



SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT

**Scoping and Environmental Impact Assessment
for the proposed Manganese Export Facility and
Associated Infrastructure in the Coega Industrial
Development Zone, Port of Ngqura and Tankatara area**

DRAFT EIA REPORT

CHAPTER 6: TERRESTRIAL ECOLOGY: FAUNA AND FLORA



SUMMARY

Within the context of the original vegetation of the area the range of Sundays Valley Thicket, Grassridge Bontveld, Motherwell Karroid Thicket, Sundays Doringveld and saltmarsh (manmade) vegetation communities cover the proposed Manganese Ore Export Facility. These areas, although largely intact or semi-intact, have in some areas been transformed and degraded predominantly through agricultural cultivation and some alien plant infestation, with the Sundays Valley Thicket along the slopes adjacent to the Coega River relatively pristine. The components of the Manganese Ore Export Facility (Compilation Yard, Rail Link, Manganese Stockyard and Conveyor) all require the clearing of land which will be almost irreversibly altered from the natural state.

- Site vulnerability varies across the site, largely dependent on the level of transformation and degradation from a variety of activities, including historical agricultural activities, mostly being moderate (Bontveld) to High (Thicket).
- Degradation in the form of invasive alien plant infestations tends to be very limited and patchy on the site. Large scale clearing was conducted in Zone 11 in the recent past.
- Some degradation from historical agriculture is present, but the area can be described as being transformed for the salt pans; near natural for Bontveld and natural for Sundays Valley Thicket.
- Areas indicated as having a high to very high vulnerability include Vulnerable Sundays Valley Thicket, where it falls within the designated Critical Biodiversity area and especially where it forms part of the designated IDZ Open Space Management Plan.
- Areas with a moderate sensitivity include those having intact vegetation but with a Least threatened or Vulnerable conservation status (Bontveld).
- Areas having a low sensitivity include areas transformed, severely degraded and heavily invaded areas, and areas having a low conservation status.

The faunal diversity of the central and western regions of the Eastern Cape, including Port Elizabeth, is relatively well-known. However, this diversity has been affected by the long history of human impact in the region and the currently degraded state of much of the area surrounding the study site. The proposed development involves actions that will compound this transformation. There is evidence of historical livestock farming in the site. Two distinct habitats can be distinguished with associated fauna, namely Bontveld and Sundays Valley Thicket (including Motherwell Karroid Thicket).

IDENTIFICATION OF KEY ISSUES AND IMPACTS

The main sources of impact of the project on terrestrial ecology are summarised below:

Proposed Rail Compilation Yard

- The proposed Compilation Yard will result in the clearing of vegetation and Endorheic pans within the required footprint to accommodate infrastructure.
- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians) and is likely to result in the direct mortality of faunal species especially during construction.
- Long term wind-borne Manganese dust may also affect adjacent vegetation.
- The Compilation Yard will extend into Tankatara Farm, which is part of the Sundays River Conservancy. Large mammals such as kudu are present within the Conservancy.



Proposed Railway Link

- The proposed Railway link will result in the clearing of vegetation within the required footprint to accommodate infrastructure.
- The proposed Railway link passes through designated CDC IDZ Open Space areas, NMBM DBP Critical Biodiversity and Ecological Process Areas, which will be further fragmented and may act as a barrier to movement of faunal species (mammals, reptiles and amphibians).
- It will pass through ephemeral drainage lines between the compilation yard and the existing railway line.
- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians and will result in mortality of faunal species.
- Long term wind-borne Manganese dust may also effect vegetation adjacent to the Railway Link within the CDC IDZ OSMP.

Proposed Doubling of Railway Line to Marshalling Yard

- The proposed Railway Line doubling will result in the clearing of vegetation within the required footprint to widen the rail reserve (including access Road) to accommodate infrastructure.
- The existing Railway line passes more or less through the centre of the designated CDC IDZ Open Space areas, NMBM DBP Critical Biodiversity and Ecological Process Areas, which will be further fragmented and reduced in extent and may also act as a barrier to movement of faunal species (mammals, reptiles and amphibians).
- It will pass through ephemeral drainage lines and watercourses between the Compilation Yard and Stockyard.
- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians and will result in mortality of faunal species.
- Long term wind-borne Manganese dust may also effect vegetation adjacent to the Railway Line within the CDC IDZ OSMP.

Proposed Manganese Stockyard

- The proposed Stockyard will result in blanket clearing of vegetation within the required footprint to accommodate infrastructure.
- The proposed Stockyard will result in the clearing of Endangered Motherwell Karroid Thicket vegetation.
- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians and will result in mortality of faunal species.
- Long term wind-borne Manganese dust may also effect vegetation adjacent to the Stockyard.

Proposed Conveyor belt to Port area

- The proposed Conveyor will result in the clearing of vegetation within the required footprint to accommodate infrastructure.
- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians and will result in mortality of faunal species.
- Long term wind-borne Manganese dust may also effect vegetation adjacent to the Stockyard.
- Long term wind-borne Manganese dust may also effect the designated 'butterfly valley' south of the N2 and west of the proposed Conveyor route.



ASSESSMENT OF IMPACTS

Eleven ecological impacts have been identified to vegetation flora and fauna and the significance of each are summarised below:

1) Direct Loss of Vegetation

During construction, the components of the Manganese Ore Export Facility (Compilation Yard, Rail Link, Manganese Stockyard and Conveyor) all require the clearing of land which will be almost irreversibly altered from the natural state.

The *Alternative 2 of the Compilation Yard* has a smaller footprint than the preferred option, hence the overall loss of vegetation will be lower. The *Rail Link of the Alternative 2 layout* will result in a lower impact to Sundays Valley Thicket within the Open Space Corridor, however it will result in the loss of more Endorheic Pans than the preferred option.

The *Alternative conveyor route* will result in a slightly lower loss of vegetation than the preferred option, as it is located in already disturbed areas.

The significance associated with the loss of vegetation habitat (due to the construction of the facility with the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. After mitigation, the residual impact significance is predicted to be *very low to medium* for all options (*Preferred and Alternatives*).

2) Loss of Flora SSC and SSC habitat

During construction, the components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in the destruction of Species of Special Concern and SSC habitat. The loss of SSC habitat will therefore mostly occur during construction and will persist for the duration of the project, although post construction rehabilitation and natural regeneration is likely to occur in time.

The *alternative layout for the Compilation Yard (Alternative 2)* will most likely result in the overall loss of fewer SSC and SSC habitat due to its smaller footprint, although the residual impact is not likely to be significant.

The *Preferred conveyor route* option will result in a significantly greater loss of SSC and SSC habitat than the alternative option which passes through disturbed areas and the saltpans which are not important habitat for terrestrial fauna and flora SSC.

The loss of flora SSC and SSC habitat associated with the construction of the facility with the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route* is predicted to be of *medium* significance before mitigation. After mitigation the residual impact of the project associated with the destruction of SSC is predicted to be of *low* significance for all options (*Preferred and Alternatives*).

3) Increased risk of alien plant invasion in disturbed areas

Alien plant species could be introduced during the construction and operational phases, especially along the access road and rail link reserve and areas disturbed during construction. The significance of the risk to introduced alien plant invasion (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. After mitigation the increased risk of alien proliferation is predicted to be of *low to very low* significance for all options (*Preferred and Alternatives*).



