

and species composition, but this has not yet been done on a formal basis.

Namaqualand Strandveld is classified as a **Least Threatened** vegetation type on a national basis (DEA 2011), with a conservation target of 26% of its total original extent, and about 10% of its total extent has been transformed (Rouget *et al.* 2004). Relatively little was formally conserved until recently, although the nearby Namaqua National Park does now include significant areas of this vegetation type (>60 000ha, or >15% of the total original extent, being over half of the conservation target of 26%). This vegetation type covers about 46% of the total prospecting area, and about 40% of the proposed mining area.

4.1.2 Namaqualand Heuweltjieveld (SKn4)

This vegetation type occurs in the Northern Cape along the western foothills of the Namaqualand Escarpment. It is characterised by undulating plains that lead up the escarpment, and soils are typically relatively rich and derived from underlying granite or gneiss. The vegetation cover comprises a mosaic of low shrubland communities dominated by leaf-succulent shrubs that occur on slightly raised, rounded termite mounds or “heuweltjies”; ascribed to former activity of harvester termites (*Microhodotermes viator*). It is classified as “**Least Threatened**” on a national basis (DEA 2011), with a conservation target of 28% of its original extent. Approximately 11% has been statutorily conserved (mostly in the Namaqua National Park) and 3-4% has been transformed by cultivation (Rouget *et al.* 2004). This vegetation type occupies about 18% of the prospecting area, but is not present in the proposed mining area.

4.1.3 Namaqualand Klipkoppe Shrubland (SKn1)

This vegetation type occurs in the Western and Northern Cape in the central and north-central regions of Namaqualand. It is typified by dramatic landscapes of large granite and gneiss domes and disintegrating boulder koppies that support open shrubland dominated by dwarf shrubs with ericoid or succulent leaves, many of which are deciduous. It is classified as **Least Threatened** on a national basis (DEA 2011), with a conservation target of 28%. Approximately 6% has been statutorily conserved and about 5% has been transformed (Rouget *et al.* 2004). This vegetation type occupies only about 1% of the prospecting area, and is not present in the proposed mining area.

4.1.4 Namaqualand Sand Fynbos (FFd1)

Namaqualand Sand Fynbos occurs on the coastal plain (usually 5-20km inland), on Quarternary and Tertiary sands of marine and aeolian origin, and is the only Sand Fynbos type found within the Succulent Karoo biome, all the others being part of the Fynbos biome further south. The topography, soil pH and moisture availability determine the dominance of Sand Fynbos or Strandveld communities. Strandveld communities prefer alkaline soils, while Sand Fynbos is found on leached (acidic) soils. In the case of Namaqualand Sand Fynbos, fire does not play a role in regeneration of the Fynbos elements, in contrast to other Sand Fynbos types. There is often a predictable presence of various shrubs of Fynbos affinity on the dune ridges, and Restionaceae are often dominant in dune slacks, and sometimes also on dune ridges.

The boundary (ecotone) between Sand Fynbos and Strandveld is usually dynamic and rather broad, and is driven primarily by soil pH. This boundary may be very diffuse, or it may be complex, and results in a difficult to map mosaic of vegetation types. The width of the ecotone from pure Strandveld to pure Fynbos may vary from quite abrupt to 2-5 km in certain areas (Mucina & Rutherford 2006). Scarps adjacent to riverine and wetland vegetation often support Strandveld, due to higher salinity in these areas.

Namaqualand Sand Fynbos occurs in the Western and Northern Cape along the coastal plain. The vegetation occurs on slightly undulating plains and is dominated by Cape reeds (*Restionaceae*) that occur between scattered shrubs. It is classified as **Least Threatened** on a national basis (DEA 2011), with a national conservation target of 29% (Rouget *et al* 2004). The Namaqua National Park has recently incorporated an unknown proportion of this vegetation type (perhaps some 11 000ha), but the total area statutorily conserved is probably still under 12% of its original extent. It is estimated that about 7% has been transformed by cultivation and by ongoing mineral sand mining near Brand se Baai, which has resulted in the loss of over 3000ha of this unit. This vegetation type occupies about 29% of the prospecting area, and about 60% of the Roode Heuvel property.

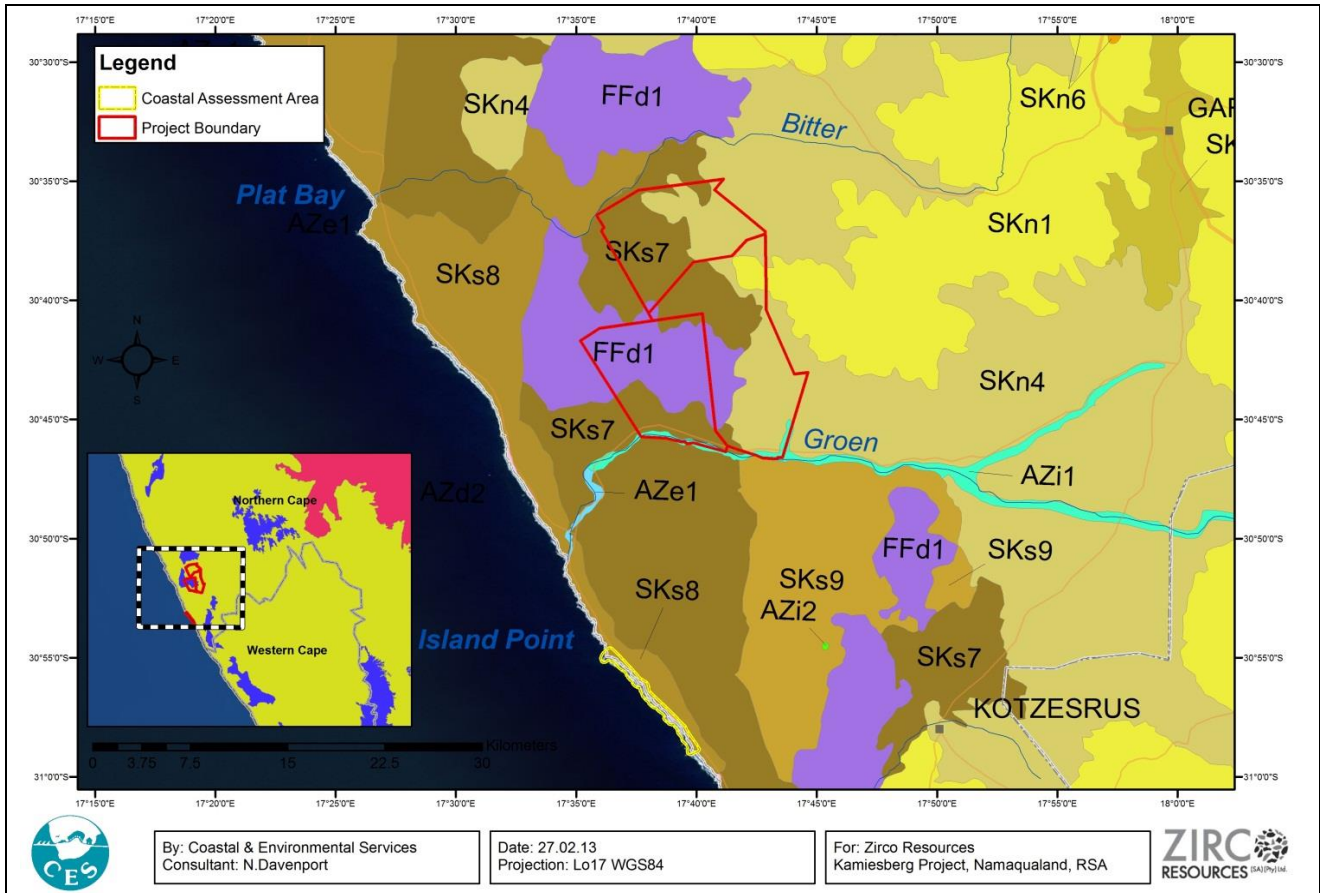


Figure 4.1: Regional vegetation of the study area as per Mucina and Rutherford (2006)

SKs7 - Namaqualand Strandveld; SKn4 – Namaqualand Heuweltjieveld; SKn1 – Namaqualand Klipkpppe Shrubland; FFd1 - Namaqualand Sand Fynbos; AZi1 - Namaqualand Riviere; SKs8 - Namaqualand Coastal Duneveld; AZd2 - Namaqualand Seashore Vegetation.

