides
(Family Bruniaceae)

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Selago canescens
(Family Scrophulariaceae)

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Prionium serratum
(Family Thurniaceae)

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Leucospermum cuneiforme
(Family Proteaceae)

3. PROPAGATION TECHNIQUE

Using the correct propagation technique for a species will allow the seeds to germinate or the cuttings to root more easily, increasing the young plants' chances of survival.

It is useful to know how best to propagate a plant. Some plants do better propagated from seed while others can be propagated very easily from cuttings. Some plants cannot survive from cuttings or do not germinate easily from seeds. The propagation method most suitable for a particular plant can be learned through researching the species or conducting trials. You can use the following as a rule of thumb:

Plant	Grow from…
Trees	Seed
Grasses, bulbs and restios	Seed or division
Groundcovers, herbaceous perennials	Seed or softwood and tip cuttings
Shrubs and climbers	Semi-hardwood stem cuttings
Succulents	Big cuttings, placed directly into bags of potting medium

Seeds may need some kind of treatment, such as smoke, scarification or soaking in hot water before sowing and may need to be sown in a certain way. For example, tree seeds need to be sown under soil in deep seed trays or directly into plant bags where they have space for their roots to grow down, while tiny seeds should be sown close to the surface as the seedlings will struggle to reach above the soil if sown too deep.

There are also many different types of cuttings that can be made, including hardwood, semi-hardwood and softwood, heel cuttings, stem cuttings or tip cuttings. It saves time if you know which technique to use and how to do it. Timing is also important – one should know when to collect cuttings and when best to sow seed as this will affect the rooting and germination success. These propagation techniques are discussed in more detail in the next section.

4. MEDIUM

Choose the medium for propagation according to the needs of the species – the medium or soil must be clean and well drained but able to hold enough moisture to start the germination or rooting process.

The medium or soil is critical to the success of plant propagation. Potting media are not the same as propagation media – potting media hold more nutrients and contain compost and organic material to sustain the plant for a long period.

The ideal propagation medium should supply the correct balance of air and water for the developing root system. It should be sufficiently firm and dense to hold the seeds and cuttings in place during rooting or germination. The mixture should be easy to wet and must retain enough moisture, but must also be sufficiently porous to allow excess water to drain away and oxygen to reach the roots. The medium should be free of weed seeds and harmful organisms.

The exact characteristics of the medium will vary according to the species you want to propagate. Soil-less media are recommended for growing large quantities of seeds and cuttings, especially when it is not possible to sterilise the soil. It is best to use a medium low in nutrients for propagation to avoid problems with algal and weed growth. Some common components of propagation media include pine bark, vermiculite, perlite and sand. These can be used separately or mixed together to make a seedling or cutting mix. A mix of one part fine bark and one part coarse sand is relatively inexpensive and makes a good medium.

Type of medium	Milled bark	Vermiculite	Sand	Perlite
				
What is it made of?	Shredded pine bark (6 mm) sieved finer for propagation	Vermiculite is a mineral that looks like mica. It contains no soil.	Sand consists of small, weathered rock particles 0,05 to 2 mm in diameter.	Perlite is a grey-white volcanic glass that expands and forms sterile sponge-like kernels when heated.
What are its qualities?	Milled bark absorbs and retains moisture well. At the same time it is coarse enough to allow rapid drainage of excess water. It is acidic in nature.	Vermiculite does not dissolve in water. It provides lots of air space if not pressed down. It is able to hold large quantities of water and nutrients.	Sand contains no nutrients and has a near neutral pH. Quartz sand is generally used for propagation. It should not be too fine. It has excellent drainage and can stimulate rooting in cuttings because of its abrasiveness. In propagation media it is often used in combination with organic materials and is added to improve drainage.	The sterile perlite kernels are very light and porous. Perlite has a neutral pH and can hold three to four times its weight in water yet will not become soggy for a long period.
Why add it to a mixture?	Milled bark lightens a mixture, increases air spaces and drainage while providing moisture-holding capacity.	When handled gently, it increases the water-holding capacity and aeration and lightens the mixture without adding organic nutrients.	Coarse river sand adds air spaces to a mix, drains rapidly and stimulates rooting in cuttings.	Perlite increases aeration and improves drainage. It is usually used in combination with milled bark.

5. POTTING

Filling potting bags to the brim and placing plants of similar ages and water requirements together can save time and labour.

At this stage, seedlings and/or rooted cuttings will be planted into plug trays, potting bags or pots filled to the brim with potting soil. Potting soil can be obtained ready mixed from various suppliers, or created at the nursery by mixing compost or milled bark with sand. Other ingredients may be added to maintain a specific pH. Slow-release fertilisers can also be included. The potting soil mix should hold moisture but must also drain well. Recommended potting soil mixes are given below:

Mixture	Components
General mix 1	6 parts well-decomposed compost 2 parts well-aged milled bark (5–12 mm) 1 part gritty river sand
General mix 2	4 parts well-decomposed compost 3 parts well-aged milled bark (5–12mm) 1 part gritty river sand
Fynbos mix	7 parts well-aged milled bark (5–12mm) 3 parts coarse washed river sand
Bulbs/succulents and open benches	4 parts general mix 2 parts well-aged milled bark (5–12mm) 2 parts coarse washed river sand

Seedlings are transplanted after they have grown their first true leaves. They must be carefully teased out of the seed trays, separated from other seedlings, and placed with all their roots covered into plug trays or potting bags, depending on the size of the seedlings. It is better to place very small seedlings into plug trays first so that they can become more established before transplanting them into bags. Be sure not to damage the roots in the potting process and place the plant at a similar depth in the soil to where it was in its propagation stage. Give the newly planted seedlings a good watering with a very fine rose watering can.

Seed leaves and true leaves

When a seed germinates, the first single leaf or pair of leaves to emerge above the soil are called the seed leaves because they are part of the seed's embryo. They provide stored nutrients to the seedling until its true leaves grow. When the true leaves emerge, the plant can begin to photosynthesise. That means the plant is able to make its own food.

Rooted cuttings can be planted into bags or pots when they are well rooted and you can see a few roots poking out of the holes on the underside of the plug trays. The same principle applies as above, except that cuttings should be carefully removed from the plug trays by pushing them up from below rather than pulling them from above. They can then be planted, propagation medium and all, into their new containers.

Containers should be filled right to the top with potting soil; once they are watered, the soil will sink slightly. Plastic plant bags, especially, should be filled to the brim. If the soil is too low in the bag, the plastic edges fold over, preventing the plant from getting water.

Plants of the same age, species, bag size and watering requirements should be placed together in the shady hardening-off area of the nursery for ease of care.

6. CONTAINERS AND LABELLING

Choosing containers and labelling plants with the plant name, propagator details and date helps with ongoing management.

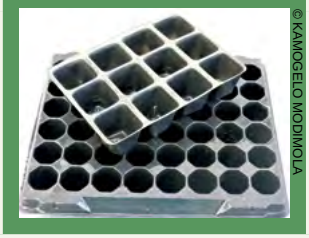
Plants can be propagated and grown in various containers. They can even be grown in open beds. White plastic labels can be used to label plants, and it is best to write on them with a 6B pencil. After planting, plants should be labelled with the following:

1. Name of the plant
2. Date of propagation and potting
3. Name of the propagator (person)
4. Name of the restoration project or restoration area
5. Origin of the plant (where the seeds were harvested)

Tip:

Use a 6B pencil to write on labels – it lasts longer and does not wash off.

Whichever container you choose to grow your plants in (see table below), it should always be **clean and sterilised before planting**. Recommended disinfectants are Terminator or Sporekill (brand names) – mix 1 mℓ to a litre of water. The active ingredient in these disinfectants is didecyl dimethyl ammonium chloride.