4) Change in natural fire regime

Fire risk will increase as a result of fragmentation of habitats during the construction and operational phases, especially along rehabilitated access road and rail link reserve verges. The change in natural fire regime (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is predicted to be of *medium* significance before mitigation and *low to very low* significance after mitigation for all options (*Preferred and Alternatives*).

5) Long-term effects of Manganese dust on adjacent vegetation.

Contamination of vegetation with wind borne Mn ore dust adjacent to the Manganese Ore Export Facility emanating most notably from the Stockyard will be prevalent during the Operational Phase. The dust suppression measures described in the Air Quality Specialist Report (Chapter 5), will significantly reduce the amount of Mn ore dust. The significance of the impact (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is assessed to be *medium* before mitigation and *low to very low* after mitigation for all options (*Preferred and Alternatives*).

6) Fragmentation of Ecological Corridors and disruption of Ecological processes as a result of artificial barriers

The components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in both the fragmentation of ecological corridors and artificial disruptions to ecological processes during the construction and the operational phases. The rail link line (rail link and line doubling) will traverse the designated IDZ open space network as well as designated NMBM DBP (2011), resulting in barriers to ecological processes and increased fragmentation.

The *Alternative* Rail Link line is likely to have a lower impact on ecological functioning of the designated Open space system, since they will be less disruptive to the solid thicket component. The preferred route has however been re-aligned significantly from the original position in consultation with the Terrestrial Ecology specialist and has thus been minimised as far as technically possible for that particular layout option. Should the preferred rail link route be implemented, multiple strategically sited Open Lattice Structure bridges will be required, whereas the alternative will most likely require fewer lattice structure bridges.

The *preferred conveyor route* will result in a greater disruption to ecological process areas in the short term than the alternative route, especially as a result of the earthworks required. However since the affected area is designated for development in the long-term, the long term impact will be insignificant.

Before mitigation, the significance associated with the fragmentation and disruption of Ecological Corridors is predicted to be *medium to high* for the *Preferred* and for the *Alternative conveyor route* and *medium* for the *Alternative compilation yard*. Residual effects that are likely to persist are predicted to be of *medium to low* significance for all options (*Preferred and Alternatives*).

7) Faunal mortality as a result of bush clearing and earthmoving activities during site preparation

Site clearing (e.g. bush clearing and earthmoving activities during construction) will have a direct impact on less mobile reptiles and Invertebrates. Before mitigation the significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium*. After mitigation the significance is rated to be of *low* (*Medium* for Amphibians) for all options (*Preferred and Alternatives*).

8) Habitat destruction may affect faunal diversity and composition

The construction of the Manganese Ore Export Facility and related infrastructure (including roads) will permanently destroy existing habitats. The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* (*High* for Amphibians)



before mitigation. The residual impact after mitigation is predicted to be of *low* significance for all options (Preferred and Alternatives).

9) Road mortality of fauna from trucks, trains and other service vehicles

Frequent truck/vehicle road and train activity will result in an increase in mortality of reptiles. The road and railway line infrastructure associated with the Manganese Ore Export Facility, will result in a permanent increase in vehicle and train traffic. The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* (Amphibians = *High* when raining and *Low* when not raining) before mitigation. With effective mitigation, the residual impact is predicted to be of *low* significance (Amphibians = *Medium* when raining and *Very Low* when not raining) for all options (Preferred and Alternatives).

10) Faunal mortalities resulting from fences (mammals and reptiles)

Fauna may enter fenced off areas around the Compilation Yard and Stockyard and get trapped. Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards which can be electrocuted. The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. Fence related mortalities will be reduced significantly with mitigation and the residual impact is predicted to be of *low* significance for all options (Preferred and Alternatives).

11) Mortalities resulting from poaching (mammals).

Workers may set snares to trap animals for food etc during construction and operational phases, which could result in faunal mortalities or severe disabilities. The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. The residual impact after mitigation is predicted to be of *low to very low* significance for all options (Preferred and Alternatives).

POTENTIAL TRADE-OFFS AND BIODIVERSITY OFFSETS

- Due to the required loss of CDC Open Space area (version 9), offsets will be required in consultation with CDC environmental management unit;
- NMBM DBP Critical Biodiversity Areas should be avoided, but if loss cannot be avoided, then offsets will be required in adjacent areas with same ecological likeness as per NMBM DBP recommendations and ratios.

SUMMARY OF REQUIRED MANAGEMENT ACTIONS

The important recommendations to avoid or minimise negative impacts on flora and fauna as a result of the proposed project are summarised below (refer to Section 6.6 for further details):

- Railway and Conveyor reserves must be kept to a minimum width to minimise disruptions to ecological processes. New reserves will need to be registered as per relevant guidelines.
- Railway line and access road design must be such that it does not impede these corridors unnecessarily or completely. Design measures, including appropriate fencing, bridge lattice structures, box culverts and drainage pipes, must be implemented to allow migration of fauna.
- Extensive and detailed final railway link line and additional Railway Line design plans should be approved by a suitably qualified ecologist as well as the appointed EO and CDC Environmental Unit and/or DEDEAT before final implementation. The design information for approval is to include at least detailed design specifications regarding railway line, fencing, culvert and bridge design as well as placement to minimise long term disruptions to ecological processes.
- The rail link route impacts can be reduced to acceptable levels by including the two open, Lattice Bridge crossing structures in the design as proposed by Transnet as well as box-culvert (or stormwater pipes) design and placement to minimise fragmentation and maximise corridor



continuity (refer to Chapter 2, Table 2.1 and Figure 2.7). Open lattice bridge structures (Figure 6-32 & Figure 6-33) are far superior regarding promoting and allowing the free movement of fauna as compared to 30 - 50 m long Box culverts and must be implemented to significantly reduce the disruption and fragmentation of corridors to acceptable levels. The final design of the proposed lattice bridges will need to be verified by a suitably qualified ecologist or specialist.

- Any areas excessively disturbed during construction that are not required during operational phases are to be timeously and adequately rehabilitated under supervision of suitably qualified specialist to enhance corridor connectivity.
- Protected flora (refer to Tables 6.2 and 6.5) and fauna, and where possible endemic flora, must be removed from the affected site footprint to be safeguarded from destruction and relocated either to undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists. Given that the designated Coega IDZ nursery is no longer operational, it is recommended to rescue and relocate plants into areas of the OSMP where rehabilitation is required or can be used for rehabilitation of non permanent areas disturbed during construction.
- Permission must be obtained from the provincial authorities to destroy or remove any protected plant and animal species.
- A suitably qualified person must be appointed to oversee the Environmental Management Plan and relocation of the Species of Special Concern before construction commences.
- A long-term alien plant management plan to control invasive plant species must be implemented within the Railway and Conveyor reserves, including measures to appropriately remove alien invasives during construction. Particular care must be given to seed bearing material minimising potential spread into surrounding areas. The removal of alien invasive plant species from the site surrounds and Railway and Conveyor reserves will reduce the spread of these species into surrounding areas.
- Fencing around the Rail Link should be standard stock fencing without barbed wire. Where the Compilation Yard extends into the Sundays River Conservancy (Tankatara Farm, standard game fencing should be used to avoid injury to large mammals such as kudu).
- Adequate anti erosion measures must be implemented in the Railway and Conveyor reserves, which is situated on slopes and removal of vegetation will result in sediment loss. The reserve must be re-grassed as a priority as the soils present are highly susceptible to erosion. Lattice bridges on drainage lines will also reduce the likelihood of in-stream scouring and erosion.

