

REVEGETATION & REHABILITATION PLAN:

**ACWA POWER SOLARRESERVE REDSTONE SOLAR THERMAL POWER PLANT,
REMAINDER OF THE FARM 469, POSTMASBURG, NORTHERN CAPE PROVINCE**



PRODUCED FOR SOLARRESERVE



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BACKGROUND & PURPOSE

The purpose of the Redstone CSP Revegetation and Rehabilitation plan is to ensure that areas cleared or impacted during construction activities of the proposed Facility are rehabilitated with a plant cover that reduces the risk of erosion from these areas as well as restores ecosystem function. The purpose the rehabilitation at the site can be summarized as follows:

- Achieve long-term stabilisation of all disturbed areas to minimise erosion potential;
- Re-vegetate all disturbed areas with suitable local plant species;
- Minimise visual impact of disturbed areas; and
- Ensure that disturbed areas are safe for future uses.

It is also important to recognize that the rehabilitation plan should also be closely aligned with the other management plans for the site as revegetation, site management and erosion are inextricably linked.

ECOSYSTEM CONTEXT

The site occurs within an arid environment which receives less than 300mm annual rainfall. A fundamentally different approach to rehabilitation efforts in such areas is required as compared to traditional rehabilitation approaches within more mesic areas. In addition, rehabilitation techniques which rely on agricultural techniques such as the application of fertilizer and the planting of annual grasses or other alien species are not appropriate. The major implication of the semi-arid nature of the site is that the use of appropriate species and techniques is a key factor in order to achieve long-term success. Due to the arid nature of the area, rehabilitation of disturbed areas is likely to be difficult and potentially costly and minimising the disturbance footprint is the key to reducing the overall footprint and impact of the development.

REHABILITATION MANAGEMENT PRINCIPLES

Topsoil management

Effective topsoil management is a critical element of rehabilitation, particularly in arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Where any excavation or topsoil clearing is required, the topsoil should be used immediately where possible or stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased.

- Topsoil is the top-most layer (0-25cm) of the soil in undisturbed areas. This soil layer is important as it contains nutrients, organic matter, seeds, micro-organisms fungi and soil fauna. All these elements are necessary for soil processes such as nutrient cycling and the growth of new plants. The biologically active upper layer of the soil is fundamental in the maintenance of the entire ecosystem. There are however some parts of the site on rocky ridges or exposed calcrete where there is little to no topsoil. In these areas, the upper layers should not be

removed and stockpiled as there is no soil structure and recovery in these areas occur more spontaneously as a result.

- Topsoil should be retained on site in order to be used for site rehabilitation. The correct handling of the topsoil is a key element to rehabilitation success. Firstly it is important that the correct depth of topsoil is excavated. If the excavation is too deep, the topsoil will be mixed with sterile deeper soil, leading to reduction in nutrient levels and a decline in plant performance on the soil. It is recommended that no more than the top 10cm of topsoil are stored and used for rehabilitation.
- Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods.
- If direct transfer is not possible, the topsoil should be stored separately from other soil heaps until construction in an area is complete. The soil should not be stored for a long time and should be used as soon as possible. The longer the topsoil is stored, the more seeds, micro-organisms and soil biota are killed.
- Ideally stored topsoil should be used within a month and should not be stored for longer than three months. In addition, topsoil stores should not be too deep, a maximum depth of 1m is recommended to avoid compaction and the development of anaerobic conditions within the soil.
- If topsoil is stored on a slope then sediment fencing should be used downslope of the stockpile in order to intercept any sediment and runoff should be directed away from the stockpiles upslope.

MULCHING

Mulching is the covering of the soil with a layer of organic matter of leaves, twigs bark or wood chips, usually chopped quite finely. The main purpose of mulching is to protect and cover the soil surface as well as serve as a source of seed for revegetation purposes.

- Some parts of the site are dominated by *Tarchonanthus* and this plant material could potentially be used for mulching. Cleared material can be fed through a shredder or chipper and the shredded material used to cover bare areas of ground. This can help to limit dust as well as increase the organic matter in the soil, trap seeds and generally encourage the recovery of the vegetation. The material should however not be applied in very thick layers as this prevents seeds emerging. A layer when fresh of 10-20cm is usually sufficient depending on the texture of the material.
- During site clearing the standing woody vegetation should not be mixed with the soil, but where significant biomass is present it can be cleared separately. The cleared vegetation should be stockpiled and used whole or shredded by hand or machine to protect the soil in disturbed areas and promote the return of indigenous species. Where there is a low shrub or grass layer, this

material can be cleared and mixed as part of the topsoil as this will aid revegetation and recovery when it is reapplied.