Shallow or deep plastic seed trays with drainage holes	Plug trays or multi-trays	Biodegradable pots	Pots and planting bags
 © KAMOGELO MODIMOLA	 © KAMOGELO MODIMOLA	 © GROWRITE	 © VICTORIA WILMAN
Used for seed propagation. Deep trays are used for larger plants, bulbs and plants with deep root structures (e.g. trees). Seeds can be sown in open sowing beds or seed trays.	Used for larger seeds that may not require an additional potting stage. Also used for cutting propagation and second potting of small seedlings from seed trays. Come in different sizes and can have cavities of 6, 20, 90, 105 and 128 or more. Seedlings or rooted cuttings can be easily removed from the tray for potting without damaging the roots. Smaller plants can be grown and transported more cheaply in these trays. Some trays have separate little plug pots that rest in wire frames so each pot can be removed individually. This is very useful for restoration.	Jiffy peat pots from Growrite are an alternative to plastic pots and are 100% biodegradable, compostable and approved for organic production. During transplanting, the rooted plant and the peat pot can be planted together, saving time and labour and reducing any stress to the plant that may be caused by disturbing the root zone. Proteaceae and other similar plants with sensitive root systems benefit from propagation in peat pots.	Seedlings and rooted cuttings are transplanted and grown on in pots or plastic bags of various sizes. Planting bags are cheaper but less likely to be reused while plastic pots are more durable and don't have the problem of tearing, breaking and folding over. If possible, once planted, the pots can be placed in crates for easy counting and transporting.

7. PLACEMENT

The correct placement of seeds or cuttings at the various stages of growth is vital.

During the different stages of propagating and growing plants, they need to be kept in different areas or structures in the nursery at different times. They will also have differing watering regimes at the different stages of propagation. The different areas or facilities and their uses were explained on pages 8 and 9. The table below contains guidelines on where plants should be placed during each growing stage.

Activity	Stages for seed propagation	Stages for cutting propagation
Collection	**Place:** In veld **Time:** When plants are seeding	**Place:** In veld **Time:** All year round, but ideal after flowering when new shoots show
Storage	**Place:** Seed store	**Place:** Cutting material can be stored in the fridge for a very short period after collection and before planting
Propagation	**Place:** Seed house **Time:** Until two true leaves have grown	**Place:** Greenhouse (soft cuttings) **Place:** Seed house or shade house (hard cuttings) **Time:** Until a substantial root ball has formed
Potting	**Place:** Potting shed **Time:** Time taken to pot	**Place:** Potting shed **Time:** Time taken to pot
Hardening-off	**Place:** Shade house **Time:** Minimum of 10 days for some species, 4 weeks ideal for a proper root ball to establish	**Place:** Shade house **Time:** Minimum of 10 days depending on species
Hardening-off phase 2 / Growing on	**Place:** Open growing area (with sunshine) **Time:** Until ready for transplanting in the veld. May require repotting if necessary	**Place:** Open growing area (with sunshine) **Time:** Until ready for transplanting in the veld. May require repotting if necessary

Seed trays and open sowing beds.

8. MAINTENANCE AND CULTIVATION

Plants in the nursery should always be well maintained and kept weed free.

When growing plants, right from the propagation stage through to the hardening-off and growing-on phase of plant production, the plants should be well maintained and kept healthy and weed free. This is an important part of nursery management and is vital to the survival of one's plants.

The nursery and its surrounds should also be kept clean and weeds should not be allowed to take root and spread. They should certainly not be allowed to reach seeding stage.

During cutting propagation, the cuttings should be monitored and any dead plants removed from the trays and cutting beds. Dead plants left in the trays can cause disease and fungal problems for the healthy cuttings. Any dead leaves that have dropped should be removed so that the cutting beds are as clean and sterile as possible.

Once cuttings are rooted, they can be removed from the cutting beds and placed in the hardening-off area before potting. They can be fed with a liquid fertiliser to help them along. The propagation medium does not contain any nutrients, so feeding at this stage between potting is beneficial.

Tip:

Remove dead plants from the trays because they can cause disease and fungal problems for the healthy cuttings.

Plants that are planted in pots and bags quickly use up any nutrients that were in the potting soil. Nutrients need to be replenished by adding fertiliser. Seedlings in plug trays and those plants planted in pots would benefit from a slow-release organic fertiliser in the potting soil that can slowly release the required nutrients over a period of six months to a year, depending on the fertiliser.

However, these fertilisers need to be used carefully as some fynbos species can react badly to an excess of fertiliser that may be released during hot weather conditions. Talbourne organic 5:1:5 fertiliser is used with good results on fynbos species and only a small pinch is needed per plant twice a year. Alternatively, an organic liquid fertiliser can be used, such as Seagro or Nitrosol, alternated every second week.

Using crates allows for easy stocktake and transporting.

9. HYGIENE

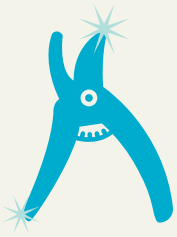
Proper hygiene throughout the nursery is essential.

Two of the most important factors of plant propagation are sanitation and hygiene. Many plants are lost due to various pathogens, diseases and insect pests because sanitation is not well managed.

Everything in the nursery should be clean or sterilised, from the beginning of the process to the end.

- Propagation facilities (places where cuttings are made, seeds are treated, etc.) should be separate from storage areas and areas where the propagation or potting media are mixed.
- Tables, equipment, greenhouse benches and floors should be regularly washed down and disinfected with bleach. Vinegar is an inexpensive alternative and just as effective. Other recommendations for disinfectants are Terminator or Sporekill (brand names) – these can be mixed at 1 mℓ per litre of water. The active ingredient of these disinfectants is didecyl dimethyl ammonium chloride.

- Irrigation water should ideally be chlorinated to kill algae and pathogens.
- Propagation mix must be mixed on a clean surface and stored in clean bins.
- Mist propagating and growing areas, such as greenhouses, seed houses and shade houses, should be kept clean. Diseased or dead plant debris and fallen leaves should be removed daily. Any weeds should be removed before they set seed. The areas immediately around greenhouses should also be kept free of weeds and pathogens.



- Propagation houses and benches should be kept free of algae on damp floors and benches.
- Tools, especially secateurs, must be kept clean and sharp and regularly dipped in a sterilising agent before cutting plant material.
- Cutting material that is collected must be placed in clean plastic bags (sterilised).
- Propagation trays must be washed and sterilised before use – mix a Terminator solution in a big drum and dip the trays into it before using.

- After the trays have been filled up with growing medium, a disinfectant solution can be sprinkled over the medium with a watering can to minimise the chances of infection.
- Cuttings that have been rooting for a while should be removed and assessed; if calluses have developed, even though no roots have formed yet, they should be retreated, placed in a fresh rooting medium and replaced in the greenhouse.

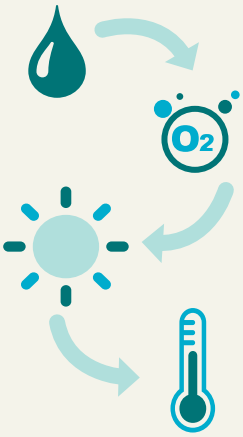
- High humidity, abundant moisture and warm temperatures can stimulate the rapid development of pathogens and insects. Humidity and moisture should be actively managed for rapid rooting without plant losses. Regular monitoring for pests and diseases is essential. Regular monitoring will also identify any problems with the irrigation system where cuttings or seedlings are not being irrigated.

- Any plants that have died during the propagation or growing stage should be removed. If they have died of disease, viruses or pest infections, they must be burned and not put with composting material that will be reused.

Keeping a clean growing environment will reduce seedling losses. It can also reduce the need for using insecticides and fungicides.

10. WATERING REGIME

The correct watering regime must be maintained throughout the propagation process.



There are four main environmental factors that affect germination, cutting production and plant growth. These are **water, oxygen, light** and **temperature**. Plants need the correct balance of water to maintain growth so that they do not dry out or become waterlogged, which can be equally damaging.

Watering during propagation

After sowing seeds, making cuttings or potting up, the trays and plant bags should be watered with a fine rose watering can, taking care to spread the water evenly over the soil so as not to wash out the seeds.

In seed propagation, the first part of the germination process is where the seed absorbs water. There should be enough water continuously available in the medium for the germinating seed. If the propagation medium is allowed to dry out once the germination process has begun, the embryo or baby plant may die. Overwatering can also be a problem, so ideally seedling trays should be watered daily and kept moist, but the surface should be allowed to dry out slightly between waterings.