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GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

- **Aestivation:** a state of animal dormancy, similar to hibernation, characterized by inactivity and a lowered metabolic rate that is entered in response to high temperatures and arid conditions. It takes place during times of heat and dryness, the hot dry season, which are often the summer months
- **Annual:** Completing the cycle from seed to death in one year or season.
- **Arboreal:** refers to animals living in trees
- **Biennial:** Completing the cycle from seed to death in two years or seasons.
- **Biological corridor** is the designation for a continuous geographic extent of habitat linking ecosystems, either spatially or functionally; such a link restores or conserves the connection between habitats that are fragmented by natural causes or human development. Such corridors are an important aspect in the preservation of species richness and biodiversity. There are different scales of biological corridors, but all share the same purpose of providing connections for species through fragmented landscapes. A biological corridor, alternatively termed habitat corridor, is used for the transportation functions of fauna and seed dispersal/propagation routes for flora and lower life forms. Specific elements of this transport for fauna include seasonal or migration movement, life cycle links, species dispersal, re-colonization of an area and movement in response to external pressures. These corridors are not always literally continuous, some acting as stepping stones that provide resting and feeding stops along migratory routes that may contain inhospitable territory.
- **Boundary:** Landscape patches have a boundary between them which can be defined or fuzzy (Sanderson and Harris 2000). The zone composed of the edges of adjacent ecosystems is the boundary.
 - Collectively, wetlands and their associated vegetation are highly diverse and productive ecosystems. Despite their invaluable social and environmental roles, wetlands have been identified as being among southern Africa's most threatened and neglected habitats.
- **Composition:** Refers to the number of patch types (see below) represented on a landscape, and their relative abundance.
- **Connectivity:** Relates to how intact patches of indigenous vegetation are (i.e. it is the opposite of fragmentation). "Functional" connectivity refers to the ability of connective corridors to sustain ecosystem processes common to linked patches. The measure of how connected or spatially continuous a corridor, network, or matrix is. For example, a forested landscape (the matrix) with fewer gaps in forest cover (open patches) will have higher connectivity.
- **Corridors:** Have important functions as strips of a particular type of landscape differing from adjacent land on both sides. Habitat, ecosystems or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "stepping stones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments.
- **Disturbance:** An event that significantly alters the pattern of variation in the structure or function of a system, while fragmentation is the breaking up of a habitat, ecosystem, or land-use type into smaller parcels. Disturbance is generally considered a natural process.



- Due consideration of certain of these processes (such as the maintenance of natural fire regimes) should also be incorporated into good land use management practices for the remaining natural vegetation and immediate surrounding areas.
- **ECO/ESO:** Environmental Site/Control Officer – person responsible for the Day-to-Day Environmental Management on-site during construction.
 - Ecological processes typically only function well where natural vegetation remains, and in particular where the remaining vegetation is well-connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes. Where basic processes are intact, ecosystems are likely to recover more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened.
- **Ecological processes:** Ecosystems work because they are kept "alive" by ecological processes such as pollination, nutrient cycling, disturbance (e.g. fire), migration of species or soil maintenance.
- **Ecosystem status:** Ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving the majority of species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem. See Critically Endangered, Endangered, Vulnerable, Least Threatened.
- **Ecosystem:** All of the organisms of a particular habitat, such as a lake or forest, together with the physical environment in which they live.
- **Ecotone:** The transitional zone between two communities. Ecotones can arise naturally, such as a lakeshore, or can be human-created, such as a cleared agricultural field from a forest. The ecotonal community retains characteristics of each bordering community and often contains species not found in the adjacent communities. Classic examples of ecotones include fencerows; forest to marshlands transitions; forest to grassland transitions; or land-water interfaces such as riparian zones in forests. Characteristics of ecotones include vegetational sharpness, physiognomic change and occurrence of a spatial community mosaic, many exotic species, ecotonal species, spatial mass effect, and species richness higher or lower than either side of the ecotone.
- **Edaphic:** Edaphic is a nature related to soil. Edaphic qualities may characterize the soil itself, including drainage, texture, or chemical properties such as pH.
- **Edge:** The portion of an ecosystem near its perimeter, where influences of the adjacent patches can cause an environmental difference between the interior of the patch and its edge. This edge effect includes a distinctive species composition or abundance in the outer part of the landscape patch. For example, when a landscape is a mosaic of perceptibly different types, such as a forest adjacent to a grassland, the edge is the location where the two types adjoin. In a continuous landscape, such as a forest giving way to open woodland, the exact edge location is fuzzy and is sometimes determined by a local gradient exceeding a threshold, such as the point where the tree cover falls below thirty-five percent.
- **Emergent trees:** Trees that grow above the top of the canopy.



- **Endangered:** Endangered terrestrial ecosystems have lost significant amounts (more than 60 % lost) of their original natural habitat, so their functioning is compromised.
- **Endemic:** A plant or animal species, or a vegetation type, which is naturally restricted to a particular defined region. It is often confused with indigenous, which means 'native, occurring naturally in a defined area'.
- **Exotic:** Non-indigenous; introduced from elsewhere, may also be a *weed* or alien *invasive* species. Exotic species may be invasive or non-invasive.
- **Fragmentation (habitat):** Causes land transformation, an important current process in landscapes as more and more development occurs.
- **Frugivorous:** feeding on fruit or fruit eating.
- **Function:** Refers to how each element in the landscape interacts based on its life cycle events.
- **Habitat:** The home of a plant or animal species. Generally those features of an area inhabited by animal or plant which are essential to its survival.
- **Halophytic:** organisms that thrive in environments with very high concentrations of salt.
- **Halophytic:** plants that grows in waters of high salinity, coming into contact with saline water through its roots or by salt spray, such as in saline semi-deserts, mangrove swamps, marshes and estuaries.
- **Herbivory:** refers to animals eating plants
- **Heterogeneity:** A landscape with structure and pattern implies that it has spatial heterogeneity or the uneven, non-random distribution of objects across the landscape.
 - In all areas where spatial components of ecological processes occur, loss or degradation of natural habitat should be avoided, to ensure that the ecological processes concerned continue to function.
 - include a diverse array of natural habitats, including wetlands
 - include significant ecological processes that contribute to the regional persistence of biodiversity
- **Indigenous:** Native; occurring naturally in a defined area.
- **Invasive:** A non-indigenous plant or animal species that adversely affect the habitats it invades economically, environmentally or ecologically.
 - Key considerations when identifying ecological corridors that can contribute to the conservation of biodiversity:
- **Least threatened terrestrial ecosystems:** These ecosystems have lost only a small proportion (more than 80 % remains) of their original natural habitat, and are largely intact (although they may be degraded to varying degrees, for example by invasive alien species, overgrazing, or overharvesting from the wild).
- **Matrix:** The “background ecological system” of a landscape with a high degree of connectivity.
- **Method statement (construction):** A method statement is prepared for each task on a particular site by the contractor; the group of work method statements are then packaged and included in the overall *Construction Plan*.
- **Nelson Mandela Bay Municipality or Nelson Mandela Bay Metro (NMBM):** The local authority within which the Coega IDZ and proposed site is located.



