Appendix H2: Rehabilitation Plan

RESTORATION PLAN TO IMPROVE THE STRUCTURE AND COMPOSITION OF DEGRADED SWARTLAND GRANITE RENOSTERVELD AT SPIER ESTATE, WESTERN CAPE

Prof. Patricia M Holmes (PhD), Cape Ecological Services

13th May 2020, updated 26th March 2021

INTRODUCTION

Spier Estate plans to cultivate an additional 19.5 hectares of virgin land (i.e. land left fallow for > 10 years) for vineyards on part of the Remainder Portion 10 of Farm 502, Stellenbosch District (Figure 1). As part of the environmental impact assessment, a specialist vegetation survey was conducted during Spring 2019 to determine the condition and sensitivity of the indigenous vegetation of the area identified as suitable for vineyard expansion (McDonald 2020). The vegetation type is Swartland Granite Renosterveld (Rebelo et al. 2006), which is Critically Endangered (NEM:BA). However, the vegetation survey concluded that the preferred area for development was disturbed secondary vegetation, dominated by pioneer shrubs, and suggested that it may have been cultivated more than 20 years previously.

The vegetation remnant is classified as a Critical Biodiversity Area in the Western Cape Biodiversity Spatial Plan; however McDonald (2020) concluded this to be an over-inflated category owing to the degraded nature of the vegetation and recommended that at most it should be classified as an Ecological Support Area. The specialist recommended that the preferred alternative of cultivating the 19.5 hectares of vegetation may be supported with mitigation to reduce the impact of habitat loss to 'very low negative'. The recommended mitigation is to conserve the remaining natural vegetation on site (both high quality and degraded areas) and to restore degraded vegetation towards a more diverse plant community more typical of Swartland Granite Renosterveld.

Terms of Reference

To compile a restoration plan to improve the ecological integrity and biodiversity of Swartland Granite Renosterveld in a 10 hectare degraded vegetation area that will form a corridor linking the undisturbed vegetation remnant to other semi-natural areas on the estate once the 19.5 hectare area has been developed to vineyards (Figure 1).

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Note: The above ToR was updated in March 2021 following comments from DEA&DP in which only 10ha of the 19.5 hectare area was approved for development with the remainder to be included in the restoration plan (Figure 2).