4.1.5 Namaqualand Riviere (AZi1)

Namaqualand Riviere occurs in the Western and Northern Cape along dry riverbeds throughout Namaqualand. It is characterised by a complex of alluvial shrubland interspersed with patches of tussock graminoids (grasses). Soils are a mix of heavy silts and coarse granitic sands, and are often strongly saline, as reflected by the presence of salt tolerant species such as *Sarcocornia* and *Salicornia*. In places low thickets of *Acacia karroo* and *Tamarix usneoides* are found, and *Phragmites* reeds are common in areas with more regular surface water. The vegetation type is classified as **Least Threatened** (DEA 2011), with a conservation target of 24% (Rouget *et al.* 2004). Only a small percentage has been statutorily conserved while almost 20% has been transformed through cultivation (Mucina & Rutherford 2006). This vegetation type occupies only about 3% of the prospecting area, and is not present in the proposed mining area.

4.1.6 Namaqualand Coastal Duneveld (SKs8)

This vegetation type occurs in the Western and Northern Cape along the coastal plains. The vegetation is typically dwarf shrubland dominated by erect succulent shrubs and non-succulent shrubs. Spiny grasses are common on the windblown semi-stable dunes. The Namaqualand Coastal Duneveld is classified as **Least Threatened** with a conservation target of 26%. As of 2004 none was statutorily conserved, but the Namaqua National Park has recently incorporated a significant but unknown area of this vegetation type (estimated at about 20% of its total original extent). Some 8% of its original extent has been transformed through diamond mining, mainly in the Hondeklipbaai area (Mucina & Rutherford 2006). This vegetation type occurs in the study area along the coast between Island Point and Knyp Point, but not in the prospecting or mining area.

4.1.7 Namaqualand Seashore Vegetation (AZd2)

Namaqualand Seashore Vegetation is distributed along the Northern Cape coastline, in a very narrow strip above the high water mark, from Holgat River to Olifants River. It is typically found on alkaline coastal dunes, and is typically a sparse vegetation community of partly succulent hummock-forming and spreading dwarf shrubs, grasses and herbs. Namaqualand Seashore Vegetation is classified as **Least Threatened** with a conservation target of 26%. As of 2004 none was statutorily conserved, but the Namaqua National Park has recently incorporated a significant but unknown area of this vegetation type. About 5% has been transformed through diamond mining (Mucina & Rutherford 2006). This widespread vegetation type occurs between the high water mark and the Namaqualand Coastal Duneveld, along the coast between Island Point and Khnyp Point.

4.2 VEGETATION AND FLORISTICS OF THE PROJECT AREA

4.2.1 Prospecting areas

Five (5) key vegetation types occur on the Zirco prospecting area (Figure 4.2), namely:

1. Strandveld (Namaqualand Strandveld)
2. Sand Fynbos (Namaqualand Sand Fynbos)
3. Heuweltjieveld (Namaqualand Heuweltjieveld)
4. Riparian vegetation (Namaqualand Riviere)
5. Klipkop Shrubland (Namaqualand Klipkoppe Shrubland)

A full plant species list for all vegetation units is included as Appendix 1. This list includes a surprisingly high total of 25 plant Species of Conservation Concern.

Strandveld (9544 ha) is the dominant vegetation unit in the study area and occurs all along the Groen River basin in the southern sections of Roode Heuvel and Sabies areas (Plate 4.1A). It is also found scattered throughout Sabies, and extends into Leeuvlei (Figure 4.2). Strandveld merges with Sand Fynbos all along the boundary between the two vegetation types, and in places it can be difficult to distinguish a clear boundary. Degraded Strandveld (181 ha) occurs along the southern section of Roode Heuvel (Plate 4.1B). The cause of degradation is overgrazing, resulting from water points and livestock pens (kraals) which occur along the road, and incidentally along the Groen River.



A. Strandveld



B. Previously cultivated and degraded Strandveld which is now dominated by grass species



C. Sand Fynbos, dune slack in foreground, dune ridge behind. The restio *Thamnochortus bachmanii* is dominant in the foreground.



D. Fallow fields in Sand Fynbos



E. Heuweltjieveld, with a high density of dwarf succulents in the foreground



F. Degraded Heuweltjieveld dominated by 'kraalbos' (*Galenia africana*)



G. Riparian bush along the Groen River, with *Acacia karroo*



H. The Groen River riparian vegetation includes salt tolerant succulent shrubs



I. Klipkop shrubland



J. Rocky outcrop with Klipkop Shrubland

Plate 4.1: Examples of the various vegetation types which occur in the prospecting area.

Typical species in Strandveld include *Zygophyllum morgsana* (skilpadbos; slaabos), *Othonna cylindrica* (ossierapuisbos), *Othonna coronopifolia*, *Tetragonia fruticosa* (klimopkinkelbossie), *Cladoraphis cyperoides*, *Berkheya fruticosa*, *Tripteris oppositifolia*, *Osteospermum incanum*, *Leucoptera nodosa*, *Lycium strandveldense* (muisbos), *Salvia africana-lutea* (bruinstrandsalie), *Limonium peregrinum* (strandroos), *Limonium* sp. nov. (*L. dagmarea* MS), *Calobota angustifolia* (fluitjiesbos), *Ruschia floribunda*, *R. subpaniculata*, *R. fugitans*, *Lampranthus watermeyerii*, *L. stipulaceus*, *Heliophila lactea*, *Euphorbia mauritanica* (melkbos), *Pelargonium gibbosum* (dikbeen malva), *Hermannia trifurca* (poprosie), *H. scordifolia*, *Thesium spinosum*, *Exomis microphylla*, *Microloma sagittatum*, *Pteronia divaricata*, *Manulea altissima*, *Stoeberia utilis* (asbos), *Manochlamys albicans* (spanspekbos; seepbos; soutbos), *Cissampelos capensis*, *Conicosia pugioniformis* ssp. *alborosea* (vetkousie), *Vanzijlia annulata*, *Phyllopodium pumilum*, *Gorteria personata*, *Tylecodon wallichii* (krimpsiektebos), *Eriocephalus racemosa* (kapokbossie; wilderoosmaryn), *Asparagus africana*, *Adenogramma mollugo*, *Pharnaceum lanatum*, and *Helichrysum tricostatum*. Scattered larger woody shrubs are a feature in some areas, especially in transitions to Sand Fynbos, and may include *Searsia longispina* (taaibos) and *Gymnosporia buxifolia* (pendoring). Grasses may be prominent after rains, mainly *Ehrharta calycina* (rooisaadgras), *Schismus barbatus* and *Stipagrostis zeyheri*. Bulbs include *Babiana brachystachys*, *B. grandiflora*, *Lachenalia unifolia*, *Oxalis flava*, *O. luteola*, *Trachyandra divaricata* (duinekool), *Trachyandra falcata* and *T. muricata* (veldkool), *Drimia capensis* (maerman), and *Boophone haemanthoides* (gifbol).