- **Network:** An interconnected system of corridors while mosaic describes the pattern of patches, corridors and matrix that form a landscape in its entirety.
- **Off-sets:** Compensation for biodiversity loss resulting from authorized changes in land use. Can include assigning stewardship or protected area status to remaining conservation-worthy land or making a financial bequest for purposes of biodiversity conservation.
 - Other examples of processes include plant-herbivore processes, diversification of plant lineages along soil type transitions and lowland to upland gradients, natural fire regimes, predator-prey relationships, migration and exchange between inland and coastal biota (often along river corridors), faunal seasonal migration and hydrologic regimes.
- **Patch:** defined as regions that are more or less internally homogeneous with respect to a measured variable (a set of spatially proximate homogeneous units).
- **Pattern:** The term for the contents and internal order of a heterogeneous area of land.
- **Process:** Spatial and temporal components for ecological and evolutionary processes necessary for biodiversity maintenance and generation, includes aspects such as migration and seed dispersal.
- **Refuge:** A location of an isolated or relict population of a once widespread animal or plant species.
- **Riparian:** Pertaining to, situated on or associated with a river bank.
- **River corridors:** River corridors perform a number of ecological functions such as modulating streamflow, storing water, removing harmful materials from water, and providing habitat for aquatic and terrestrial plants and animals. These corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Rivers provide for migration and exchange between inland and coastal biotas.
- **Shrub:** A woody plant that produces no trunk but branches from the base.
- **Spinescent:** Having a spine or spines.
- **STEP:** Sub-Tropical Ecosystem Planning, a conservation planning project conducted in the Eastern Cape and Western Cape where Thicket vegetation occurs.
- **Structure:** Is determined by the composition, the configuration, and the proportion of different patches across the landscape.
 - support connections between critically endangered or endangered vegetation and large, intact areas of natural vegetation
 - support connections between remaining natural habitat
- **Transformation:** In ecology, transformation refers to adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation - the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments.
- **Tributary/Drainage line:** A small stream or river flowing into a larger one.
- **Understory:** The area of a forest which grows in the shade of the canopy. Plants in the understory consist of a mixture of seedlings and saplings of canopy trees together with understory shrubs and herbs. Young canopy trees often persist as suppressed juveniles for



decades while they wait for an opening in the forest overstory, which will enable their growth into the canopy. On the other hand, understory shrubs are able to complete their life cycle in the shade of the forest canopy.

- **Vulnerable:** Vulnerable terrestrial ecosystems have lost some (more than 60 % remains) of their original natural habitat, and their functioning will be compromised if they continue to lose natural habitat.
- **Weed:** An indigenous or non-indigenous plant that grows and reproduces aggressively, usually a ruderal pioneer of disturbed areas. Weeds may be unwanted because they are unsightly, or they limit the growth of other plants by blocking light or using up nutrients from the soil. They also can harbour and spread plant pathogens.
 - Wetlands perform a number of valuable ecosystem functions.
- **Wetlands:** A collective term used to describe lands that are sometimes or always covered by shallow water or have saturated soils, and where plants adapted for life in wet conditions usually grow.



CHAPTER 6: TERRESTRIAL ECOLOGY: FLORA AND FAUNA

This chapter presents the Terrestrial Ecology Specialist study undertaken by Mr Jamie Pote, under appointment to CSIR, as part of the Environmental Impact Assessment for the proposed Manganese Ore Export Facility and associated infrastructure in the Coega Industrial Development Zone, Port of Ngqura and Tankatara area.

6.1 INTRODUCTION AND METHODOLOGY

6.1.1 Scope and Objectives

The Specialist Study on Terrestrial Ecology is being undertaken within the context of a full EIA, and the outcomes thereof have been designed to provide sufficient detailed information with which to inform the EIA Report and Environmental Management Plan (EMP).

The overall objectives of the specialist study are to:

- Describe the vegetation on the study area, including the species composition of each vegetation type and any potential protected, endangered or vulnerable species.
- Describe the current state of vegetation on site (i.e. natural, transformed, disturbed and presence of alien species) and the conservation status and value of this vegetation.
- Describe the faunal species (i.e. mammal, amphibian and reptile) present on site based on available studies and a faunal assessment, and include those species which are likely to occur within, traverse across or forage within the proposed project area. Vulnerable, endangered or threatened species must be identified and discussed.
- Identify species of special concern (flora and fauna) and that may need to be relocated, as well as associated permit/licence requirements.
- Provide a vegetation sensitivity map, indicating the presence of species of special concern, “no-go” areas, as well as the identification of red flags or risks associated with the terrestrial ecology in the proposed project area.
- Identify gaps in baseline data. The best available data sources must be used to predict the impacts, and extensive use must be made of local knowledge. Information derived from similar specialist studies conducted previously within the area must be utilised.
- Conduct the assessment of impacts in accordance with the conventions and requirements in terms of the South African EIA legislation and guidelines (refer to the approach to the EIA presented in Chapter 3).

6.1.2 Terms of Reference

The Terms of Reference (TORs) for the terrestrial ecology study are contained in the Final Scoping Report (CSIR, 2012) for this EIA, and include the following:

1. Carry out fieldwork to locate and describe the terrestrial vegetation on the study area; key focus on the impact footprint(s) for the site(s).
2. Drawing on desktop information sources; the knowledge of local experts, information published in the scientific press and information derived from relevant EIA's and similar specialist studies previously conducted within the surrounding area.
3. Determine the species present and localities within each vegetation type.
4. Determine whether the study area falls wholly or partially within the distribution range of species listed as Vulnerable, Endangered or Critically Endangered, Protected, IUCN Red Listed or Endemic.



5. Provide a description of the current state of the vegetation on site supported by relevant photographs.
6. Identify and describe the conservation value and conservation planning frameworks relevant to this site (Regional Planning) for represented vegetation units.
7. Determine the status of the Eastern Cape Biodiversity Conservation Plan in terms of the National Environmental Management Act.
8. Describe the areas where indigenous vegetation has been transformed.
9. Highlight and provide specialist input into the siting of the infrastructure and the associated impacts onto the open space management system.
10. Assess any potential loss of habitat or disturbance to the saltpans as a result of all phases of the proposed project.
11. Identify and determine invasive alien species present; as well as their distribution within the study area and recommended management actions for their control.
12. Note and record the position of unusually large specimens of trees, if applicable, in the study area.
13. Compile and provide a detailed vegetation sensitivity map of the site, including mapping of disturbance and transformation on site.
14. Faunal Assessment (Mammal and reptile) will be integrated into Ecological (Biodiversity) Assessment Report.
15. Identify and rate potential impacts (direct, indirect and cumulative) related to the terrestrial ecology for the construction, operational and decommissioning phases of the proposed project, including the impacts on the open space management system, thicket, and coastal dunes. Outline mitigatory measures and additional management guidelines.
16. Consider any relevant issues that may be raised during the public consultation process.
17. An Environmental Management Plan (EMP) will be compiled, to include recommendations relating to flora and vegetation, and generic rehabilitation and re-vegetation guidelines.

6.1.3 Approach and Methodology

The approach to the study is based on review of available information (refer to section 6.1.5), field work, application of guidelines and regional biodiversity planning frameworks, and the extensive experience of the specialist in the Coega area.

The potential impacts on terrestrial ecology are assessed using the methodology described in Chapter 4 (Section 4.8) of this EIA Report.

A Vegetation Vulnerability Assessment was also conducted, to inform the assessment of impacts, and the method is provided in Appendix 6.B, with associated Fine Scale Maps provided in Appendix 6.C (Figure 6.44 to Figure 6.48).