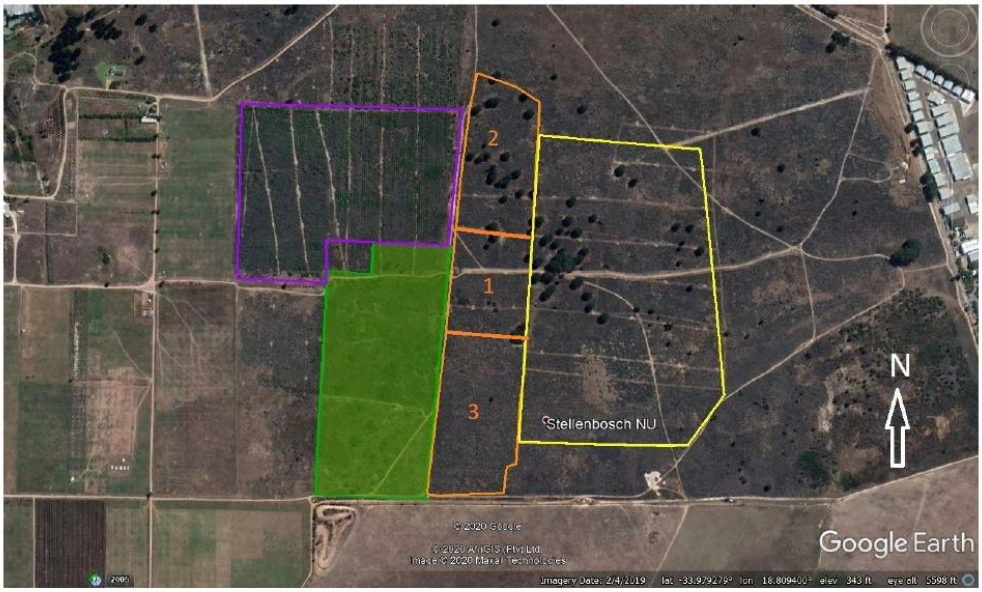

Figure 1. Aerial image of the relevant Spier Estate land portion, indicating cultivated areas, fallow areas supporting degraded renosterveld and a natural renosterveld area (green filled polygon). The preferred area for new cultivation is indicated by the yellow polygon and the identified corridor area targeted for mitigation action is indicated by the orange polygon. Portions 1, 2 and 3 of the corridor are described below. Large alien pine trees (*Pinus pinea*) are evident on the image.

SITE BIOPHYSICAL INFORMATION

Spier Estate soils are dominated by granitic parent materials that weather to coarse sandy or loamy soils. Where annual rainfall is less than 600 mm p.a. such clay-rich soils generally support renosterveld vegetation, in this case Swartland Granite Renosterveld, potentially grading into fynbos vegetation in any sandier, less fertile soils or in wetter areas where soils are more leached of nutrients. Although long-term average rainfall on Spier Estate is 700mm p.a., it is variable with only half that amount received over the last five years (Estate Manager, pers. Comm.).

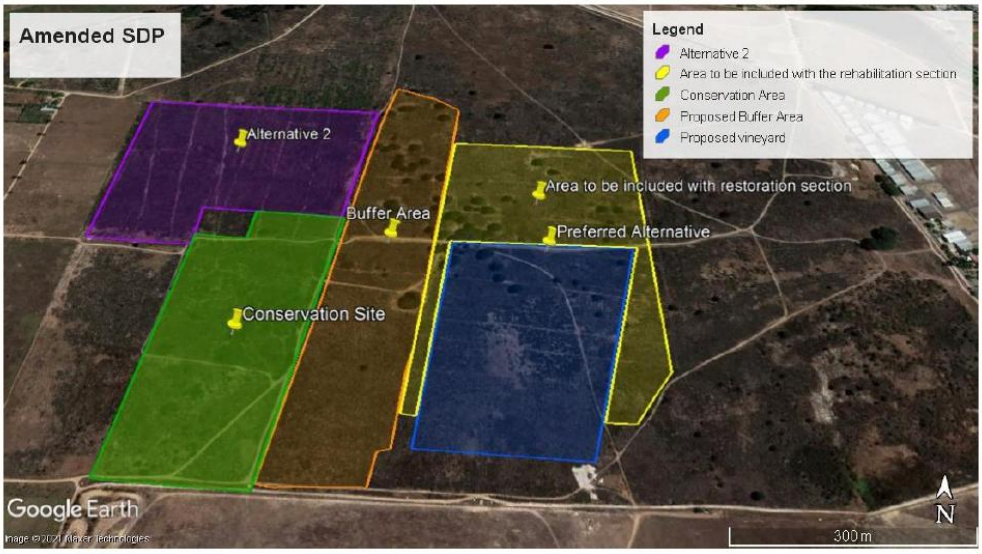

Figure 2. Updated aerial image (March 2021) showing the reduced area approved for vineyard development (blue polygon) and the additional area to be included with the restoration plan (yellow polygon).

In common with fynbos vegetation types, renosterveld vegetation is a fire-driven ecosystem requiring periodic summer fires to thrive and maintain ecological integrity. Plant species regenerate mainly during the rainy season after a fire. However, in contrast to fynbos, renosterveld historically supported episodic grazing and browsing by large ungulates: note that this was not continuous grazing, but short periods of intense grazing as herds of game migrated through the area and moved elsewhere, allowing time for subsequent vegetation recovery. Swartland Granite Renosterveld is described as a mosaic of herbaceous vegetation patches, dominated by perennial grasses, and shrubland dominated by ericoid- and cupressoid-leaved shrubs, such as renosterbos (*Elytropappus rhinocerotis*). Geophytes (e.g. bulbous and cormous species) and annuals are prominent after fires. Small trees and larger shrubs (e.g. Wild Olive, *Olea europaea* subs. *africana*) form thickets that are confined to fire-protected rocky outcrops or areas of high productivity, such as heuweltjies (Rebelo et al. 2006).