Relatively few **SCC** are known to occur in true Strandveld, but nevertheless six SCC were recorded in this unit (24% of those in the total study area).

1. *Leucoptera nodosa* (Plate 4.2) is Red Listed as Vulnerable (Helme & Raimondo 2006). This is a succulent shrub in the daisy family, previously known from only five definite localities in the Strandveld between Hondeklipbaai and Lamberts Bay. The species was recorded at three new localities within the study area (see Figure 4.2), and at various other new localities within the Namaqua National Park during the August 2014 survey. The species seems to usually occur as scattered individual plants, although one of the localities (Leeuvlei area) supported what is to date the largest known population of the species (about 150 plants).
2. *Arctotis* sp nov.1 is an undescribed perennial daisy known only from this unit, and although widespread (Brand se Baai to Hondeklipbaai) it may be threatened by mining (pers. obs.). As it is yet to be described the species has not been assessed for the Red List.
3. *Calobota lotononoides* (Near Threatened; Helme et al. 2008) is common in this habitat, often on the ecotone with Sand Fynbos.
4. *Helichrysum tricostatum* (Near Threatened) is also fairly common in this habitat, but is a very widespread species (Saldanha to Orange River).
5. *Hermannia* sp nov. is common in this unit, but has not yet been assessed. The species is common in the region from Brand se Baai to Hondeklipbaai.
6. *Wahlenbergia asparagoides* (Vulnerable) is most common in Sand Fynbos, but may also occur in this unit.



Plate 4.2: *Leucoptera nodosa* is a perennial daisy Red Listed as Vulnerable, photographed here west of Leeuvlei. This is the largest known population of this rare species.

Sand Fynbos (6072 ha) is the second largest vegetation unit in the area. It is the dominant vegetation on Roode Heuvel, but also extends into Sabies and Leeuvlei (Figure 4.2). Sand Fynbos occurs on slightly undulating plains and is often dominated by restios (typically *Thamnochortus bachmanii* and *Restio macer*) in the dune slacks (troughs), and asteraceous fynbos or restios (*Willdenowia incurvata*) on the dune ridges (Plate 4.1C). The vegetation on the dune ridges often includes Strandveld elements.

Species typical of this unit include *Nenax arenicola*, *Arctotis canaliculata*, *Willdenowia incurvata* (sonkwasriet), *Thamnochortus bachmanii*, *Restio macer*, *Kedrostis psammophila*, *Ficinia argyropa*, *Ficinia indica*, *Grielum humifusum* (pietsnot), *Chrysocoma longifolia*, *Eriospermum arenosum*, *Salvia lanceolata*, *Wahlenbergia asparagoides*, *Lebeckia ambigua*, *Aspalathus cuspidata*, *A. quinquefolia*, *A. spinescens* ssp. *lepida*, *Chlorophytum viscosum*, *Coelanthum grandiflorum*, *Albuca* sp., *Nemesia affinis*, *Justicia cuneata*, *Elegia* sp nov., *Diosma ramosissima*, *Osteospermum incanum*, *Trichogyne pilulifera*, *Elytropappus rhinocerotis* (renosterbos), *Stoebe nervigera*, *Aspalathus cuspidata*, *Leucospermum rodolentum* (luisbos), *Leucadendron brunioides* ssp. *brunioides*, *Metalasia densa*, *M. adunca*, *Macrostylis* sp., *Wiborgia obcordata*, *Ornithoglossum viride* (slangblom), *Moraea ciliata*, *Calobota lotononoides*, *Muraltia obovata*, *Gethyllis* sp. (kukumakranka), *Asparagus juniperoides*, *Pteronia onobromoides* and *Limeum africanum*.

This habitat unit is known to support at least **15 SCC**, and is the richest vegetation type in the study area in terms of number of threatened plant species. This is a highly significant number of SCC for a single vegetation unit, being 60% of all SCC recorded in the total study area. See Appendix 2 for a full list of the SCC in this unit, and a list of the significance of the populations of all SCC. Only the most significant are outlined below.

The unit includes a number of undescribed or only recently described species, which is indicative of how poorly known the unit is, or at least was until recently.

- *Elegia* sp nov is a striking, undescribed restio that is only known from the northern Sandveld. Originally (in 2009) recorded close to Kotzesrus, it was found to be fairly common on site (the second known locality) only on the northern edge of RoodeHeuvel (Figure 4.3). The August 2014 fieldwork showed that it also occurs in about a 20ha patch of the adjacent Namaqua National Park, and again in a small area north of the Bitter River, where new cultivation had already resulted in loss of about half this population.
- *Lachenalia* sp nov (Plate 4.3) is a bulb that was first discovered in September 2012 close to Koekenaap, and was then found to be fairly common in the study area, where the Type collection was made, and the species will be described in 2014 (as *L. arenicola* MS). The August 2014 fieldwork revealed this species to be present but never common as far north as Riethuis (giving it a total known range of about 170km), and is fairly well represented within the Namaqua National Park.
- *Lampranthus procumbens* (Plate 4.4) is a creeping vygie that was described in 2009, and is known from Kommagas south to Kotzesrus, and the species is common on site only in the northern areas of RoodeHeuvel. It was found to be common in the adjacent parts of the Namaqua National Park, but was rare elsewhere in the Park.
- *Agathosma elata* is a buchu that was previously only known from near Vanrhynsdorp and Klawer, some 150km to the southeast, and its discovery here was thus a major surprise. The species is Red Listed as Endangered, and the population in the study area is small. In August 2014 the species was found at various other localities as far north as Riethuis (40km NW of the site), including 3 within the Namaqua National Park, but it is never common, and the total population is small (estimated at <500 plants).
- *Caesia sabulosa* is a common geophyte in Sandveld, but was also only recently described, and is here at or close to its northernmost distribution.

Fallow cereal (oats, rye and wheat) fields (308 ha) occur scattered throughout large sections of the Sand Fynbos communities, especially in the north western sections of Roode Heuvel (Figure 4.2; Plate 4.1D). The Pilot mine (5 ha) is located on Roode Heuvel on the ecotone between Sand Fynbos and Strandveld. These disturbed areas support a limited number of widespread, pioneer species, and generally do not support any SCC. However, a population of *Wahlenbergia asparagoides* (Vulnerable) was observed in the rehabilitated portion of the pilot mine, suggesting that this shrubby species is tolerant of disturbance, and is perhaps a pioneer species. Similar observations from Namakwa Sands support this idea, but it does seem to be the only SCC readily able to colonise the mined areas. Alien invasive species are rare, even in these disturbed areas.

Rehabilitation potential of these disturbed areas is fairly good, as they are generally narrow strips surrounded by extensive areas of natural vegetation which could act as a seed source. Rehabilitation success would be significantly better in the absence of livestock grazing, as heavy grazing of recovering veld promotes the abundance and dominance of unpalatable species such as *Galenia africana* (kraalbos).



Plate 4.3: This bulbous plant is an undescribed species of *Lachenalia* found in the Sand Fynbos on site (see Figure 4.3), and will be formally described in 2014 as *L. arenicola*.