Cuttings in a greenhouse need to have a balance of air and water at the rooting zone as well as humidity around the leaves. Humidity of 70–80% is ideal and prevents water loss from transpiration, especially for softwood and leafy cuttings. Softwood cuttings need an intermittent misting system that can be programmed to mist many times a day. Good air circulation around the cuttings is also essential. However, the cutting medium should not be allowed to become waterlogged.

Watering seedlings and young plants

Young seedlings and newly rooted cuttings require regular watering as they are susceptible to drying out, especially during the summer months. They should be watered daily.

Watering established plants in pots

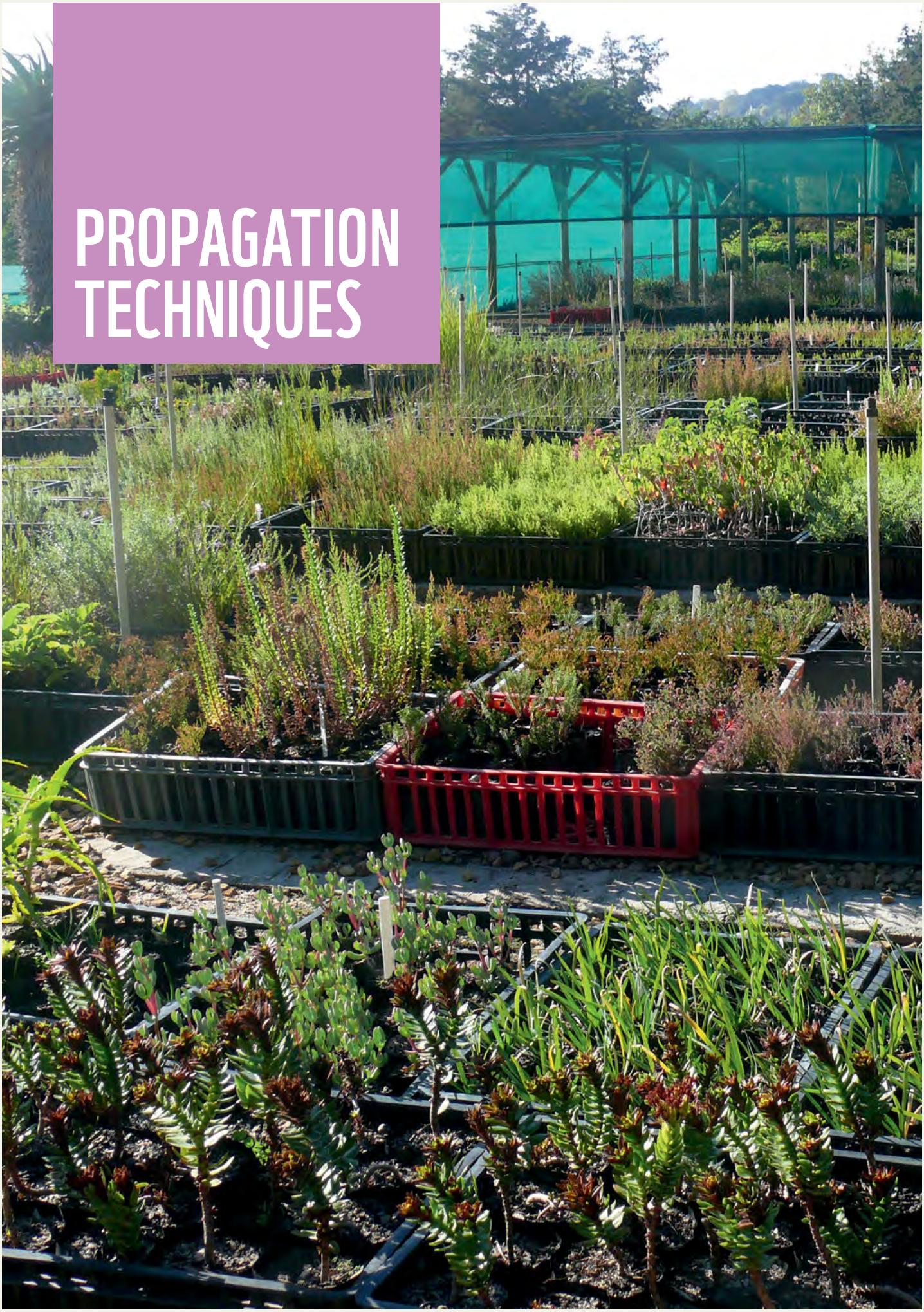
Established plants in pots or bags should be watered based on daily monitoring of the potting medium in their containers. They may only need watering every 2–4 days on average, but the exact frequency depends on the size of the bags, root development, the size of the plant and the duration of watering. The soil in the bags should always be slightly moist and never completely dry.

An irrigation system on a timer that waters automatically would be ideal. However, even with an automated system, regular monitoring of the water shadow and sprinkler nozzles is essential to make sure that all the plants are receiving water and to prevent plant losses. It is important to note that overwatering can be just as damaging as underwatering and can result in waterlogging and suffocation of the plants.

Seeds should be watered frequently and kept moist, but the surface should be allowed to dry out slightly between watering.

Water seed trays and cuttings with a fine rose spray or watering can.

PROPAGATION TECHNIQUES



Many different species are propagated and grown for restoration in the Kirstenbosch National Botanical Garden collections nursery.

SEED PROPAGATION

Propagation of plants from seed begins with seed collection.

SEED COLLECTION

Seed collecting requires good planning and knowledge or research of flowering and seed-producing times for the required species.

Seeds should be collected at the optimum stage of development. This is usually when they are in the process of natural dispersal, i.e. when seeds are dropping naturally.

Certain signs can be observed when seeds are ready to be collected:
Changes in fruit or seed coat colour
Fruits splitting or breaking open
Seeds rattling
Seeds are hard and dry
Some seeds have already dispersed
Seeds can easily be removed from the plant

In some cases a balance has to be found between early and late harvesting to obtain the maximum amount of good quality seeds. If collection is delayed too long, fruits could split open and seeds drop to the ground, or they may be eaten by birds or animals. It is good practice to visit the collection site regularly to sample seeds and determine their stage of maturity.

Seeds in follicles, pods, capsules, siliques, achenes and cones can be harvested before they are fully mature and then dried. Branches containing pods or capsules can be cut and placed on canvas or in open trays to dry for one to three weeks. Capsules and pods split open and release the seeds.

Where small amounts of seed are needed, the seed-bearing stalks can be cut and hung upside down in a paper bag to dry.

Berries change colour from green to red or black when they are ripe.

Pods and capsules become dry and split open to release the seeds.

HOW SEEDS TRAVEL

By wind

Thamnochortus insignis
(thatching reed)
Restionaceae

Taraxacum officinale
(dandelion)
Asteraceae

Scabiosa incisa
(koringblommetjie)
Dipsacaceae

By animals

Strelitzia reginae
(crane flower)
Strelitziaceae

Xanthium strumarium
(cocklebur)
Asteraceae

Sclerocarya birrea
(marula tree)
Anacardiaceae

By water

Nymphaea nouchali
(blue waterlily)
Nymphaeaceae

Typha capensis
(bullrush)
Typhaceae

Rhizophora mucronata
(mangrove)
Rhizophoraceae

By bursting

Pelargoniums and geraniums
(stork's bill)
Geraniaceae

Cyclopia, Aspalathus
and other Fabaceae

Agathosma, Coleonema
and others in the
Rutaceae family
(buchu)

SEED COLLECTION TECHNIQUES

There are many different techniques that can be used for collecting seed. The most appropriate technique will depend on the species and, in particular, how the seeds are dispersed.

- Hand picking is the simplest technique and works best in species where seeds are shed over a long time period and where fruits are easily accessible.
- Containers can be strapped around the picker's waist, leaving both hands free for collecting.
- The cluster pruning technique can be used when collecting seeds from tall trees or species that produce clusters of seeds at the ends of branches.

  Long tree pruners can be used to remove entire clusters from the tree.
- For species that disperse their seeds via the trigger or ballistic (bursting) mechanism, when protection from animals or birds are required, or when species are hand pollinated, bagging of the seed heads may be needed.