The degraded renosterveld on the estate, as described by McDonald (2020), is species-poor, missing some of the key growth form components such as geophytes and perennial tussock grasses, and dominated by a few indigenous pioneer Asteraceae shrub species.

Invasive alien tree and shrub species and other alien weeds, including annual grasses, are prominent (McDonald 2020).

Restoration of this site will require the re-establishment of ecological processes, such as a typical renosterveld fire regime with a fire return interval of 5-10 years in summer, and the re-introduction of missing components, such as key growth forms and plant species, either by seed or rootstock during the post-fire recruitment window. Control of invasive alien vegetation will be another important requirement (see “Fixing the Damage” chapter in “Fynbos Ecology and Management”, edited by Esler et al. 2014).

Box 1 outlines the generalized species composition for Swartland Granite Renosterveld (Rebelo et al. 2006; note: some of the species’ scientific names may require updating).

RESTORATION PLAN FOR THE DEGRADED TEN HECTARE CORRIDOR AREA

Restoration Goal

The restoration goal is to reinstate the natural renosterveld vegetation structure and functioning. This will ensure that the ecological integrity of the remnant approaches a near-natural state, whereby the Swartland Granite Renosterveld vegetation type is better conserved in the long-term.

The implementation of an effective management plan, with particular reference to veld restoration, fire management and invasive species management, will assist in the long-term contribution that the site makes towards the overall conservation efforts of this Critically Endangered vegetation type. Threatened and endemic taxa requiring population augmentation and other species of interest that historically would have occurred in the area may be re-introduced after future fire-cycles if not feasible to do so after the first prescribed burn.

Current corridor habitat condition

Please refer to figure 1 for locations of the corridor descriptions below.

Section 1

Section 1 lies across the hilltop and has more loamy (clay-rich) soils than the lower sections 2 and 3. Where rocky granite boulders or outcrops occur some thicket elements can establish, including *Olea africana* (Wild Olive). The vegetation here is dominated by common Asteraceae shrubs (*Elytropappus rhinocerotis, Eriocephalus africanus, Athanasia trifurcata,* Helichrysum crispum, *Seriphium plumosum*) and other common shrubs such as *Passerina*

corymbosa, *Anthospermum aethiopicum* and *Phylica c.f. imberbis*. There are a few forbs and graminoids such as *Senecio hastatus* and *Pentameris* sp. respectively. Weed species are relatively uncommon. Section 1 should be improved by the re-introduction of geophytes, perennial graminoids and additional perennial forb and shrub species to boost structure and diversity (see Table 2).

Photo: Section 1 degraded vegetation of proposed corridor

Section 2

Section 2 lies downslope and to the north of Section 1. It differs in having very sandy granitic soils and a dominant understorey of *Cynodon dactylon* (Kweek), possibly suggesting a different land-use history. The dominant shrubs are the same as above, with the addition of the common legume shrub *Otholobium hirtum*. The site conserves more geophytes, with some dense patches of bulbs coinciding with the shrub-free *Cynodon* patches (e.g. *Bulbine praemorsa, Moraea fugax, Geisorhiza aspera, Monsonia speciosa, Oxalis* spp and *Pelargonium myrrhifolium*). Here the dense turf of *Cynodon dactylon* would need to be removed before sowing a mix of additional indigenous species (possibly by applying herbicide on grass regrowth following a summer burn and before indigenous species emerge post-fire). Perennial forb, graminoid and shrub species should be re-introduced to boost structure and diversity (Table 2). The sandy nature of the soils indicates that some of the ecotonal species (i.e. between granite renosterveld and fynbos) could also be re-introduced. These include the restios: *Restio gaudichaudiana, Willdenowia glomerata,* Proteaceae such as *Leucadendron lanigerum*, *Leucospermum grandiflorum* and Ericaeae such as *Erica*

paniculata. This section has most of the mature pines occurring on the proposed corridor and these should be removed.