6.1.4 Assumptions and Limitations

- Whilst the fauna and flora of the area are relatively well known, the flora and fauna surveys conducted for this study were based upon a limited sampling time period and may not fully reflect the actual species composition of the site, for example, because of seasonal variations.
- While all reasonable attempts were made, the author cannot guarantee that **all** plant species were recorded during the assessment because of the rapid sampling and assessment techniques employed.

6.1.5 Source of Information

- Information was obtained from literature sources as indicated in the references section for the desktop component of the study. Fieldwork was conducted to obtain site-specific information

and local expert knowledge was also obtained where pertinent and available. Plant species lists for the site based on plant collections and identification conducted during the site visit and previous site visits in the general area conducted between 2006 and 2012).

The ecological assessment is based on information from the following sources:

- A review of the Biodiversity Planning Frameworks applicable to the area:
 - STEP - Subtropical Thicket Ecosystem Planning Project,
 - NSBA - National Spatial Biodiversity Assessment,
 - ECBCP - Eastern Cape Biodiversity Conservation Plan,
 - SAVeg - Vegetation of South Africa, Lesotho and Swaziland.
 - NMBM CAP - Nelson Mandela Bay Municipality Conservation Assessment and Plan (2011)
- Published lists of Species of Special Concern:
 - NEM: Biodiversity Act List,
 - National Red List for South African Plants (2012),
 - Red Data Book for Mammals,
 - Red Data Book for Birds,
 - Red Data Book for Reptiles,
 - Red Data Book for Butterflies,
 - Cape Nature and Environmental Conservation Ordinance (No 19 of 1974)
 - List of Protected Tree Species under the National Forest Act (No 84 of 1998) (Government Gazette 32731, Notice 1106), November 2009 .
 - List of Threatened and Protected Species (National Environmental Management: Biodiversity Act (No. 10 of 2004)
- A review of the relevant literature regarding the ecological/biodiversity features in the study area (list provided in the references section of this report).

6.1.6 Declaration of Independence

The declaration of independence by the Terrestrial Ecology specialist is provided in Box 5.1 below:

BOX 6.1: DECLARATION OF INDEPENDENCE FOR TERRESTRIAL ECOLOGY IMPACT ASSESSMENT

I Mr Jamie Pote declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Manganese ore Terminal, Port of Ngqura, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Signature

Name: Mr Jamie Pote B.Sc (Hons)



6.2 PROJECT ASPECTS RELEVANT TO TERRESTRIAL ECOLOGY

For a general overview of the project description for the proposed Manganese Ore Export Facility, refer to Chapter 2 (Project description) of this EIA Report. The following section provides additional detailed information on specific aspects of the proposed project that is relevant to the potential impacts on terrestrial ecology. The following information is therefore added:

- The rail link and the return loop reserve (between the Compilation Yard and the main line) to be bush cleared during construction will be between 30 and 50 m in width enclosed by a stock fence on both sides. Depending on cut and fill requirements, the reserve will have a minimum width of 30 – 35 m and a maximum width of 45 – 50 m. The reserve will be comprised of:
 - a 4 m raised service road and verge on either side which will house cabling requirements with a total width of approximately 11 m.
 - A raised rail platform with a width of 10 m, which will be kept clear of vegetation for its lifetime by Transnet.
 - An additional 2 – 5 m cleared corridor between the rail and the outer fence to allow for possible future expansions.
- Fencing will be provided along the railway line doubling and rail link line from the Stockyard to the Compilation Yard. The type of fencing to be used is expected to be 6 to 8 strand wire “stock” fence with a height of approximately 1.35 to 1.5 m. There will be a spacing of approximately 300 mm between the strands and the distance between the bottom strands can vary to allow animals to pass through, but will keep out cattle and sheep. The 75 mm vermin proof diamond diagonal mesh and barbed wire are optional.
- Box culverts are proposed as crossing structures over drainage lines along the route of the rail link/return loop and line doubling. Size to be used will be 3 m wide and 2 m high where allowable.
- Lattice type structure rail crossings (creating underpasses by allowing natural light penetration) are also proposed by Transnet where the railway crosses over gulleys and drainage lines along sections of Open Space with a span of approximately 20 m and a height of approximately 1.5 m. The purpose of these lattice structures is to allow for a continuity of the open space system corridor and for small animals to cross the railway line
- A cutting to accommodate the preferred Conveyor Route is proposed that will result in clearing of vegetation and cut and fill slopes to accommodate the required infrastructure.

6.3 APPLICABLE LEGISLATION AND PERMITTING REQUIREMENTS

6.3.1 Environmental legislation relevant to impacts on terrestrial ecology in the study area

6.3.1.1 National Environmental Management Act

The National Environmental Management Act (NEMA: Act no. 107 of 1998) requires that all organs of state take biodiversity considerations into account in their decision making. The bioregional plan facilitates this by serving as the official reference for biodiversity priorities within the bioregion, superseding all previously published spatial biodiversity plans. The portions of the following plans pertaining to the NMBM are **superseded by the NMBM Bioregional Plan**: The Cape Action Plan for the Environment (C.A.P.E.), The Subtropical Thicket Ecosystem Plan (S.T.E.P.), the Eastern Cape

Biodiversity Conservation Plan (E.C.B.C.P.) and the Nelson Mandela Bay Conservation Assessment and Plan (NMBM CAP)

6.3.1.2 National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004)

- Albany Alluvial Vegetation is listed as endangered in terms of NEMBA.
- The area where Albany Alluvial Vegetation will be affected by the proposed Facility is already transformed and thus no additional loss of vegetation cover is likely to occur.

6.3.1.3 Conservation of Agricultural Resources Act 43 of 1983 (CARA)

Alien Invasive Plants require removal according to the Conservation of Agricultural Resources Act 43 of 1983 (CARA). This requires that specific eradication and management procedures must be stipulated in the EMP in terms of the methods to be implemented to remove and control the various alien invasive species as they tend to require species specific techniques. Introduced weed species do not require removal but management is advised to prevent proliferation as a result of disturbance (i.e. on road verges, etc).

Table 6.1: Alien Invasive plants and common weeds present and CARA classification.

Botanical Name	Common name	Family	Category ¹	Extent
<i>Acacia cyclops</i>	Rooikranz	Mimosoideae	CARA2	Abundant in dune areas south of the site. Some small clumps present and also removed. Disturbed areas will be susceptible to re-infestation.
<i>Eucalyptus sp</i>	Gum Tree	Myrtaceae	CARA 2	In surrounding areas
<i>Opuntia ficus-indica</i>	Prickly Pear	Cactaceae	CARA 1	Present in transformed areas
<i>Opuntia monacantha</i>	Jointed Cactus	Cactaceae	CARA1	Scattered, uncommon
<i>Aptenia cordifolia</i>	Rooi brakvygie	Mesembryanthemaceae	Introduced weed	Scattered, uncommon
<i>Conyza canadensis</i>	Canadian Horseweed	Asteraceae	Introduced weed	Scattered, uncommon
<i>Exomis microphylla</i>	Hondebossie	Chenopodiaceae	Introduced weed	Scattered, uncommon
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Poaceae	Introduced weed	Scattered, uncommon

6.3.1.4 Other legislation

- **E.C.A:** At the time of compilation of this report the provincial Environmental Conservation Bill (2003) had not yet been promulgated. Should the Act be promulgated before site activities commence, respective permits may be required. The species list accompanying the Act would thus take precedence over previous lists as appropriate.
- **T.O.P.S.:** A number of **Threatened or Protected Species** (Fauna) may be present within the affected area and permits will be required. Refer to faunal species listed in Table 6.8. No T.O.P.S. listed floral species are present.