  A mesh bag or a bag made from a material that will let air and light through, is fixed loosely over the seed heads and tied in place around the branch. The seeds will be captured in the bags as they are shed.
- Shaking the branches of trees or shrubs will dislodge ripe seeds that can be collected on a tarpaulin or sheet laid on the ground beneath the plant.
- Grasses, restios and other species with erect flower stalks can be collected by stripping.

  Grasp the seed heads at the base and pull the hand upwards, gently dislodging the seeds, which can then be transferred to a collecting bag.
- Some seeds can be collected from the ground beneath the tree, but care must be taken not to collect seed that has been damaged by insects. However, it may sometimes be beneficial to collect seed from the ground especially where birds and fruit-bats have roosted. These seeds have been naturally scarified and will germinate easily.

  When collecting seeds, they should be stored in paper or cloth bags and never in plastic bags. Seeds with fleshy fruits can be initially stored in plastic bags or in buckets while collecting but the flesh should be removed as soon as possible.

Tip:

For hand picking seeds, strap a container in which to collect the seeds or seed bags around the picker's waist.

Tip:

When collecting seeds from the ground, take care not to collect seeds that have been damaged by insects.

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Seeds are collected and stored in cloth or paper bags – not plastic – to prevent them from going mouldy.

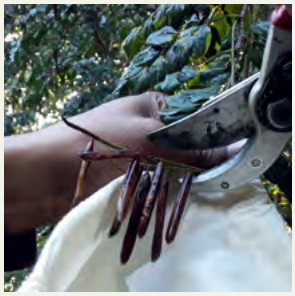
© VICTORIA WILMAN

Seeds are set out to dry in flat trays or boxes. Once dry, they can be cleaned by separating seed from non-seed material.

Hand picking

Stripping grasses and restios

Cluster pruning



Cluster pruning can also be used for grasses and restios if seeds are not completely ripe and are dispersing easily.

Collecting seed from umbel flowerheads

When collecting seed from umbel flowerheads such as agapanthus, carefully place a bag around the entire umbel, close the bottom, cut the stem and turn the bag right side up and shake. All the seeds will fall into the bag.

Tip:

It's a good idea to take a herbarium specimen with your seed collection so that the species can be verified by an expert.

Bagging of flowerheads and hand pollination

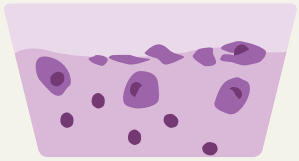
SEED CLEANING

Once the seeds are dry, they can be cleaned. This involves separating the seed from the outer seed coat, and separating seed from chaff or other non-seed plant material that invariably gets collected with the seed.

Hand sorting is the simplest method and is mostly used to clean large seeds or seeds with minimal chaff, such as seeds that are in pods, which only need to be taken out of the pods. Depending on the seed, it can be lightly crushed to break up the outer seed coat, e.g. dried Aloe sp, or it can be rubbed through wire mesh to separate the seed from capsules, e.g. Ericaceae (ericas or heathers).

The resultant mix can then be winnowed or **screened** by passing it through various sizes of mesh sieves. With certain seeds, the chaff can be removed by carefully throwing seed into the air and catching it again, or pouring it back and forth from one container to another. A slight breeze will carry the chaff away and leave the heavier seeds to fall into the tray.

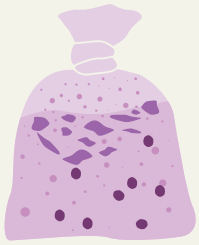
Sticky seeds such as *Pittosporum viridiflorum* (cheesewood) can be rolled in fine wood ash or talcum powder and wiped with a piece of coarse hessian. The dust absorbs a great amount of the sticky mucilage and both are wiped off the seed.



Fleshy fruit or **berries** need slightly different treatment to dry fruits. In general, fleshy fruit is easiest to handle if it is ripe or overripe, but this is seldom the case as seeds need to be collected before birds and animals eat them all.

With ripe fruits, the flesh must be removed from the seeds before the seeds are stored and sown. The berries can be squashed and the seeds extracted by hand. They can be trod in tubs, or they can be soaked in water to soften the flesh. The seeds are then removed in the water or rubbed through screens or sieves under running water.

Another method to remove seeds from small seeded fleshy fruits is to use an electric blender with the metal blade that has been replaced with a piece of rubber tubing. The rubber tubing is fastened at right angles to the revolving axis of the machine. A mix of fruit and water is placed in the blender and stirred for about two minutes. When the pulp has separated from the seed, the pulp can be removed by **flotation**. The seeds and pulp are placed in water. The heavy, sound seeds will sink to the bottom and the lighter pulp and empty seeds will float.



Fermentation is a method that works well for species with sticky or milky flesh such as *Sideroxylon inerme* (milkwood). The seeds can be placed in a strong plastic bag with a litre of water, three tablespoons of sugar and a sachet of instant yeast. These ingredients are mixed thoroughly and the bag is sealed. The bag is left for three to four days until it has swollen. This shows that the fermentation process is well under way and that the flesh is falling off the seeds. The seeds can then be washed in water.

Fleshy seeds must be cleaned soon after collection.

Mesh sieves of various mesh sizes are used for cleaning seed.

Use a rubber bung to crush capsules or prickly seeds through a sieve.

Tip:

Always keep the label with seeds during processing and cleaning to avoid mix-ups.

Hand sorting large seeds and seeds in pods.

Grass seeds can be rubbed over a ribbed rubber mat to remove the seeds from the husks. The seeds fall into the grooves in the mat and can then be tipped into a tray.

SEED DORMANCY

Dormancy refers to the period in a plant's life cycle when growth, development and physical activity are temporarily stopped.

Seeds become dormant because the environmental conditions are not suitable for germination and growth – it could be too dry or too cold, for example.

When seeds mature, they develop internal and external dormancy mechanisms that control when they will germinate. This is to prevent a seed from germinating in an unfavourable environment, where it will not survive. If the environment is favourable, the seed will germinate. For most fynbos plants, a favourable environment would be when temperatures are cool in autumn and the rainy season starts in the Cape. Other seeds have a hard seed coat that needs to pass through an animal. The seed will germinate when the animal has taken it to another area, away from the mother plant. This is called **dispersal**.

In many cases seeds naturally dry to a level below what is required for germination. They only need to soak up water at the correct temperature to start the germination process. These seeds do not need any special treatment but need to be sown at the right time, e.g. in the autumn or rainy season. Some seeds need to be sown fresh and will lose viability if they are stored too long before sowing.

Main types of dormancy

Physical or chemical seed coat dormancy

Seeds with **physical seed coat dormancy** have a hard outer seed covering that cannot be penetrated by water or oxygen. In nature, temperature fluctuations, high temperature, fire, mechanical abrasion such as lying in sand, passing through the digestive tracts of birds and animals or the actions of micro-organisms in the soil over time, break down the seed coat and so break the dormancy.

When germinating these seeds in the nursery, this type of dormancy can usually be overcome by **scarification**.