Photo: Section 2 of corridor showing Cynodon patches

Photo: Mature pines in Section 2 of proposed corridor

Section 3

Section 3 lies downslope and to the south of Section 1. It is similar to Section 2 in having very sandy, granitic soils. This section is the weediest of the three, probably because it was ploughed up for sweet potatoes as recently as 2005. The common Asteraceae shrub species are present, dominated by *Seriphium plumosum* but less dense than in the other sections. *Cynodon dactylon* is not evident as an understorey plant. The weedy indigenous herbaceous perennial, *Nidorella ivifolia* (Ovenbush, Oondbos) is quite prominent, as is the alien annual weed *Erigeron bonariensis*. Here a hot summer fire would help to reduce the annual weed presence (by burning their shallow seed banks), but a higher density of post-fire sowing and/or planting of rootstock would be required to restore structure and biodiversity here than in the other sections to compensate for the weedy nature of the site. It may also be appropriate to sow a higher density of indigenous annuals and fast-growing shrubs in this section to suppress any alien weeds that germinate. This section would also be suitable for the re-introduction of ecotonal fynbos elements as described above.

Additional Restoration Area (Figure 2. Yellow polygon)

This area has been degraded by previous ploughing and should be treated as for Section 2 where there is dense Kweek and Section 3 where Kweek is less dominant. Any dense turf of *Cynodon dactylon* would need to be removed before sowing a mix of additional indigenous species (possibly by applying herbicide on grass regrowth following a summer burn and before indigenous species emerge or are sown post-fire). Invasive alien species should be controlled both before and after the prescribed burn. Perennial forb, graminoid and shrub species should be re-introduced to boost structure and diversity after fire, as described above for Section 3 (Table 2).

Reference Ecosystem

The natural remnant adjacent to the corridor may be used as a reference for intact Swartland Granite Renosterveld (photo below). Other extant renosterveld remnants in the wider area, such as drier sections of the Bottelary Hills, may provide additional information on the structure and species composition of the target plant community.

Photo: Natural renosterveld remnant at Spier Estate

Photo: Rocky outcrop with taller thicket elements present

Box 1. Important and Endemic Taxa for Swartland Granite Renosterveld (Rebelo et al. 2006)

Important Taxa:

Tall Shrubs (Cape thickets=T): *Euclea racemosa subsp. racemosa T, Olea europaea subsp. africana T, Putterlickia pyracantha T, Searsia laevigata T, Aspalathus acuminata subsp. acuminata, Osteospermum monilifera, Diospyros glabra T, Dodonaea viscosa var. angustifolia, Maytenus oleoides T, Myrsine africana T, Passerina corymbosa, Searsia angustifolia T, S. crenata T, S. tomentosa T, S. undulata T, Wiborgia obcordata.*

Low Shrubs: *Anthospermum aethiopicum, Elytropappus rhinocerotis, Eriocephalus africanus var. africanus, Felicia filifolia subsp. filifolia, Salvia lanceolata, Anthospermum galioides subsp. galioides, Aspalathus hispida, Asparagus rubicundus, Athanasia trifurcata, Chironia baccifera, Erica paniculata, Galenia africana, Gnidia squarrosa, Helichrysum cymosum, H. dasyanthum, H. revolutum, H. teretifolium, Hermannia alnifolia, H. hyssopifolia, H. prismatocarpa, Leucadendron lanigerum var. lanigerum, Lobostemon argenteus, L. fruticosus, Nenax hirta subsp. hirta, Oftia africana, Phylica thunbergiana, Searsia dissecta, S. rosmarinifolia, Salvia africana-caerulea, Stoebe cinerea.*

Succulent Shrubs: *Lampranthus sociorum.*

Woody Climbers: *Cissampelos capensis, Microloma sagittatum.*

Herbs: *Helichrysum crispum, Annesorhiza macrocarpa, Cotula turbinata, Hebenstretia paarlensis, Lichtensteinia obscura, Stachys aethiopica.*