Plate 4.4: *Lampranthus procumbens* is a rare and recently described creeping vygie known only from the northern Sandveld, between Komaggas and Kotzesrus, and is uncommon in the study area. These flowers have yet to open.

Heuweltjieveld (3798 ha) may be found all along the eastern extent of Leeuvlei, and a large part of north eastern Sabies (Figure 4.2). It generally occurs on undulating topography of the Kamiesberg escarpment foothills, and comprises largely succulent dwarf shrubland communities amongst a mosaic of heuweltjie communities. Degraded Heuweltjieveld (252 ha) occurs in the south eastern sections of Sabies adjacent to alluvial corridors, and is dominated by the unpalatable shrub *Galenia africana* (kraalbos). This vegetation type may be spectacular after good winter rains, when extensive displays of annuals, herbs and bulbs colour the landscape, and at that stage is capable of supporting a high diversity of insects, birds and other animals.

Common species in this unit include *Drosanthemum hispidum*, *Othonna sedifolia*, *Osteospermum pinnatum*, *Oncosiphon suffruticosum* (stinkkruid), *Zalusianskya villosa*, *Ursinia cakilefolia*, *Leysera tenella*, *Felicia tenella*, *Zygophyllum retrofractum*, *Aridaria noctiflora*, *Lycium cinereum*, *Manochlamys albicans*, *Ruschia leucosperma*, *Stoeberia frutescens*, *Didelta carnososa*, *Salsola aphylla* (gannabos), *Tetragonia fruticosa*, *T. spicata*, *Berkheya fruticosa*, *Limeum africanum*, *Lampranthus otzenianum*, *Psilocaulon foliosum*, *P. junceum* (asbos), *Ehrharta calycina*, *Rhynchosidium pumilum*, *Oxalis annae* and *Pharnaceum croceum*.

This unit is relatively poorly researched, but at least six **SCC were recorded here, two of which are undescribed species discovered for the first time.** The conservation value of the poorly known quartz patches within this unit (the habitat of 4 of the 6 SCC) is thus Very High (Figure 4.3).

Both the new species were discovered on an isolated quartz patch in the Leeuvlei area, near the Outeep River (Figure 4.3), and both are vygies. The two new species are a species of *Jacobsenia* (Plate 4.5) and a species of *Cheiridopsis* (Plate 4.6). Both species are being sequenced and described by Dr C. Klak of the Bolus Herbarium. Both seem to be restricted to this isolated quartz patch, which is less than 5ha in extent, and other suitable looking quartz patches in the region (not all within the study area) were surveyed for these species, with no success. This pattern of extreme endemism is not uncommon amongst quartz patch specialists in the region.

Othonna lepidocaulis (Plate 4.7) is a rare, perennial, tuberous daisy known previously only from the Knersvlakte, some 150km to the south, and its occurrence here, on the same quartz patch (Figure 4.3), is both very interesting and highly significant. *Aloe krapohlina* is a dwarf aloe that was also observed primarily in the vicinity of this quartz patch, and the species is Red Listed as Data Deficient and, according to the available data, should be listed as Threatened (von Staden 2008).



Plate 4.5: A new species of what is likely to be a *Jacobsenia vygie*, discovered near the Outep River on Leeuvlei. The species will be described by Dr C Klak.



Plate 4.6: A new species of *Cheiridopsis* discovered near the Outep River, in a different part of the same quartz patch.



Plate 4.7: *Othonna lepidocaulis* – a rare species previously only known from 150km to the south, and also found on the quartz patch on Leeuvlei.

Riparian (564 ha) areas consist largely of alluvial corridors of the Groen River in the south and Bitter River in the north, but also includes tributary alluvial drainage lines scattered largely in the eastern sections of Leeuvlei and Sabies, commencing in the Kamiesberg escarpment foothills and draining down to the larger river basins (Figure 4.2, also refer to Figure 3.3). The vegetation varies from *Acacia* thicket to alluvial halophytic shrublands. These areas serve as important corridors for bird species.

Acacia karoo is characteristic of this unit, and may form dense thickets in places. The only other notable tree is *Tamarix usneoides*. Shrubs include *Galenia africana* (kraalbos), *Zygophyllum retrofractum*, *Hoplophyllum spinosum*, *Lycium* spp., *Cephallophyllum* sp., *Malephora lutea*, *Suaeda fruticosa*, *Atriplexa cinerea*, *Salsola tuberculata* and *Ballota africana*, and the perennial grass *Stipagrostis namaquensis* may be prominent. The succulent *Mesembryanthemum guerichianum* may be prominent in silty areas. Where surface or near surface water accumulates there are also some large patches of reedbed (*Phragmites australis*), which provide critical roosting sites for many bird species. The reedbeds may be interspersed with *Odyssea paucinervis*, *Scirpoides dioecus*, *Juncus* sp. and *Sporobolus virginicus* (brakgras).

Saline areas may be dominated by *Salicornia* sp. (an undescribed species, according to L. Mucina, in Snijman 2013) and *Sarcocornia pillansii* (brakkoraal), with *Salsola* sp. (gannabos), *Odyssea paucinervis* and *Spergularia bocconii*.

No SCC were recorded in this unit, and no such species are likely to occur here in significant numbers.

Klipkop Shrubland (251 ha) vegetation occurs as scattered communities surrounding rocky outcrops of the Kamiesberg escarpment foothills. These can be found in central Leeuvlei and northern Sabies (Figure 4.2). These serve as important sites for local reptile populations.

Typical plant species include *Montinia caryophyllacea* (klappers), *Berkheya fruticosa*, *Didelta spinosa* (perdebos), *Euphorbia mauritanica* (melkbos), *Leipoldtia schultzei*, *Manochlamys albicans*, *Pelargonium crithmifolium*, *Phyllobolus roseus*, *Othonna cylindrica*, *O. furcata*, *O. macrophylla*, *Ehrharta calycina*, *E. barbinodis*, *Chaetobromus dregei*, *Stoebera utilis* (asbos), *Senecio junceus*, *Tylecodon paniculatus* (botterboom), *T. reticulatus*, *Hermannia disermifolia*, *Eriocephalus microphyllus* (kapokbos), *Whiteheadia bifolia*, *Calobota sericea*, *Solanum burchelli*, *Selago glutinosa*, *Crassula muscosa*, *Crassula tomentosa*, *Conophytum bilobum* and *C. spp.*, *Ornithogalum multifolium*, *O. rupestre* and *Sarcostemma viminale*.

No SCC are likely to occur within the limited extent of this unit in the study area, but the unit was not surveyed extensively, and it is known to support many SCC in nearby areas.