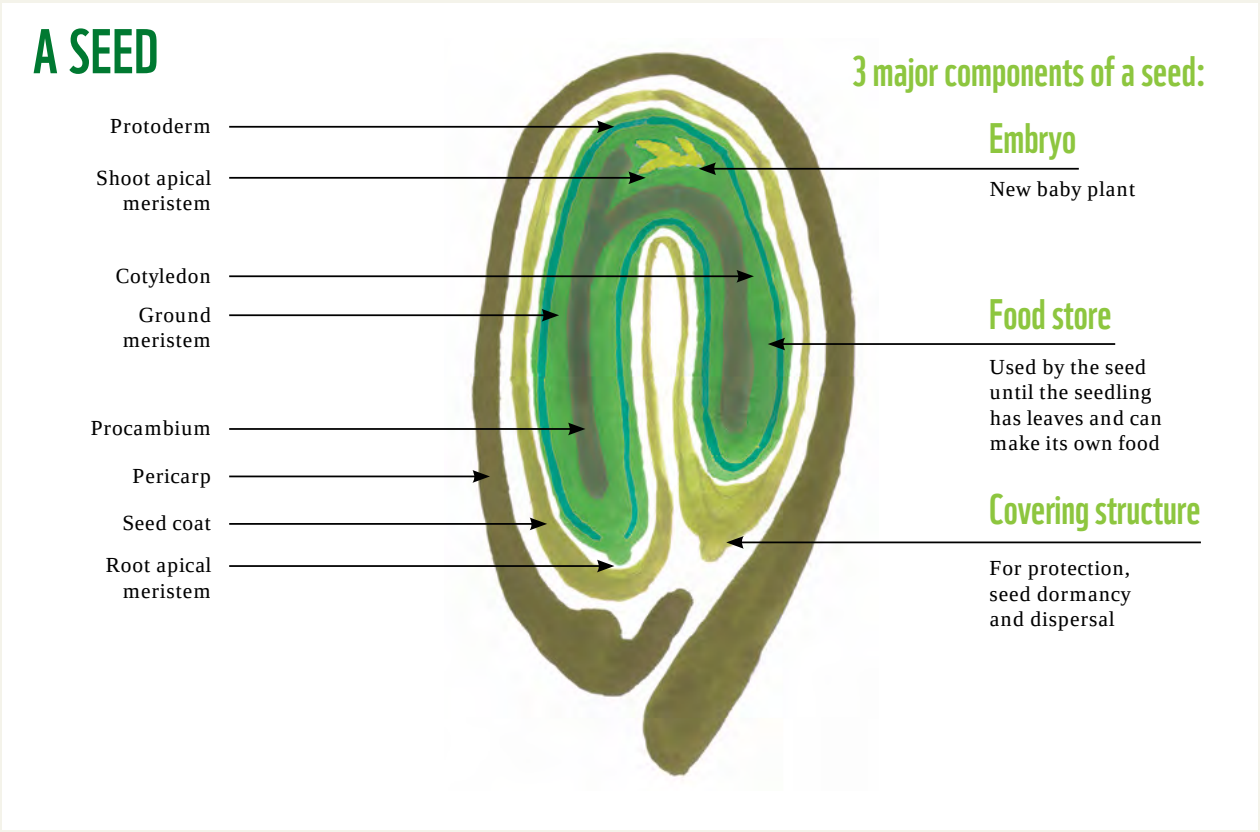
Chemical seed coat dormancy inhibits germination via chemicals found in the fruit and seed-covering tissues. In particular, fleshy fruits or juices from these fruits can stop the seed from germinating.

In nature these inhibitor chemicals are washed out of the seeds by heavy rains, but in the nursery the seed coat must be removed and the seeds must be washed in water.

Internal dormancy

Seeds with **internal dormancy** fail to germinate because of factors within the embryo. Dormancy can occur in some seeds because the embryo is not yet fully developed and needs a period of after-ripening. Seeds with this type of dormancy can be stimulated to germinate when they have been subjected to moisture and a period of high temperatures followed by low temperatures, or vice versa. This is known as cold or warm stratification. Sometimes a period of dry storage is sufficient to break the dormancy. Gibberellic acid can also be used to stimulate germination.

Combinational dormancy or **double dormancy** combines two or more kinds of dormancy. In this case, all blocking conditions must be eliminated in the correct sequence for the seed to germinate. Some seeds may require light or dark conditions, particular or alternating temperatures, or a combination of these.



There are several ways in which one can break seed dormancy, depending on the type of seed coating:

8 different ways to break seed dormancy

1. Acid scarification

Acid treatment can be used to break hard seed coat dormancy. It is used for particularly thick and impermeable seed coats. Dry seeds are placed in concentrated sulphuric acid (H_2S0_4) for a length of time, depending on the species and the thickness of the seed coat. The ratio is about one part seed to two parts acid and the amount of seed treated at any one time should not be more than 10 kg. The acid should be at room temperature and containers should be glass or ceramic, never plastic or metal. The seeds and acid can be stirred occasionally with a glass rod, although too much stirring should be avoided as it can cause the acid to heat.

The seeds are removed from the acid after the allotted time, which can be from 10 minutes to 6 hours or more depending on the species, or before the acid penetrates the seed coats. After removal, the seeds can be placed in a large amount of water with a small amount of sodium bicarbonate (baking soda) to neutralise any remaining acid, or they can be washed thoroughly for 10 minutes under running water. After the acid treatment, seeds may either be sown immediately, or dried and stored.

2. Dry heat treatment

Seeds of many species are adapted to germinate in response to direct and indirect cues provided by fire. Heat from flames may break the coats of hard-seeded species such as in *Podalyria calyptrata* (Fabaceae) (sweetpea bush). Dry heat improves germination in members of the Rutaceae (buchus), Rhamnaceae (buckthorns), Ericaceae (ericas or heathers) and Restionaceae (restios) with hard, nut-like seeds. Heat from fire also has a desiccating or drying effect which, combined with wetting, can break the hard seed coats, resulting in germination in *Leucospermum cordifolium* (pincushion).

For this treatment, seeds should be placed in a shallow container in a pre-heated incubator or oven. The specific temperature and time span will depend on the species and the size of the seed and a certain amount of experimentation. Acacia seed, for example, requires two minutes in the oven.
Heat treatment can also be done in a microwave oven. After the treatment, seeds should be cooled and sown.

3. Mechanical scarification

Seeds with hard seed coats can be tumbled in containers lined with sandpaper or mixed with coarse sand or gravel in a revolving container. They can be rolled on a cement floor using a brick or board, or rubbed with sandpaper by hand. Seed coats can be nicked with a knife or cracked gently. Care must be taken not to injure the embryo and it may be necessary to open a couple of seeds to see where the embryo is located to avoid damaging it.

Seeds with hard seed coats such as these *Erythrina lysistemon* (coral tree) seeds can be nicked with a knife or rubbed with sandpaper, taking care not to damage the embryo.

4. Hot water treatment

For small to medium-sized seeds or large quantities of seeds, hot water treatment may be more practical. Seeds should be dropped into about four to six times their volume of water pre-heated to 77–100 °C. The seeds should be left in the gradually cooling water for 12 to 24 hours and then planted. Seeds that have not swollen can be subjected to another treatment.

5. Pre-chilling or cold treatment

Seeds that require cold treatment can be placed on moistened germination substrate and kept at 3–5 °C in a refrigerator for seven days. The treatment may be extended to 14 days for seeds showing more dormancy. After the cold period, the seeds can be sown and allowed to germinate in the (warmer) conditions recommended for the species.

6. Leaching

For seeds with chemical inhibitors in the fleshy fruit and seed-covering tissues, it is necessary to leach or wash these chemicals out. The fruit pulp should be removed first and any inhibiting chemicals left can be removed by soaking the seeds in tap water or by placing them in slowly running tap water for various lengths of time before soaking. When soaking seeds, the water should be changed every 12 to 24 hours. The seeds are sown directly after the treatment.

7. Light and temperature dormancy

Seeds can 'sense' their environment to schedule their germination. The two major natural environmental signals are light and temperature. Seeds perceive **light** – the presence or absence of light indicates how deeply the seed is buried, whether the soil has been disturbed, and whether there are gaps in the canopy. All this could indicate to the seed that conditions are right for germination. The seeds of some species are light sensitive and must receive light during germination. Seeds that require light should not be covered when sown but merely sown on the surface and watered in.

Certain **temperatures** may be required to 'tell' the seeds that the season is good for germination, such as the autumn temperatures required by many fynbos species. The range of temperatures required may be very narrow and specific. Temperature and duration of light and dark can both be required, as for fynbos seeds. These seeds require fluctuating temperatures of 4–10 °C for 16 hours and 20–28 °C for 8 hours. In other words, they will germinate during the hot days and cold nights that happen naturally in autumn. If the recommended temperatures are not available naturally, they must be imitated in a growth chamber or greenhouse at the nursery.

8. Smoke treatment

Seeds of many species are adapted to germinate in response to direct and indirect cues provided by fire. Smoke treatments can cue germination in many fynbos seeds and can be carried out by placing previously sown seed trays in a polythene tent into which smoke is pumped. A mixture of dry and green fynbos plant material is ignited in a metal drum and the resulting smoke is pumped into the tent using bellows or a compressed air line. This system allows the smoke to cool before it enters the tent. The seed trays remain in the tent for about two hours while the smoke settles, after which they are removed and watered.

A simpler method is to place trays in a plastic tent, ignite fynbos material in a small metal drum and then dampen it down to create smoke. The drum is placed inside the tent and the tent is sealed while the chemicals in the smoke settle onto the soil in the trays. The trays can be removed after two hours and watered.