Geophytic Herbs: *Mohria caffrorum, Chlorophytum undulatum, Geissorhiza monanthos, Moraea papilionacea, Oxalis obtusa, O. pes-caprae, O. purpurea, Pelargonium longifolium, Romulea eximia, R. rosea, Sparaxis parviflora, Watsonia borbonica subsp. borbonica.*

Succulent Herb: *Crassula capensis.*

Herbaceous Climber: *Cynanchum africanum.*

Graminoids: *Ehrharta calycina, E. villosa var. villosa, Restio gaudichaudiana, Cymbopogon marginatus, Ehrharta longiflora, E. ottonis, E. thunbergii, Restio capensis, Thamnochortus bachmannii, Themeda triandra, Tribolium uniolae.*

Endemic Taxa:

Low Shrubs: *Agathosma hispida, A. latipetala, Aspalathus glabrata, A. rycroftii.*

Succulent Shrubs: *Antimima menniei, Erepsia hallii, Lampranthus citrinus, L. scaber, Phyllobolus suffruticosus, Ruschia klipbergensis.*

Herbs: *Arctopus dregei, Oncosiphon glabratum.*

Geophytic Herbs: *Babiana pygmaea, B. regia, B. rubrocyanea, Geissorhiza darlingensis, G. eurystigma, G. malmesburiensis, G. mathewsii, G. radians, Haemanthus pumilio, Ixia aurea, I. curta, Lachenalia purpureo-caerulea, Moraea amissa, Oxalis stictocheila, Watsonia humilis.*

Restoration Annual Plan of Operation

The Restoration Annual Plan of Operation (RAPO, Appendix 1) must include and integrate invasive alien plant control, fire management and species re-introduction by seed and/ or rootstock. The RAPO includes pre-fire and post-fire operations and therefore spans several years and will include the following generalized operational guidelines. Note that the factors outlined below may not all be relevant to every site, but should be considered in operational planning.

Alien Vegetation Control

Goal: To remove and control invasive alien vegetation by the most cost-effective method that simultaneously minimizes damage to indigenous vegetation. **Note:** *All the invasive alien trees listed in Table 1 must be removed from the conservation and restoration corridor areas prior to the prescribed burn, including the mature pines that fall into these sections.* These species outcompete and replace the indigenous species and will proliferate after fires.

Refer to Table 1 for examples of appropriate invasive alien plant species control methods. Note that initial and follow-up control will be required for most invasive species. The most important alien species to control ahead of prescribed burning are the trees and shrubs: *Pinus pinea* (Stone Pine), *Eucalyptus cladocalyx* (Sugar Gum), *Acacia longifolia* (Long-leaved Wattle), *Acacia saligna* (Port Jackson Willow), *Leptospermum laevigatum* (Australian Myrtle) and perennial herbs such as *Pennisetum clandestinum* (Kikuyu). Most of the alien annual weeds (e.g. *Erigeron* and *Bromus* species) with shallow soil seed banks may be controlled by the summer prescribed burn which should kill a large portion of their seed banks. However, herbs such as Patterson's Curse (*Echium plantagineum*) should be manually or chemically controlled to prevent further spread (this plant is toxic to herbivores).

Pre Operation: Site Evaluation:

a) Vegetation: Invasive alien species present and their perceived re-invasion potential (seed bank), density or coverage, area (ha), growth stage (vegetative, flowering, fruiting); indigenous species of concern (rare and threatened);

b) Terrain: slope, accessibility, mobility

c) Labour: type – skilled / unskilled

d) Method: type – manual, mechanical, chemical, biological, integrated

e) Biophysical conditions: environmental constraints, timing (season)

f) Costs: labour, transportation, maintenance, equipment

During – Operation

a) Monitor clearing process: ensure methods are applied correctly (quality control)

Post – Operation

a) Appropriate method for removal of alien slash material (e.g. ecological block burn, brush piles and/ or remove large wood to reduce risk of heat scars; *in corridor area remove large wood & scatter smaller branches to assist prescribed burn*)

b) Monitoring: follow-up requirement (regrowth of aliens)

    - Monitor alien regrowth from resprouts and seed germination
    - Apply appropriate follow-up control at optimal time & season.