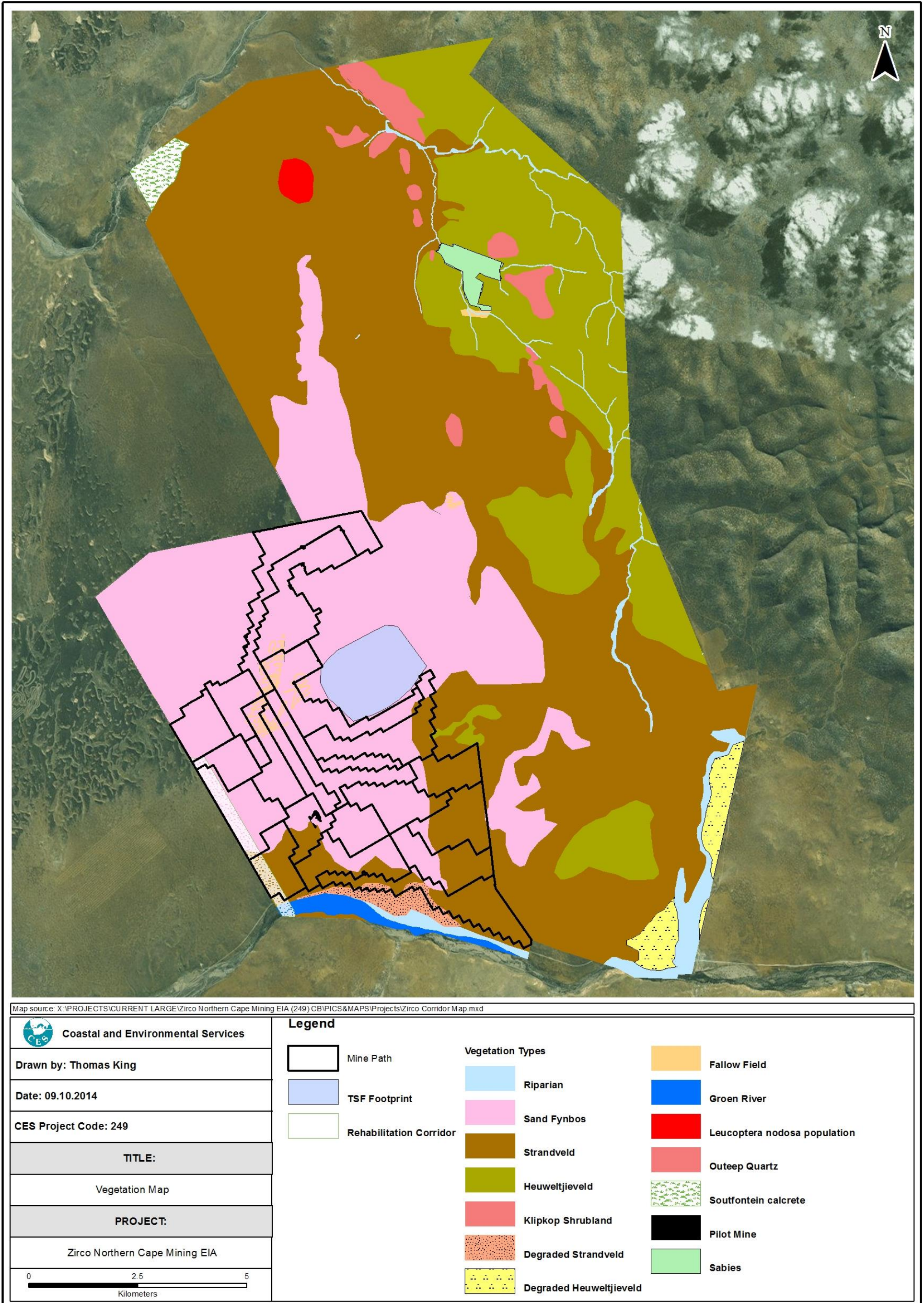


Figure 4.2: Vegetation Map of the Kamiesberg Project area.

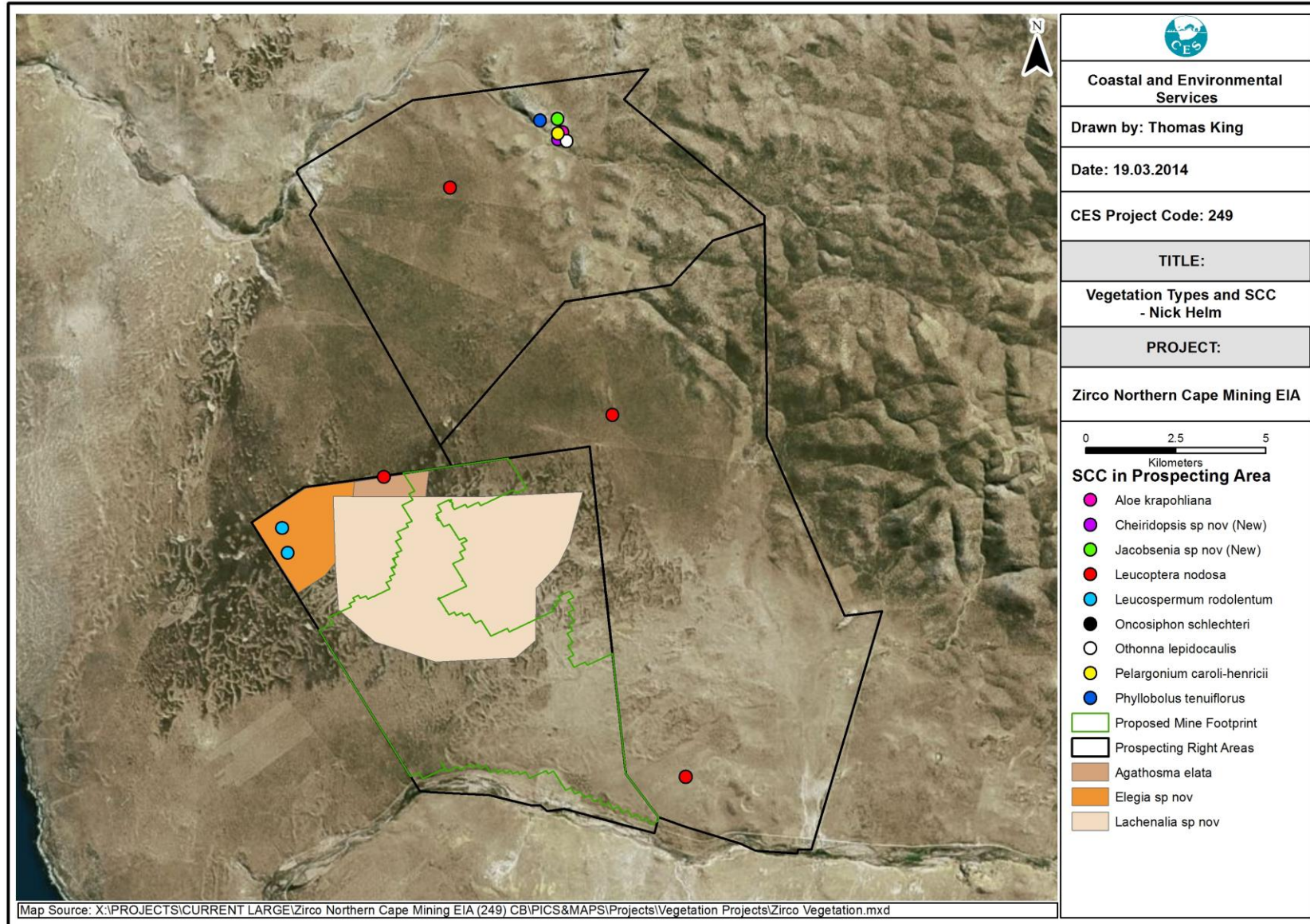


Figure 4.3: Map of 11 of the 23 plant Species of Conservation Concern (SCC) in the project area (black outline). The other 12 SCC are too common and widespread within the RoodeHeuvel property to map at this scale. The green outline is the proposed mine footprint

4.2.2 Coastal Area

Two key vegetation types occur within the coastal assessment area (Figures 4.3-4.6):

1. Seashore Dunes
2. Coastal Duneveld

Seashore Dunes occur as a belt along the coastline, above the high tide water mark, and on the seaward side of the Coastal Duneveld. Essentially it consists of Namaqualand Seashore Vegetation, but also includes transition zones of seashore vegetation occurring on white dune sands, which have taller shrubs, but are not considered part of the Coastal Duneveld (Plate 4.8).