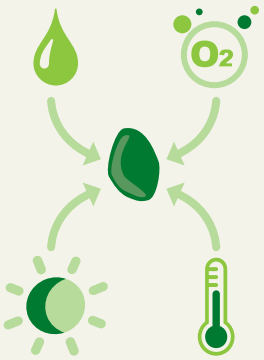
Alternatively, Kirstenbosch Seed Primer can be used. The seed primer is absorbent paper that has been impregnated with a smoke solution and a range of germination stimulators, and then dried and sealed in a polythene packet. Water is added to the paper and seeds are soaked in this solution for 24 hours.

Ignite a mixture of dry and green fynbos plant material in a metal drum and pump the smoke into the tent using bellows or a compressor. Keep the seeds in the tent while the smoke settles. Remove the trays after two hours and water them.

SEED GERMINATION

Germination is the process where seeds absorb water and start to grow and develop after a period of dormancy.

There are four main environmental factors that affect germination and plant growth. These are **water, oxygen, light** and **temperature**.



- The first part of the germination process in seeds is the absorption of water. There should be enough water continuously available for the germinating seed.
- Seeds need to breathe. Dormant seed may need little oxygen, but it is still required. Seeds need more oxygen during germination and the propagation medium in which the seeds are sown should be well aerated. Germination can be severely hindered by sodden, oxygen-poor environments.
- Different species require either light or darkness to germinate.

  Seeds that require light should be sown on the surface and either left, or covered only lightly with fine bark or vermiculite.

  Seeds requiring darkness should be sown deeper and can also be placed in a dark area until germination has started.
- Favourable temperature is another requirement for germination. Some seeds will germinate over a large range of temperatures, whereas others require a narrow range. Some seeds have minimum, maximum and optimum temperatures at which they germinate. The best practice is to find out about the natural ecology and germination of each species and mimic these conditions as best as possible in the nursery.

SEED SOWING

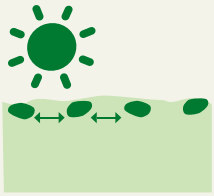
Tip:

Clean and sterilise seed trays before use.

Before filling the seed trays, the trays should be cleaned, sterilised and placed in the sun to dry. The growing medium should be mixed on a clean cement surface. Once the medium and trays are ready, the trays can be filled to a level about 10–20 mm from the rim. This is to keep the water and the medium from spilling over the rim during watering. The medium should be levelled and patted down gently to create a uniform surface. Water it with a very fine rose watering can before sowing the seed.

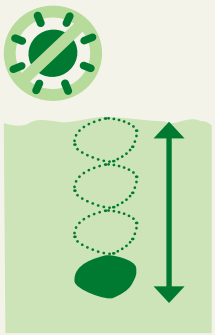
Seeds should be sown evenly and sparingly over the surface of the tray. Seeds sown too densely become overcrowded. Seedlings that have to compete for resources in an overcrowded environment are more prone to disease.

- Very fine seeds can be mixed with sand and scattered over the surface.
- Medium-sized seeds can be scattered or sown in furrows.
- Fine seeds can be gently patted down to give them good contact with the growing medium.
- Large seeds can be sown in rows and pushed gently into the medium.



The seeds can be covered with vermiculite, sifted bark or sifted propagating medium.

Unless they require light to germinate, seeds should generally be planted to a depth of three to four times their diameter. Seeds should be watered with a very fine rose watering can and **labelled carefully**, as explained on page 19, as follows:



1. Name of the plant
2. Date of propagation and potting
3. Name of the propagator (person)
4. Name of the restoration project or restoration area
5. Origin of the plant (where the seeds were collected)

Seeds can be treated with a fungicide such as Apron XL or Previcur N after sowing to prevent losses due to damping off. Seed trays are then placed in the seed house.

The seed trays should be kept moist enough for the seeds to germinate without becoming waterlogged.

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Sowing protea seed in open beds.

© KAMOGELO MODIMOLA

Covering seeds with a fine layer of sowing medium.

VEGETATIVE PROPAGATION

Plants that cannot be easily propagated by seed, or that produce very little or no seed, can be propagated vegetatively (asexually). The main methods of vegetative propagation are stem and leaf cuttings, offsets and division, using various parts of the plant.

Softwood cuttings placed in plug trays in the greenhouse.

STEM CUTTINGS

Stem cuttings may either be softwood, herbaceous, semi-hardwood or hardwood cuttings.

Stem cuttings are segments of shoots that have lateral (side) or terminal (main tip) buds and the potential for adventitious roots to develop.

Stem cuttings can be taken from the tip of the stem with a terminal bud or from other parts of the stem. Some plants can be propagated from either of these, but many plants root best from tip cuttings.

Cutting material should be collected in the cool, early mornings while mother plants are still turgid and fresh. They should be stored in clean plastic bags containing a tiny amount of water to keep the cuttings moist. Cuttings should not be covered in water for prolonged periods, but should be kept moist, cool and turgid at all times.

How to make cuttings

- Cuttings should be made using sharp and sterilised secateurs.
- Stems are cut just below a node and all but the top few leaves are removed neatly with the sharp secateurs.
- Large leaves left on the cutting may be reduced in size by cutting them in half.
- The cuttings are then placed in plug trays that have been filled with a rooting medium. The medium should be well aerated and well drained while being able to retain moisture. The main functions of the medium are to hold the cutting in place, to provide moisture to the cutting, to allow an exchange of air at the rooting zone and to create a dark environment for the cutting base.

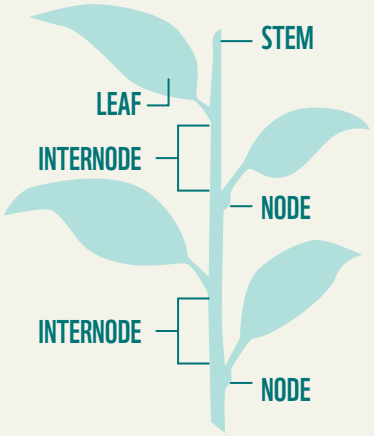
Taking cuttings, cutting just below a node.

Mixture	Components
Cutting mix 1	1 part fine bark and 1 part polystyrene
Cutting mix 2	1 part fine bark and 1 part coarse sand
Cutting mix 3	1 part bark and 1 part perlite

Rooting hormones can be applied to speed up rooting and are sometimes necessary for hard-to-root species. An inexpensive, easy-to-use and effective rooting hormone is Seradix, which comes in various strengths: Seradix 1, 2 and 3. The cutting is dipped into the powdered rooting hormone to form a thin layer on the open cut part of the stem.

SOFTWOOD CUTTINGS

Softwood cuttings are prepared from the soft, succulent new growth of stems and are usually tip cuttings.



The cuttings should not be too soft and tender, as these tend to rot. The best material should be flexible but mature enough to break when bent sharply. Softwood cuttings generally root easier and quicker than other types, but require more attention.

- The cuttings are made by cutting a shoot that includes at least four nodes, two for roots and two for shoots.
- The basal or lower cut is made just below the node. In the case of middle-of-the-stem cuttings without a terminal shoot, the upper cut is made just above the node.
- The leaves on the lower two-thirds of the stem are removed.
- To sterilise the cutting, it can be dipped into a diluted bleach solution, a disinfectant like Sporkill or various broad-spectrum fungicides mentioned earlier.
- The bottom or basal end of the cutting can then be dipped into a rooting hormone for softwood cuttings, such as Seradix 1.

A hole is made in the rooting medium and the cutting is placed into the hole. The medium is pushed firmly against the stem. The cutting is then watered to settle it down and placed in a greenhouse, propagation tunnel or open-air greenhouse with intermittent misting and bottom heat.

A softwood cutting.

A rooted softwood cutting.

HERBACEOUS CUTTINGS

Herbaceous cuttings are made from succulent, non-woody plants such as geraniums, pelargoniums or vygies and succulents such as *Portulacaria afra* (spekboom).