¹ CARA: Conservation of Agricultural Resources Act (Category 1, 2 or 3); Introduced weed- -not a declared weed, but they tend to proliferate in disturbed areas, especially after construction and should be controlled to promote optimum rehabilitation.



- **N.E.M.B.A. (57) 1:** *Albany Alluvial vegetation* is listed, but the affected area is already transformed by the presence of the existing railway bridge crossing and no additional loss of habitat is likely (i.e. clearance of an area 300 m² where 75 % constitutes indigenous vegetation)

Note: The various biodiversity regional planning documents are discussed under section 6.4 on the Affected Environment.

6.3.2 Environmental licences and/or permits applicable to terrestrial ecology in the study area

- In terms of the **National Forests Act**, 1998 (Act No 84 of 1998) and Government Notice 1339 of 6 August 1976 (promulgated under the Forest Act, 1984 (Act No 122 of 1984) for protected tree species), the removal, relocation or pruning of any protected plants will require a license from the Department of Agriculture, Forestry and Fisheries (DAFF).
 - Department of Agriculture, Forestry and Fisheries (DAFF) for NFA permits: Mr. Thabo Nokoyo; Department of Water Affairs and Forestry; Port Elizabeth; Email: NokoyoT@dwaf.gov.za; Tel: (041)586 4884; Fax: (041) 586 0379.
- Protected indigenous plants in general are controlled under the relevant provincial Ordinances or Acts dealing with nature conservation. In the Eastern Cape the relevant statute is the 1974 **Provincial Nature Conservation Ordinance** no 19 (PNCO) and **Threatened or Protected Species** (T.o.P.S) in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA). In terms of the Ordinance and Act, permits must be obtained from the Department of Economic Development, Environmental Affairs Environment and Tourism (DEDEAT) to remove or destroy any listed plants and animals.
 - Department of Economic Development and Environmental Affairs and Tourism (DEDEAT) for PNCO permits: Mr. Alan Southwood; Private Bag X5001; Greenacres; Port Elizabeth; 6057; Email: alan.southwood@deaet.ecape.gov.za ;Tel: (041) 508 5800; Fax: (041) 585 1964/585 1958.

6.4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section provides an understanding of the affected environment pertinent to the project activities, under the following sub-sections:

- Site topography
- Habitats affected by the various components of the proposed project
- Vegetation and ecological processes
- Regional Planning Frameworks
- Fauna.

6.4.1 Site topography

The site, located within the Coega IDZ (Figure 6.38) is variable in topography, with the Compilation yard located on a level elevated Plateau, the Rail line running through an incised valley adjacent to the Coega River, the Stockyard located on a level floodplain west of the Coega River, and the Conveyor running along the edge and palaeodunes on the west side of the Coega River to the Port area (Figure 6.38). In general soils on the plateaux are well developed with shallower, rocky soils where the topography slopes towards the drainage lines and where calcrete outcrops are exposed.



The general plateau area is dotted with seasonal pans, especially in the vicinity of the Compilation Yard.

6.4.2 Habitats affected by the proposed project components

The habitat affected by the proposed project components are described below. An assessment of site vulnerability is provided in Appendix 6.B with fine-scale maps provided in Appendix 6.C.

6.4.2.1 Habitat affected by the Proposed Compilation Yard

The predominant vegetation of the proposed Rail Compilation Yard (RCY) is Grassridge Bontveld or Coega Bontveld (Stewart *et al.* 2004) associated with shallow calcareous soils on the Alexandria formation. The preferred site of the proposed Compilation Yard (Alternative 1) is on flat and gently sloping areas with predominantly Grassridge Bontveld, which is composed of a grassy matrix with exposed calcrete outcrops and interspersed with clumps of thicket where better developed soils allow. The Bontveld is generally in moderate to good condition within the IDZ, with some degradation relating to historical grazing activities. Within the existing Tankatara farm outside of the IDZ, levels of degradation are elevated, with significant loss of thicket clumps and typical Bontveld habitat as a result of farming management practices. Some areas of the Bontveld are invaded with alien Rooikrans *Acacia cyclops* and there is evidence of extensive clearing having occurred in the recent past. The alternative option (Alternative 2) is located in more or less the same area; but is situated slightly northwards, closer to the existing railway line and occupies a slightly smaller footprint. A number of Endorheic pans will be affected by both alternatives (refer to Chapter 9 Aquatic Ecology Impact assessment).

Bontveld occurs in the area northeast of Port Elizabeth, in the Coega area; with some patches in the Addo and Paterson areas on shallow calcareous soils of the Alexandria formation. It is generally comprised of a low grassy shrub matrix of grassland, fynbos shrubs and karoo elements interspersed with small bushclumps of woody thicket elements. The unit has numerous plant species of special concern and is under threat from industrial development and mining in the Coega area. It provides favourable habitat for a number of reptiles (snakes and tortoises), amphibians and small mammals. The unit is classified as *Vulnerable* in the NMBM Draft Bioregional Plan (2011). The conservation status rating is considered to be an underestimation and the conservation rating of Grassridge Bontveld is recommended to be rated as Critically Endangered "based on their remaining extent, ecological importance and susceptibility to degradation and transformation". More than 60% of remaining natural Bontveld has been approved for opencast mining (negotiations are underway to conserve around 20% of this, but this will be in a fragmented way) and a further 30% for development in the Coega IDZ. There are no further opportunities for conservation of Bontveld other than on private land. A few hectares are conserved in Addo Elephant National Park and Shamwari Private Nature Reserve and a small area has been allocated as open space in the IDZ OSMP (Campbell, pers. comm., 2008).

Sundays Valley Thicket (also called Sundays Thicket or Sundays Mesic Succulent Thicket) is restricted in distribution to the coastal plain between the Sundays and Gamtoos Rivers. It occurs on red loam and clay soils derived from the Sundays River and Kirkwood Formations. It is comprised of a dense thicket of often spinescent woody shrubs, trees and succulents. Reptiles and amphibians are not that abundant in Sundays Valley Thicket, but it does provide some habitat for small to medium sized mammals. Historically, however a greater abundance of larger mammals may have been present, although these now tend to be more prevalent in less developed inland wilderness and rural areas. Bird diversity and abundance is relatively high in the Thicket vegetation and birds are important seed-dispersal agents for thicket flora. However, bird populations are comprised mostly of relatively common and widespread passerine and bush dwelling species. The unit is classified as *Vulnerable* in the NMBM Draft Bioregional Plan (2011). Extensive areas are being



cleared to accommodate urban expansion within the Metropolitan area, especially in the vicinity of Uitenhage and Motherwell.



Figure 6.1: Typical Grassridge Bontveld, with Grassy matrix, thicket clumps and exposed calcrete outcrops.



Figure 6.2: Typical degraded Grassridge Bontveld.



Figure 6.3: Close-up of calcrete outcrop within Bontveld.



Figure 6.4: Typical Sundays Valley Thicket clumps within Bontveld matrix.

6.4.2.2 Habitat affected by the Proposed Railway Link line

Two Railway link line options are proposed (with return loops), the preferred option (Alternative 1) linking the preferred Compilation Yard to the main railway line and the alternative option (Alternative 2) linking the alternative Compilation Yard option to the main railway line.