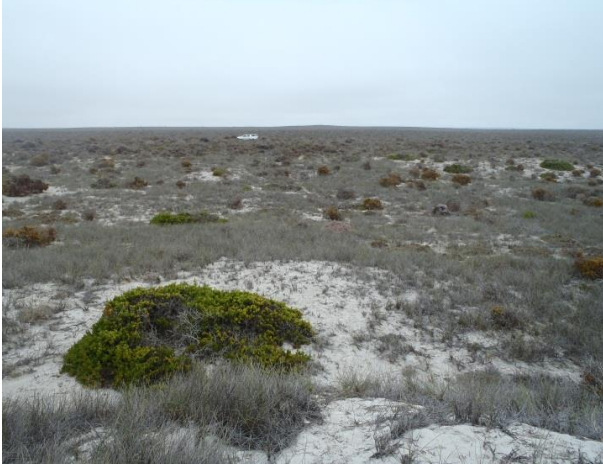
Typical species include *Cladoraphis cyperoides*, *Eriocephalus racemosus*, *Lycium strandveldense*, *Babiana hirsuta*, *Didelta carnosus*, *Senecio arenarius*, *Amphibolia hutchinsonii*, *Zygophyllum morgsana*, *Thinopyrum distichum*, *Arctotheca populifolia*, *Thesium elatior*, *Othonna cylindrica*, *Lessertia* cf. *globosa*, *Hypertelis angrae-pequenae*, *Helichrysum tricostatum*, *Othonna coronopifolia*, *Arctotis decurrens*, *Conicosia pugioniformis* ssp. *alborosea*, *Trachyandra divaricata* and *Tripteris oppositifolia*.

This environment is not known to host many **SCC**, although at Brand se Baai there are at least three SCC in this unit, two of which are local endemics not yet known from the current study area (Desmet & Helme 2003). *Oncosiphon schlechteri* is Red Listed as Endangered, and was recorded only in the vicinity of proposed Gulley Intake 3 (Figure 4.4). What may be *Limonium decumbens* (Data Deficient) was also recorded here. *Helichrysum dunense* (Vulnerable; Helme & Raimondo 2006) is restricted to coastal dunes north of Elands Bay, and was recorded in the study area only in the vicinity of Gulley Intakes 4 and 1 (Figure 4.4). *Manulea cinerea* is restricted to this dune habitat on the Namaqualand coast, and may also occur within the study area (although not recorded), and is Red Listed as Vulnerable (Helme & Raimondo 2005).

Coastal Duneveld is situated on the inland side of the Seashore Dunes, and gradually merges with Strandveld further inland (Plate 4.8 A & D). Common species *Jordaaniella spongiosa*, *Odysea paucinervis*, *Asparagus capensis*, *Phyllobolus trichotomus*, *Zygophyllum cordifolium*, *Z. cuneifolium*, *Z. morgsana*, *Mesembryanthemum guerichianum*, *Dicrocaulon crassum*, *Ruschia* spp., *Cephalophyllum luteum*, *Hypertelis salsoloides*, *Galenia sarcophylla*, *Didelta carnosus*, *Drosanthemum* spp., *Leipoldtia schultzei*, *Osteospermum incanum*, *Othonna cylindrica*, *O. sedifolia*, *Lycium strandveldense* and *Gazania* sp. *aff. krebsiana*.

No SCC were recorded in this unit.

The littoral zone (the area from the high water mark to shoreline areas that are permanently submerged) along the west coast consist of alternating zones of rocky and sandy shores (i.e. sandy beaches), which is true for the coastal assessment area (Figures 4.4-4.7).



A. Seashore Dune vegetation merging inland into Coastal Duneveld, within which the vehicle is parked



B. Seashore Dune vegetation above the high water mark, below which is a sandy beach



C. Seashore Dune vegetation above the high water mark, below which is a rocky shoreline



D. Coastal Duneveld, which in this case comes very close to the littoral zone shoreline

Plate 4.8: Examples of the various vegetation types which occur in the coastal assessment area

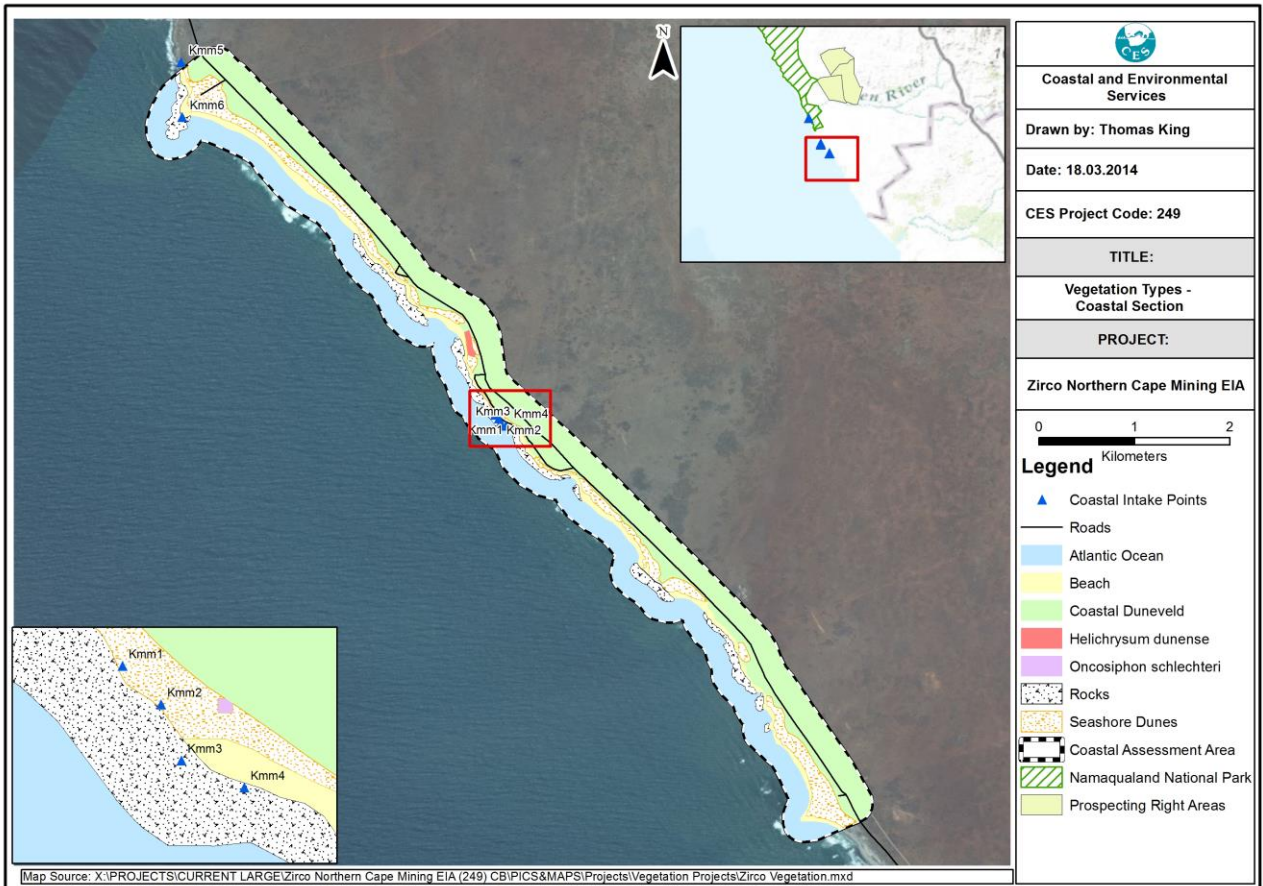


Figure 4.4: Vegetation Map of the coastal assessment area.