- These cuttings can be from 8 to 13 cm long with a few leaves retained at the tips, but they will grow even without leaves.
- Succulent herbaceous cuttings are often left to callus or 'seal' for a few days to a week before inserting them into the rooting medium.
- Rooting hormones are not always required but can be beneficial for the development of heavier root systems.
- Herbaceous cuttings can be rooted under the same conditions as softwood cuttings but can also be rooted in a shade house without frequent intermittent misting.

A herbaceous pelargonium cutting.

A rooted herbaceous pelargonium cutting.

SEMI-HARDWOOD CUTTINGS

Semi-hardwood cuttings are usually taken in summer from new shoots that have been allowed to partially mature, after flowering and just after a flush of growth has taken place.

- They are made 7,5–15 cm long and two-thirds of the leaves of the lower portion are removed.
- If the leaves are very large, they may lose too much water and be unable to photosynthesise and make food, which is necessary for root formation as softwood and semi-hardwood cuttings depend on food produced while in propagation. Large leaves may be trimmed to a third or half their size to reduce the leaf surface area, lowering water loss.
- The bottom or basal cut for semi-hardwood cuttings can be made at a slant, or cuttings can be wounded to expose more cambium (the green layer just under the bark). This is where rooting takes place and it will create a greater surface area from which rooting hormones can be absorbed. It may also improve the contact area between the cutting and the medium.
- The rest of the cutting-making process is the same as for softwood cuttings.

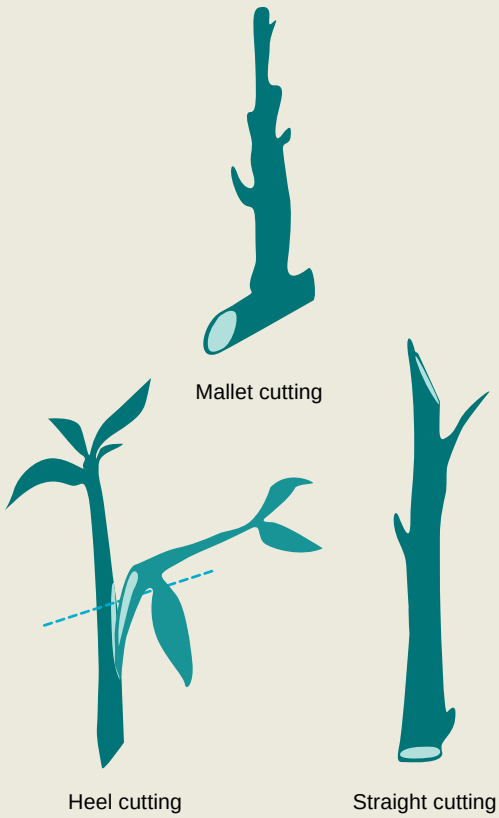
HARDWOOD CUTTINGS

Hardwood cuttings are generally made from deciduous (plants that lose their leaves in winter or summer) or semi-deciduous species and are made using hard, woody material.

- Hardwood cuttings are taken before the end of winter when the sap is rising and the buds are about to swell.
- The wood is usually from the previous season's growth, but for a few species older wood can also be used.
- Material should be taken from healthy, moderately vigorous mother plants.
- The wood should not have abnormally long internodes, nor be from small, weak interior shoots.
- In general, hardwood-cutting material is ready when the leaves can be removed without tearing the bark.
- Hardwood cuttings can be from 10 to 76 cm long. The smaller cuttings should have a diameter of 0,6 to 2,5 cm. Very long cuttings, whose diameter can be more than 40 mm, are called **truncheons**.
- Hardwood cuttings can also be wounded as in semi-hardwood cuttings.
- Deciduous cuttings are made without leaves, but hardwood cuttings can also be made from narrow-leaved evergreen species, in which case some leaves remain on the tip of the cutting.
- Cuttings can be treated with a hormone such as IBA at 2 500 to 5 000 ppm or Seradix 3 for hardwood.
- Hardwood cuttings can be rooted in a greenhouse with bottom heat of 18 to 21 °C. These cuttings can also be rooted in a shade house but must be kept moist.

Tip:

Hardwood cuttings should not be allowed to dry out during handling and storage.



Mallet, heel and straight cuttings

Three different types of hardwood cuttings can be made, namely **mallet**, **heel** and **straight** cuttings.

A **mallet** includes a short entire section of stem of the older wood while a **heel** is pulled off the old stem, taking with it a small piece of the older wood.

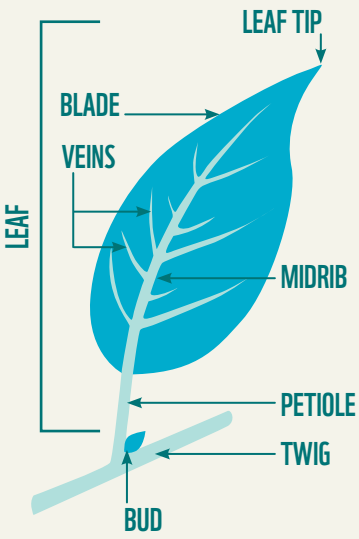
Heel cuttings are usually made from semi-hardwood and hardwood cuttings. Species of erica and buchu propagate successfully from heel cuttings.

- This type of cutting is made by tearing a side shoot off the main stem so that a part of the main stem remains attached to the base of the cutting. This is the heel.
- Rooting takes place at the callus tissue that forms around the heel.
- The lower leaves are removed and the cuttings are rooted under the same conditions as for softwood and semi-hardwood cuttings.

A **straight cutting** is the most commonly used and does not include any older wood. The straight bottom or basal cut is made just below a node while the top of the cutting is made above a node and is cut at an angle to make it easier to distinguish between the top and the bottom of the cutting.

LEAF CUTTINGS

Some plants can be propagated by means of leaf cuttings, where the leaf blade or the leaf blade and petiole (leaf stalk) are used as cutting material.



Adventitious buds, shoots and roots form at the base of the leaf and develop into a new plant. Species such as Streptocarpus (Cape primrose), Sansevieria (mother-in-law's tongue), Gasteria (ox tongue), Haworthia (zebra plant), Crassula (jade plant) and Kalanchoe can be propagated in this way. Some bulbs or geophytes can also be propagated by leaf cuttings, including Lachenalia (wild hyacinth) and Haemanthus (paintbrush lily).

- The leaf is removed from the mother plant by slicing cleanly through the petiole so that about 5 cm of stalk is attached to the leaf. A small hole is made in the propagating medium and the leaf petiole is inserted into the medium at a shallow angle so that the leaf blade lies almost flat on the medium and the stalk is close to the surface. The medium is pressed down firmly around the stalk. New plantlets will form on the cut surface of the leaf stalk.
- In one method, the long tapering leaves in species such as Sansevieria (mother-in-law's tongue) are cut into horizontal sections of 8 to 10 cm long. Three-quarters of the leaf section is inserted into the rooting medium and after some time, a new plant forms at the base of the leaf piece.
- Plants with fleshy and usually hairy leaves such as Streptocarpus (Cape primrose) can be propagated by making incisions into the large veins on the underside of the leaf. The leaf is laid flat on the surface of the propagating medium and pinned or held down with the upper surface of the leaf exposed. New plants form at the place where each vein was cut and the old leaf gradually disintegrates.
- Some leaf cuttings can be made by cutting large leaves into triangular sections, each with a section of a large vein. These leaf pieces are then inserted upright into sand with the pointed end down. The new plant develops from the large vein at the base.

Well-developed, healthy leaves should be used and leaf cuttings should be rooted under the same conditions of high humidity as softwood cuttings.

Tip:

Well-developed, healthy leaves should be used for leaf cuttings.

Dipping leaf blade into the rooting hormone.

Planting leaf blade cuttings.

OFFSETS AND DIVISION

Some plants can be propagated vegetatively (asexually) by separating or dividing them.

Offsets are produced by some species such as cycads, some aloes and many bulbs. An offset is a lateral or side shoot or branch that develops from the main stems.

- Offsets can be removed by cutting them off close to the main stem with a sharp knife.
- Some offsets may have already produced roots and can be planted directly.
- If the offsets are not sufficiently rooted, they can be placed in a rooting medium and treated in the same way as a leaf cutting.

Many herbaceous perennials and grasses produce their new shoots from crowns at the surface or just below ground level. These can be increased by **division**.