Alternative 1

The proposed preferred Alternative 1 (linking the main railway line to the preferred Compilation Yard) passes through typical Bontveld (with grassy matrix and thicket clumps) west of the Compilation Yard, before crossing through a band of solid Sundays Valley Thicket, which forms part of the designated IDZ OSMP on the slopes along the eastern banks of the upper Coega River, which will be fragmented. It then passes through a section of transformed vegetation, having grasses and other pioneer herbaceous and woody species, with some alien invasion. The loop-back route similarly traverses a band of solid to slightly fragmented thicket.

Alternative 2

The proposed alternative (Alternative 2), linking the main railway line to the alternative Compilation Yard option) passes through typical Bontveld (with grassy matrix and thicket clumps) as above but will also cross some Endorheic pans, before crossing through a narrow band of solid Sundays Valley Thicket, which forms part of the designated IDZ OSMP on the slopes along the eastern banks of the upper Coega River, which will be fragmented. The loop-back route similarly traverses Bontveld, but joins the Railway line outside of the designated OSMP ecological process area.

CDC IDZ OSMP: The OSMP will be traversed and fragmented by both rail link alternatives (and return loops) as described above in order to link the Compilation Yard with the railway line. Two OSMP versions have used in this assessment, the approved version (version 9) and the proposed amended version (version 10).

OSMP Verison 9 (Refer to Figure 6.42).

Alternative 1 will result in the ecological processes area (1.5) being fragmented by the link line and the return loop line, with a small section passing through thicket (MST 1.6).

Alternative 2 will result in the ecological process area (1.5) being fragmented only by the link line. The return loop will fall outside of the OSMP.

OSMP Verion 10(Refer to Figure 6.43).

Alternative 1 will pass through the OSMP Mesic succulent Thicket, and the return loop will fragment designated Ecological Processes area.

Alternative 2 will fragment designated Ecological Processes area on both the the main link and return loop. The areas of Ecological process area tend to be vegetated with a mosaic of Thicket, Bontveld and secondary (degraded or transformed) elements and clearing of a reserve will have a lower ecological impact than clearing a reserve through solid thicket. (Refer to Figure 6.42).

NMBM CBA: Both Rail link alternatives and Conveyor route alternatives will cross and fragment the designated NMBM Critical Biodiversity Area.



Figure 6.5: Typical Endorheic Pan.



Figure 6.6: Solid Thicket Band along eastern side of railway line

6.4.2.3 Habitat affected by the proposed doubling of the Railway Line to Marshalling Yard

The proposed route of the additional Railway Line between the Compilation Yard and the Marshalling Yard is located on the eastern side of the existing railway line. It passes through



portions of intact, semi intact and transformed thicket located on slopes, and bands of thicket border the existing railway line. Cut and fill requirements will require additional clearing of thicket to accommodate the widening of the reserve. The line will cross over the Coega River at a number of points, where existing crossings are situated and will run closely parallel to small portions as well. In general the Thicket along the reserve is disturbed and tends to be somewhat fragmented. A thicket band directly adjacent to the existing line will also require removal, although much of this is secondary in nature as a result of secondary regeneration after construction of the original line. The line also passes through some semi intact Bontveld patches and transformed and disturbed vegetation patches along the route. The route along the eastern side of the existing line will marginally cut into the edge of the proposed IDZ OSMP (Ver. 9 and 10), although this is likely to be of less significance than the fragmentation resulting from the Link Lines. Towards the existing Marshalling Yard, disturbance and transformation is more extensive and the route will not result in significant loss of intact habitat.



Figure 6.7: Typical solid Sundays Valley Thicket along Railway route



Figure 6.8: Typical solid Sundays Valley Thicket along Railway route.



Figure 6.9: Typical solid Sundays Doringveld



Figure 6.10: Disturbed Grassridge Bontveld adjacent to railway line.

6.4.2.4 Habitat affected by proposed manganese ore stockyard

The proposed Stockyard site is located on an alluvial terrace adjacent to the Coega River north of the N2 and is bounded on the south by the N2, on the west by the (existing) Ngqura Marshalling



Yard, on the east by the Coega River and minor saltpans and on the north by a tributary of the Coega River with Sundays Valley Thicket and Sundays Doringveld.

The predominant vegetation prevalent at the proposed Stockyard is Motherwell Karroid Thicket, which comprises a matrix of Succulent Karoo and grassy elements with clumps of Sundays Valley Thicket (Stewart *et al.* 2004; SRK 2010). It is classified as Endangered in the NMBM Conservation Assessment and Plan (SRK 2010). On the deep alluvial soils adjacent to the Coega River in the northern half of the site away from the influence of salt water is Sundays Doringveld Thicket, also classified as Endangered.

In general, the site is semi intact with approximately 30 Ha transformed, as a result of historical dumping (sewerage waste and rubble) from the nearby Brick Works. What portions of Motherwell Karroid Thicket remain, tend to be historically over utilised and degraded, although some protected species and other species of special concern are present. Such disturbed areas, especially having dumped rubble, do however tend to provide habitat for numerous cosmopolitan reptile species.



Figure 6.11: Disturbed portion of Stockyard.



Figure 6.12: Semi intact Motherwell Karroid Thicket in Stockyard site.

6.4.2.5 Habitat affected by the proposed Conveyor belt to Port area

The proposed preferred Conveyor belt passes along the western side of the Saltpans, along the existing railway corridor, before traversing through an overland cutting slightly westwards along the east facing slope towards the Port area. The slopes along the western edge of the Saltpans tend to be disturbed to some extent, although thicket and Bontveld pockets elements are still present. The route passes over a few small drainage lines, which are essentially becoming modified as stormwater channels from the areas west of the Coega River.

The alternative option (the CDC approved corridor) passes through some intact vegetation south of the N2 before traversing along the edge of the saltpans adjacent to the railway line to the port,

Saltpans (Man-made) occupy the valley floor between the N2 freeway and the Port of Ngqura with the Coega River routed along an artificial channel along the eastern edge of the floodplain. The Coega Estuary and Coega Estuary Floodplain have been so extensively modified that very little of the natural habitat remains. The Estuary and Estuary Floodplain are classified as Vulnerable in the NMBM Draft Bioregional Plan (2011). A portion of the Conveyor will pass through and adjacent to saltpan areas.



Sundays Valley Thicket and Bontveld: A portion of Sundays Valley Thicket (MST) with some Bontveld patches is located centrally along the proposed Conveyor route for both the preferred and the alternative routes. This area is however NOT located within the Open Space Management Plan (Ver. 9) and is designated as 'MST to be lost' in the OSMP (Ver. 10).

Port Area: No intact vegetation remains within the port area. The Port area is largely transformed as a result of Port construction.



Figure 6.13: Saltmarsh, existing railway line and slopes with intact Sundays Valley Thicket along western banks of Coega River.

6.4.3 Vegetation and Ecological Processes

The vegetation of the Eastern Cape is complex and is transitional between the Cape and subtropical floras. On a regional scale, the study area is located within the Subtropical Thicket Biome, known for its role in separating northern (summer rainfall) and southern (winter rainfall) floral regions. This biome extends from Mossel Bay in the West to Buffalo City in the East and reaches inland for roughly 100 to 200 km from the coast. The Terrestrial Ecology Research Unit (TERU) (now known as African Conservation Ecology (ACE)) estimated this biome to include in excess of 1558 plants. Outcrops of limestone (Nanaga Formation) and calcareous paleo-dune fields on wave-cut platforms provide habitat for an assemblage of unique flora endemic to the area.