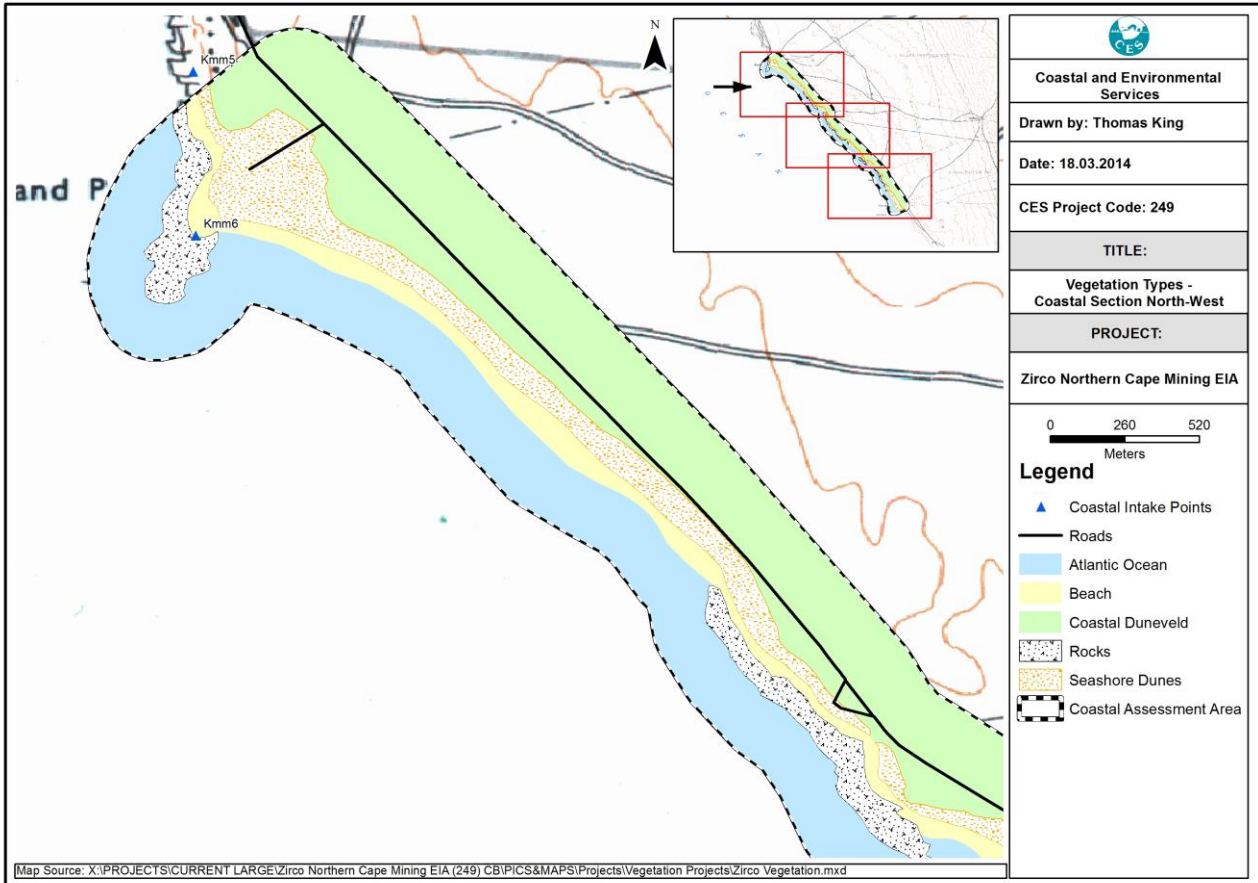


Figure 4.5: Vegetation Map of the coastal assessment area – north western section.

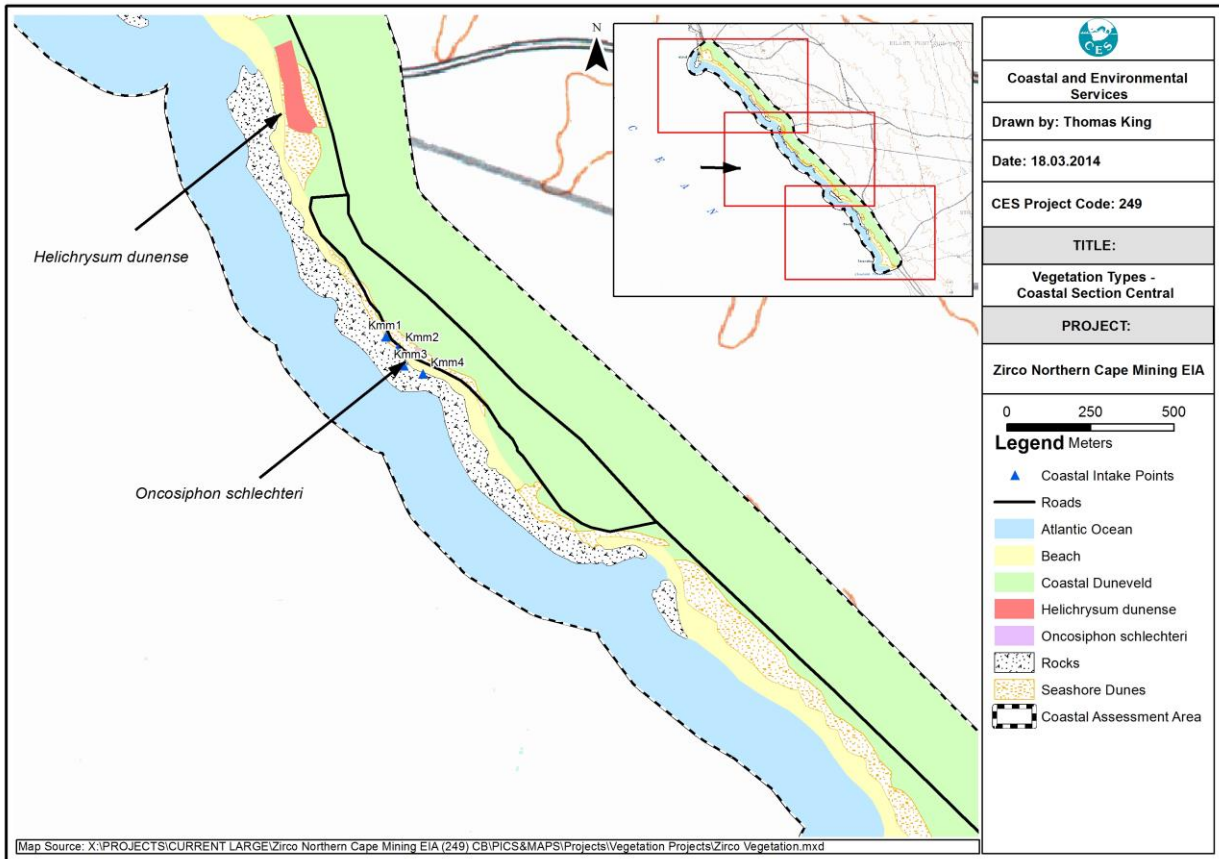


Figure 4.6: Vegetation Map of the coastal assessment area – central section. This map shows the portion of the coastal study area where the two recorded plant Species of Conservation Concern were found