- The plant is lifted out of the ground, usually in the spring just before new growth begins.
- It is either separated by hand or cut into sections with a knife or other sharp instrument.
- These divisions can then be planted straight into the veld or into bags for growing on.

Division of agapanthus by cutting into sections and replanting.

Offsets, *Prionium serratum.*

PLANTING ON SITE

This guide has outlined some propagation techniques and provided information on the general guidelines for growing plants to plant back into nature as part of a restoration programme.

The next step for any enthusiastic plant propagator is to read as much as possible about the desired species and to mimic in the nursery the natural environment in which the plants grow and regenerate.

Once the plants grown for restoration have been successfully propagated, they are planted into containers and placed in shade for a few weeks until they are ready to be moved out into the sun. Watering is reduced at each stage to harden the plants off and prepare them for planting on site. Hardening off is particularly important when growing for rehabilitation as plants only receive water from natural rainfall after they are planted.

Planting on site should ideally take place during the rainy season. The plants are transported to the rehabilitation site and placed under a temporary shade structure and kept moist, if possible, until they are planted. Care should be taken during the transportation stage that plants do not become damaged due to rough handling. Planning should be such that plants do not remain out in the veld for too long or over weekends without watering.

Plants should be placed deep enough into planting holes to allow for a shallow bowl around each plant to collect moisture. If possible, plants are given an initial watering at planting, after which they rely on moisture present in the soil and natural rainfall.

If care is taken at each stage in the process, it is possible to rehabilitate a degraded landscape so that it can become a functional ecosystem again.

Planting threatened species in Tokai Park in Cape Town.

GLOSSARY

Achenes	A dry one-seeded fruit that does not open to release the seed.
Adventitious roots	Roots that are formed from areas of the plant other than the root, such as stems or leaves.
Bulbs	Structurally a short stem or basal plate from which a growing point or flower arises. This is enclosed by concentric layers of fleshy leaves that function as food storage organs during dormancy and dry periods.
Callus	A soft tissue that forms over a wounded or cut plant surface, leading to healing, which arises from cells of the cambium. This is also where roots form on cuttings.
Capsules	A dry fruit that releases its seeds by bursting open when ripe, such as a pea pod or Gladiolus pod.
Catchment	The geographic, usually mountainous, area from which rainfall accumulates and flows into a river, lake, wetland or reservoir.
Climbers	A plant that grows upwards by attaching itself to other plants or objects.
Cones	The dry fruit of conifers or Leucadendron (cone bushes), typically tapering to a rounded end and formed of a tight array of overlapping scales on a central axis which separate to release the seed.
Cultivation	The act of caring for or raising plants.
Damping off	A disease caused by several different pathogens which affects seedlings before or after germination. Stems often rot at soil level and the seedlings die.
Deciduous	Plants that lose their leaves or become dormant either during winter when it's cold, or summer when it's dry.
Dormancy	A period in an organism's life cycle when growth, development and (in animals) physical activity are temporarily stopped.
Ecosystem	A biological community of interacting organisms and their physical environment.
Ecosystem services	Services and benefits provided by nature or ecosystems, such as water, climate control, soil, recreational benefits, oxygen, etc.
Endangered species	A species that has been assessed as having very few populations or individuals left in the wild and is at risk of extinction.
Endemic species	A species that is only found in a particular region or area.
Evergreen	Plants that do not lose their leaves or become dormant during winter or dry periods.
Fermentation	The process where fruit breaks down and becomes softer and is easier to remove from seeds.

Follicles	A dry fruit that is derived from a single carpel (ovary, stigma and style) and opens on one side only to release its seeds.
Geophyte	Plants that have underground storage organs such as bulbs, corms, tuberous roots or rhizomes that store water and nutrients during unfavourable conditions.
Germination	The process whereby a seed overcomes any dormancy, absorbs water and starts to grow and develop.
Grasses	Herbaceous plants with jointed stems and spikes of small wind-pollinated flowers, leaves with blades and sheaths at the nodes along hollow culms/stems.
Greenhouse	A glass/polycarbonate-enclosed structure for propagating plants, particularly from cuttings. Also used to grow plants that need protection from cold or need particular environmental conditions that can be simulated inside a greenhouse.
Growing on	The process after potting and hardening off when the plant is placed in its final growing area to grow up.
Habitat	The natural home or environment of an animal, plant or other organism.
Herbaceous perennials	A non-woody plant whose growth may die down annually but whose roots or other underground parts survive. Also a non-woody plant that only lives for 4–5 years.
Herbarium specimen	Pressed and dried plants that have been mounted together with a data label. A type specimen of all species is kept at national herbariums. The species description and Latin name are based on these specimens. Plants collected in the field can be sent to the herbarium for verification of the species. Field herbariums of species can be kept for easy reference.
Indigenous species	A species that naturally occurs in a region.
Leaf blade	The broad flat part of a leaf.
Medium	Soil or other components in which plants are germinated, rooted or grown.
Mother plant	A healthy, adult plant from which growers take cuttings or collect seeds. Cuttings, or clones, as they are often called, are expected to grow into adult plants that have the same genetics as the mother plant.
Node	The part of a plant stem from which one or more leaves or buds emerge, often forming a slight swelling.
Petioles	The little stem that attaches the leaves to the main stem.
Potting shed	A shed or structure that is a work area for potting plants into pots and trays.
Potting soil	A medium in which to grow plants in pots after the propagation stage is completed.
Propagation	To grow a new plant from a parent plant or seeds by using a variety of different means.
Propagation house	A building similar to a greenhouse where the process of growing new plants from a variety of sources like seeds, cuttings and other plant parts takes place.

Pruning	A horticultural practice involving the selective removal of certain parts of a plant, such as branches, buds or roots.
Restios	A wiry reed-like plant of southern Africa, used for thatching and brooms, with green culms/stems without obvious leaves and with split leaf sheaths occurring along nodes.
Secateurs	Sharp cutting tools used for making cuttings and pruning.
Sedges	Plants with solid and often triangular culms/stems, bearing flowers not right at the tip and leaves and leaf sheaths clustered at the base of the plant.
Seed house	A shaded structure with raised benches or open beds for germinating seeds.
Seed primer	Absorbent paper that has been impregnated with smoke solution. Water is added to the paper and seeds are soaked in this solution for 24 hours.
Seedling mix	The mixture of different soil or soil-like ingredients in which seeds are sown and germinated.
Shade house	A structure enclosed by shade netting that allows required sunlight, moisture and air to pass through, creating an appropriate microclimate conducive to plant growth.
Shrubs	A woody plant that is smaller than a tree and has several main stems arising at or near the ground.
Side shoot	A side-growing shoot that arises from a stem.
Siliques	The long, narrow seed pod of many plants of the cabbage family, derived from two carpels splitting open along both sides when mature.
Smoke treatment	A mixture of dry and green fynbos plant material is ignited in a metal drum and the resulting smoke is pumped into a tent containing fynbos seeds using bellows or a compressed air line.
Succulents	Plants that have some parts that are more than normally thickened and fleshy, usually to retain water in arid climates or soil conditions.
Transplanting	The process of removing a plant from the place where it has been growing and replanting it in another place.
Tributary	A smaller river or stream that connects to, and flows into a larger river or lake.
Vegetative cells	Cells of plants that are actively growing.
Water shadow	The area around plants where water from a sprinkler system reaches.

USEFUL RESOURCES

Organisation	Website	Topics
Botanical Gardens Conservation International (BGCI)	bgci.org	Various topics
Brahms online (SANBI)	newposa.sanbi.org	Localities Herbarium records
Millennium Seed Bank Resources	kew.org/science/our-science/projects/banking-the-worlds-seeds brahmsonline.kew.org/msbp/Training/Resources	Seed information Propagation protocols for South African species
Plantzafrica	pza.sanbi.org	Individual species information How to propagate
Sabonet	sanbi.org/document-type/sabonet-publications	A free resource Books on a variety of subjects
Society for Ecological Restoration	ser.org	Restoration
South African National Biodiversity Institute (SANBI)	sanbi.org bgis.sanbi.org	Vegetation maps General information
WWF	wwf.org.za	General and specific conservation projects

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propagate and stock plants required for replanting into the veld

22

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