- Material for mulch should be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants;
- No harvesting of vegetation may be done outside the area to be disturbed by construction activities;
- Brush-cut mulch should be stored for as short a period as possible, and seed released from stockpiles can also be collected for use in the rehabilitation process.
- Based on the existing PV plants at the site, recovery of the grass layer is fairly rapid in most areas and mulching can be used in problem areas where recovery of the grass layer is slow due to repeated disturbance or loss of seeds in the soil.

SEEDING

In some areas the natural regeneration of the vegetation may be poor and the application of seed to enhance vegetation recovery may be required. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Seed can be broadcast onto the soil, but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch.

- Indigenous seeds may be harvested for purposes of re-vegetation in areas that are free of alien or invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites;
- Seed may be harvested by hand and if necessary dried or treated appropriately;
- Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs must be kept apart from individually harvested seed;
- No seed of alien or foreign species should be used or bought onto the site.
- In context of the site, probably the best candidates for reseeded would be the indigenous grasses of the site, such as *Eragrostis lehmanniana* and *Cynodon dactylon*.

TRANSPLANTS

Where succulent plants are available or other species which may survive translocation are present, individual plants can be dug out from areas about to be cleared and planted into areas which require revegetation. This can be an effective means of establishing indigenous species quickly and within the context of the current site, this is likely to be an effective means of rehabilitation on some areas because establishing perennial species from seed in this arid environment is likely to be challenging. The primary

purpose of using transplants is not to restore plant cover to its' former levels, but rather to provide nodes of biological activity and a source of propagules that can spread and recover disturbed areas on their own. As such transplants should be planted in clumps rather than as isolated individuals.

- Plants for transplant should preferably be removed from areas that are going to be cleared.
- Succulent shrubs and geophytes are the most suitable candidates for transplant. Most woody species are not likely to survive transplant once the roots have been disturbed.
- Transplants should be placed within a similar environment from where they came in terms of aspect, slope and soil depth.
- Transplants must remain within the site and may not be transported off the site.
- There are not a lot of species suitable for transplant at the site and this should be done opportunistically if there are species present which may survive and if conditions in terms of rainfall and moisture conditions are favourable.

USE OF SOIL SAVERS

In areas where seed and organic matter retention is low, it is recommended that soil savers are used to stabilise the soil surface. Wind and water erosion are likely to be potential issues at the site following construction and measures to protect the soil surface including soil savers may be necessary. Soil savers are man-made materials, usually constructed of organic material such as hemp or jute and are usually applied in areas where traditional rehabilitation techniques are not likely to succeed.

- In areas where soil saver is used, it should be pegged down to ensure that it captures soil and organic matter flowing over the surface.
- Soil saver may be seeded directly once applied as the holes in the material catch seeds and provide suitable microsites for germination. Alternatively, fresh mulch containing seed can be applied to the soil saver.

GENERAL RECOMMENDATIONS

- Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible.
- Once revegetated, areas should be protected to prevent trampling and erosion.
- No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated.
- Where rehabilitation sites are located within actively grazed areas, they should be fenced.
- Fencing should be removed once a sound vegetative cover has been achieved.
- Any runnels, erosion channels or wash-aways developing after revegetation should be backfilled and consolidated and the areas restored to a proper stable condition.

MONITORING REQUIREMENTS

As rehabilitation success, particularly in arid areas is unpredictable, monitoring and follow-up actions are important to achieve the desired cover and soil protection.

- Re-vegetated areas should be monitored every 6 months for the first 18 months following construction.
- Re-vegetated areas showing inadequate surface coverage (less than 10% within 12 months after re-vegetation) should be prepared and re-vegetated;
- Any areas showing erosion, should be re-contoured and seeded with indigenous grasses or other locally occurring species which grow quickly.

CONCLUSIONS AND RECOMMENDATIONS

- The most cost-effective way to reduce the cost and effort for rehabilitation is to reduce and minimize the disturbance footprint. Particular attention should be paid to the location of temporary-use areas such as any lay-down areas which should be located in disturbed areas.
- The soil at the site is fairly finely textured and dust is highly likely to be an issue during the construction of the facility. As a result, specific measures to reduce dust and protect the soil are likely to be required. The simplest solution to this problem is to minimise the amount of vegetation clearing at the site.
- No seed or plants from outside of the area should be brought onto the site for rehabilitation purposes. If established plants must be brought onto the site for rehabilitation, then these should be grown from seed or vegetative material collected on-site. This is because, even within a single species, there are local variants adapted to the local conditions and plants from elsewhere can contaminate the local gene pool.
- The natural recovery of the vegetation at the site is generally good after disturbance due to the quick recovery of the grass layer. However, areas that are repeatedly disturbed or which have their topsoil removed are slower to recover and these areas are likely to be the areas where active rehabilitation will need to focus.