Fire Management

Goal: To conduct a prescribed burn to promote indigenous vegetation recovery and provide a window for species re-introductions by seed and rootstock. **Note:** *Summer fire is an essential process, both for ecological restoration and long-term biodiversity management.* Fynbos and renosterveld flora and fauna are adapted to summer fires. In the case of some animals, like tortoises, they behave like plants in burying their eggs (rather than seeds) in the soil from where they hatch in April after the summer fire season. Late autumn fires can therefore kill young tortoises. The adults do not need to be removed before fire as the next generation will replace them (as for the plants that rely on seeds). If too many tortoises are "rescued" they will carry pathogens onto the next generation. They will also over-graze the young restoration seedlings that germinate post-fire. Only in extreme cases, such as for the Critically Endangered Geometric Tortoise (which does not occur at Spier) should animals be rescued ahead of fires.

The Spier site is relatively flat and will be surrounded by cultivated land so it should be relatively straightforward to conduct prescribed dry season burns. Remaining natural areas should be divided into blocks and burnt in consecutive years, with the 10 ha corridor area being the first block burnt to allow integration of the other restoration interventions. *Note that renosterveld dominated by renosterbos only burns well under hot, dry conditions and resists burning if the humidity is too high, so a summer burn should be planned for*. Reasonable pre-fire protection measures are necessary, as well as a plan of action in the event of wildfire. Consultation with the Municipality and independent stakeholders, as well as the local Fire Protection Association (FPA), is advised (refer to the National Veld and Forest Fire Act 101 of 1998) as a permit will be required for the burn.

Pre – Operation: Site Evaluation:

a) Vegetation: indigenous vegetation cover and condition; invasive alien vegetation present

b) Terrain: slope, accessibility, mobility (*not relevant in this case as accessible and relatively flat*)

c) Labour: type – skilled / unskilled

d) Method: type – brush piles, fire breaks, ecological block burns (*block burn in this case*)

e) Administration: permits, FPA letters, first aid kit; create check list for day of burn

f) Biophysical conditions: environmental condition, climatic conditions, timing (*season: summer in this case*)

g) Costs: labour, transportation, maintenance, equipment.

During – Operation

a) Equipment: appropriate equipment is available

b) Biophysical conditions: environmental conditions, climatic conditions and timing are to be monitored closely prior to the burn

c) Administration: permits, FPA letter, first aid kit (necessary documents must always be in hand; refer to fire check list)

Post – Operation

a) Monitoring of objectives: (note also immediate post-fire assessment e.g. fire debris that may pose a risk, soil erosion risk: *unlikely an issue here on gently undulating land*)
    - later post-winter assessment: Indigenous and alien vegetation regrowth
    - specific restoration operations to apply (fire, erosion control, re-introductions)

Re-introduction of Plant Species

Goal: To re-introduce key structural growth forms and plant species historically occurring in the degraded site in order to improve ecological integrity.

Ten hectares is a large area to restore in terms of obtaining sufficient seeds and rooted material to re-introduce post-fire. It is suggested to rather sow and plant a series of patches across the corridor, selecting species mixes and quantities that suit each of the three corridor sections. In fynbos biome ecosystems the general rule of thumb is to sow the

equivalent of 10kg cleaned seed per hectare. Seeds need not all require total cleaning, so if partial cleaning is done a higher mass of seeds must be sown to compensate for this. Depending on the amount of seed collected and the number of rooted plants propagated, the number and size of patches for re-introduction may be calculated and mapped. Here the idea is to facilitate future dispersal of desirable species from these patches across the site, so that with each fire event a larger proportion of the area becomes colonized with desirable renosterveld species. It is also possible in the second autumn post-fire to sow additional material into patches that remain very bare, provided seeds are pre-treated with smoke and/or heat if required. Similarly rooted material may be propagated in the second year to augment plants established in the first year, or replace those that died over the first summer.