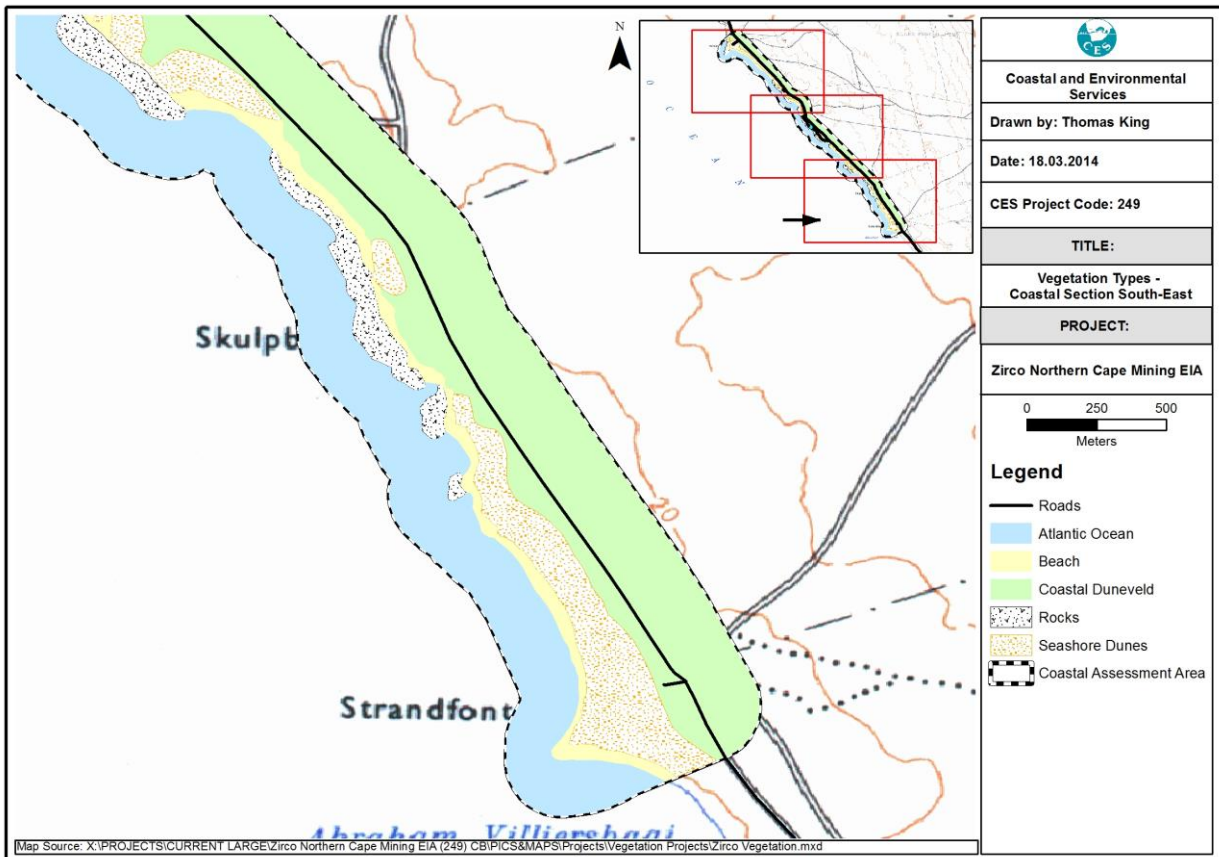


Figure 4.7: Vegetation Map of the coastal assessment area – south eastern section.

4.3 ALIEN PLANT SPECIES

Alien invasive plant species are not a major feature of this area, but there are a limited number of invasive species present, most of which occur only in disturbed environments, notably in old lands, around kraals, and along roads. All the invasives currently in the area are likely to become more prominent in an area disturbed by mining, particularly if these areas are grazed after rehabilitation.

Galenia africana (kraalbos) is indigenous, but is also considered as invasive in disturbed and overgrazed areas, as it is unpalatable, and benefits from the lack of competition from more palatable species. The only way to eradicate it is to rest an area from grazing for long periods (>12 years). *Atriplex lindleyi* ssp. *inflata* (klappiesbrak, blasiebrak) is the most common alien invasive in the area, and is likely to be a prominent feature of any areas disturbed by mining. This is a low, grey perennial shrub with wind and water dispersed seeds, and is best removed by mechanical means. *Salsola kali* (Russian tumbleweed; tolbos) is a spiny shrub that also invades disturbed areas, particularly those with higher nutrient loads, such as around kraals, and is common in places. It also has wind dispersed seeds, and can become a problem. The species was noted in the pilot mine rehabilitation areas. *Brassica tournefortii* (wild mustard) is a winter growing annual that can be surprisingly common in sandy soils, even in relatively undisturbed Strandveld. *Erodium moschatum* (cranesbill) is very common annual herb in some areas, but seldom becomes a problem. *Nicotiana glauca* (wildetabak) is most common along watercourses, but is not a problem in the study area. Two species of invasive tree were recorded. *Prosopis glandulosa* (mesquite) also prefers water courses, but will also invade silty soils. It has been planted for shade, firewood and fodder, but can be very difficult to remove once it starts spreading. *Acacia cyclops* (rooikrans) is present in low numbers in the Sand Fynbos areas, mainly in the vicinity of water troughs, and conditions are too arid for it to become a major problem. Various species of alien, annual grasses are likely to be present, including *Vulpia myuros* (ratstail fescue), *Bromus* spp. (brome), *Lolium* spp. (ryegrass), and *Avena* spp. (wild oats), but they are not likely to be a major problem, due mainly to the arid conditions.

4.4 FLORISTICS AND SPECIES OF CONSERVATION CONCERN IN THE REGION

Due to the large number of Species of Conservation Concern (SCC) found within the prospecting area, an additional survey was undertaken. This focused on the plant SCC that had been identified within the prospecting area and whose populations outside of this footprint area were poorly or not known. The survey was undertaken in August 2014, when most Namakwaland plants are flowering. Two botanist with a good knowledge of the West Coast flora spent over a week in the field specifically to find out if these species occurred elsewhere, and in relatively close proximity to the study area, and if so, where and in what numbers. The secondary aim was to assess possible biodiversity offset areas in terms of the presence of suitable habitat and presence of the focus SCC.

The primary focus was on the following species:

- *Lachenalia* sp. nov. (to be described as *L. arenicola* G. Duncan & N. A. Helme)
- *Elegia* sp. nov.
- *Agathosma elata*
- *Lampranthus procumbens* and
- *Leucoptera nodosa*.

***Lachenalia* sp. nov.**

This species (to be *Lachenalia arenicola* - currently in press) was found to be present as far north as the dunes north of Riethuis, some 63km north of the project area. It typically occurs as widely scattered plants, in relatively low numbers. Estimated population density in suitable habitat is about 15 plants/ha. The species is thus now known to occur from Riethuis to near Koekenaap, a distance of some 150km, and the total population, although very difficult to estimate, may be between 35 000 and 100 000 plants, of which as many as 30% may occur within the current boundaries of the Namaqua National Park. The species was found to be widely but sparsely distributed within Focus Areas 10 and 13 (outside the Park, but no data points were taken for this