Pre – Operation: Site Evaluation:

a) Vegetation: indigenous vegetation cover and condition; identification of missing growth forms and key species; species of concern (rare, endemic and threatened); areas to be targeted for re-introductions

b) Terrain: slope, accessibility, mobility

c) Method: collection (seed and/ or cuttings), re-introduction (seed and/ or planting); *refer to Table 2 for suitable species to re-introduce*; apply appropriate sowing pre-treatments, such as smoke or heat pulse

d) Biophysical conditions: environmental condition, climatic conditions, timing (season)

e) Costs: labour, transportation, propagation and seed storage, equipment

f) Specific objectives: set objectives for 1) canopy cover of re-introduced growth forms and species, 2) richness and density of re-introduced growth forms and species.

Post – Operation

a) Monitor planted rootstock according to set objectives (subsampling appropriate): Number of surviving plants per species after the first summer/ autumn season, and if possible in subsequent years, to inform whether methods are appropriate and whether further active restoration is required;

b) Monitor seeded areas according to set objectives (subsampling appropriate): Record the species and quantities of seeds sown (e.g. weight of uncleaned seed) and monitor establishment success over the next two seasons. Plots and/ or fixed point photographs may be used, but some recording of established species is advisable.

Table 1. Recommended invasive alien species control methods

Note: Use of herbicides is extremely damaging to indigenous species; herbicides (especially foliar spray) should only be used where absolutely necessary and limited to the dry season in wetlands. Herbicides used must be registered for the particular species and must be applied according to the manufacturer's instructions.

Species	Method	Herbicide
Acacia longifolia (Long-Leaved wattle)	Fell at ground level; hand pull seedlings	Not required if cut very low; otherwise treat as for *A. saligna*
Acacia saligna (Port Jackson Willow)	Fell at ground level and immediately stump-treat with herbicide to prevent resprouting; hand pull seedlings BUT ensure roots removed; kill saplings by cutting below the root crown or remove with tree-popper; coppice may be foliar-sprayed while <0.5m tall otherwise should be recut and stump-treated	Cut stump: triclopyr (e.g. Lumberjack, Timbrel) Foliar: glyphosate (e.g. Roundup, Mamba)
Eucalyptus cladocalyx (Sugar Gum)	Large trees should be frilled: i.e. bark & outside wood removed to a combined depth of about 25mm to expose cambium layer, then sprayed with systemic herbicide to kill tree. Smaller trees too large to hand-pull or tree-pop should be cut at ground level & stump treated as for *A. saligna*.	Glyphosate or triclopyr should be sprayed onto frilled area.
Leptospermum laevigatum (Australian Myrtle)	Fell at ground level; hand pull seedlings	Not required if cut very low; otherwise treat as for *A. saligna*
Pennisetum clandestinum (Kikuyu)	Foliar spray while actively growing in summer	Glyphosate, e.g. Roundup Turbo, Muscle-up
Pinus pinea (Stone Pine)	Fell at ground level or below lowest green leaf; hand pull seedlings	Not required

Table 2. Suggested Swartland Granite Renosterveld species for restoring growth form structure to degraded areas post-fire at Spier Estate

NB. Other species may be substituted depending on availability, location and plant community. The aim is to re-establish several species for each major growth form and thus improve vegetation resilience. Propagation: S=seed, B=Bulb/corm, C=cutting, D=division.

Species	Growth Form	Propagation
Cotula turbinata	Annual	S
Dimorphotheca pluvialis	Annual	S
Nemesia affinis	Annual	S
Polycarena capensis	Annual	S
Aristea capitata	Geophyte	S
Babiana rubrocyanea	Geophyte	S
Brunsvigia orientalis	Geophyte	S
Chasmanthe aethiopica	Geophyte	S, B
Geissorhiza monanthos	Geophyte	S
Moraea papilionacea	Geophyte	S
Oxalis pupurea	Geophyte	S, B
Pelargonium longifolium	Geophyte	S
Romulea rosea	Geophyte	S
Sparaxis parviflora	Geophyte	S
Watsonia borbonica subsp. *borbonica*	Geophyte	S, B
Cymbopogon marginatus	Graminoid	S, D
Ehrharta thunbergii	Graminoid	S, D
Restio gaudichaudiana	Graminoid	S, D
Themeda triandra	Graminoid	S, D
Tribolium uniolea	Graminoid	S, D
Annesorhiza macrocarpa	Perennial forb	S, C
Helichrysum crispum	Perennial forb	S
Indigofera digitata	Perennial forb	S, C
Lichtensteinia obscura	Perennial forb	S, C
Scabiosa columbaria	Perennial forb	S, C
Stachys aethiopica	Perennial forb	S, C
Anthospermum galioides subsp. *galioides*	Low shrubs	S
Aspalathus hispida	Low shrubs	S, C
Chironia baccifera	Low shrubs	S
Erica paniculata	Low shrubs	S
Felicia filifolia subsp. filifolia	Low shrubs	S
Gnidia squarrosa	Low shrubs	S
Helichrysum teretifolium	Low shrubs	S
Hermannia alnifolia	Low shrubs	S, C
Lampranthus sociorum (succulent shrub)	Low shrubs	S, C
Leucadendron lanigerum var, *lanigerum*	Low shrubs	S, C
Lobostemon argenteus	Low shrubs	S, C
Microloma sagitattum (vine)	Low shrubs	S
Oftia africana	Low shrubs	S, C
Phylica thunbergiana	Low shrubs	S, C
Searsia dissecta	Low shrubs	S, C
Salvia africana-caerulea	Low shrubs	S, C
Note: In areas ecotonal to fynbos, it may be possible to introduce other Proteaceae, such as *Serruria candicans*, *Protea repens*, *P. burchellii*, *Leucadendron rubrum*, *L.salignum*,		

Leucospermum calligerum and *L. grandiflorum;* Restionaceae such as *Restio gaudichaudiana, Willdenowia glomerata;* and *Erica paniculata;* select stock from the nearest natural populations.

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Appendix 1. Restoration Annual Plan of Operation for Spier Estate

A. Degraded Swartland Granite Renosterveld (SGR) areas. Note: different sections may be staggered, depending on availability of resources, especially renosterveld seeds.

	ACTIVITY	RESPON-SIBLE PARTY	BUDGET	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
2020 to 2021 (pre-burn year)																
1	Control of Kikuyu (if needed)	Estate staff	Herbicide costs; staff time						x	x	x	x	x			
2	Initial control of invasive alien trees & shrubs	Estate staff &/ or appointed contractor	Herbicide costs; Staff time/ contractor costs					x	x	x	x					
3	Identify source sites for SGR species to be re-introduced & plan for seed & cutting collecting field trips	Estate staff &/ or appointed contractor	Staff time/ contractor costs	x	x											
4	Collect seed & cuttings for propagation	Estate staff &/ or appointed contractor	Staff time/ contractor costs		x	x	x	x	x	x	x	x				
5	Map most degraded areas in block for targeted sowing & planting	Estate staff &/ or appointed contractor	Staff time/ contractor costs				x	x								
6	Pre-treat seeds & prepare seed mixes	Estate staff &/ or appointed contractor	Staff time/ contractor costs									x	x			
From pre-burn year onwards (2021-2022+)																
7	Conduct prescribed burn	Estate staff &/ or appointed contractor	Staff time/ contractor costs										x	x		
8	*Cynodon dactylon* control in patches planned for sowing (spot herbicide spraying before indigenous species emerge)	Estate staff &/ or appointed contractor	Staff time/ contractor costs												x	
9	Sow pre-treated seed mixes in predetermined areas; embed in soil (rake in or provide cover by applying sparse wood chip mulch)	Estate staff &/ or appointed contractor	Staff time/ contractor costs												x	x
10	Plant hardened-off rooted material in mixed clumps in predetermined areas once soils moist	Estate staff &/ or appointed contractor	Staff time/ contractor costs	x	x	x										
11	Monitor sown & planted areas according to objectives (repeat following year); recommend further interventions if needed	Estate staff &/ or appointed contractor	Staff time/ contractor costs				x	x						x	x	