6.4.3.1 Ecological Processes in Thicket (*sensu* Vlok & Euston-Brown, 2002)

The majority of the vegetation type identified on the site is Coega or Grassridge Bontveld and Sundays Valley Thicket, with some Motherwell Karroid Thicket and Sundays Doringveld, all considered part of Subtropical Thicket, or the thicket biome. As with all ecological systems, within the Subtropical Thicket a number of processes at all levels have shaped and will continue to shape the structure and function of the vegetation communities. The most important and relevant of these will be discussed, although a detailed discussion is contained in the various STEP documents, particularly Vlok & Euston-Brown (2002), and are summarized below.

6.4.3.2 Dynamic Ecosystem Processes in Sundays Valley Thicket

The most important ecological and evolutionary processes that are an integral part of Thicket include *climatic* and *edaphic* conditions at a regional level as well as *fire* and *herbivory* to maintain



diversity within and between the different vegetation types. *Dispersal* is also an important ecological process that shapes the vegetation community.

There is a distinct guild of spinescent woody plants in the Valley Thicket that develop recurved branches once these plants are more than a meter tall.

In terms of edaphic conditions the Thicket vegetation in itself is probably the largest determining factor, as it is the largest contributor towards build-up of leaf litter and thus soil forming processes. One should, however, take note of the vital importance of retaining this leaf litter layer as its demise will undoubtedly also result in the demise of the Thicket vegetation. This seems particularly so in the case of the Valley Thicket units. Here the mulch layer may not only have an important water retaining function, but also have allelopathic properties to prevent grasses from establishing under the bush-clumps. Once grasses are abundant they can fuel the eternal enemy of this Thicket type, fire. Especially along riverbanks and in floodplains where the soils are vulnerable to erosion, soil building and retaining factors are important processes to maintain the local ecological system in a healthy condition. The soil and water “binding” ability of the Thicket vegetation is an important aspect in regional ecological processes, not only because much of the Thicket vegetation occurs in river valleys, but also because much of it occurs in regions where it “never rains, but pours”.

The role of ecosystem processes or drivers can be summarized as follows:

- Edaphic factors
 - Vegetation types (or Broad Habitat Units) are largely defined by the underlying geology and soils which play a critical role in the community structure.
 - Soil forming processes (including leaf-litter accumulation) are further critical in maintaining thicket units, through water and nutrient retention and possibly preventing grasses from establishing under bush clumps (and hence increase fire likelihood).
 - Thicket also provides an important water and soil conservation function in that it is able to retain water in the soil and humus during high rainfall events (Vlok & Euston Brown, 2002).
- Climatic factors
 - Rainfall (pattern and amount) plays an important role in defining thicket vegetation units, where moist and dry sites vary markedly in species composition and structure.
- Fire and herbivory
 - These act as important shaping factors of Thicket at a local level and the relative abundance of both these factors play a fundamental role in shaping the vegetation communities present within an area.
 - The relative abundance and frequency of fire and herbivory determine whether a particular area will become a climax solid Thicket unit or will remain as a Grassland or Grassland Mosaic unit.
 - Grasses tend to be fire prone compared to solid Thicket units, so frequent fires (and herbivory) will tend to maintain a grass dominated community. In the presence of fire, grassland dominated vegetation types are favoured, whilst when fire and herbivory is excluded the vegetation will tend towards a Thicket type, which in turn becomes fire resistant.
 - Herbivory (particularly by browsers) tends to favour a vegetation type that is sensitive to fire, unless there is excessive grazing and loss of grass cover, in which case lack of fire will favour the formation of small clumps of thicket, particularly around termite mounds.
 - Fire also serves to create gaps in Thicket which allow the full complement of Thicket species to occur.
 - Species richness levels tend to be highest at the contact or tension zones between Thicket and different vegetation types, partly because species from both biomes are present but also due to the presence of localized endemics.



- Some disturbance is thus important to maintain optimal species diversity within the Thicket biome, from both fire (especially during dry periods) and herbivory (to create gaps).
 - The proportion of browsers to grazers is important in maintaining a balance of disturbance, which varies between vegetation types.
 - Further ecological studies should be conducted to determine the historical occurrence of large herbivores and other disturbance agents within the area.
- Dispersal mechanisms
 - Seed dispersal is particularly important in Thicket ecology and many pioneer Thicket species are bird and wind dispersed. Fences, provide natural perches for birds and in most areas this is visible as distinct hedgerows of small shrubs and trees along fence lines. These fence lines provide an important corridor in areas that have been transformed through agricultural practices as they provide a habitat for many Thicket preferring species. The retention of an unbroken habitat is important to maintain these processes.
 - Thicket plays an important role in maintaining connectivity between different vegetation types as it shares many common species with them. It is important to retain this connectivity for adequate functioning at a landscape level.

Conventional restoration techniques have been shown to deliver poor results in degraded subtropical thickets (Todkill, 2001). Not only are many thicket plant species relatively slow growing, but there is also very little evidence of natural regeneration – probably as a result of poor seedling survival and lack of canopy recruitment (Sigwela, 2004). Frugivorous birds may play an important role in seed dispersal within subtropical thicket (Dean, 2002), explaining the high number of plant species with fleshy fruits (Vlok & Euston Brown, 2002).

6.4.3.3 Factors Threatening the Thicket Vegetation

The impacts by man on the Thicket vegetation started long before colonial times. Especially the inland Thicket units may have been exposed to grazing pressure by domestic stock for 2 000 or more years. The Dune Thicket and adjacent Valley Thicket in the coastal environment has also been exposed to the use of fire by man for 100 000 years and stock farming for 2 000 years. There can, however, be little doubt that the transformation process of the Thicket vegetation has accelerated considerably during the past 300 years.

At present much of the coastal Thicket is highly threatened by formal and informal urban development. Not only directly in being displaced by towns and townships, but also indirectly by utilization of Thicket species by the local inhabitants. Ironically, the introduction of alien species (such as *Acacia cyclops* and *Acacia saligna*) and altered fire regime (reduction of fire frequency) in Dune Fynbos vegetation that still occurs in semi-urban areas, may favour the establishment of Dune Thicket clumps. If left unburned for long enough they will develop into solid stands of Dune Thicket. The reverse is, however, true for Limestone Fynbos. Where dense stands of *Acacia cyclops* occurs, the fire intensity is increased and these high intensity fires can enter and eradicate stands of Dune Thicket. The occurrence of these alien *Acacia* species holds a threat to the patterns of biodiversity in the Dune Thicket vegetation, especially as many of the localized endemic species tend to occur in the open sites between the Thicket clumps (mosaic areas).

The mainland Thicket also has a number of alien species that threatens the intrinsic biodiversity of its units. The best-known example is the Prickly-pear (*Opuntia ficus-indica*), which despite concerted efforts to eradicate it over many years still remain abundant in some of the Valley Thicket units. The Prickly-pear populations may be on the decline or stable, but there are several other alien weeds increasing their populations gradually in the Thicket vegetation. None of these invasive alien plant



species can hold any good for the maintenance of the ecological processes or the biodiversity of the Thicket Biome.

The Thicket vegetation may well be remarkably resilient to withstand even major shifts in climatic conditions. With those at any particularly point temporally changing from one to another type, as the temporal climatic conditions dictates. Such shifts in the Thicket vegetation can, however, only happen when the Thicket vegetation retains its connectivity through a series of river valleys and especially the Dune Thicket along the coast. Any extensive break in the connection of these Thicket units may well break an important genetic retention route of the faunal or floral components of the Thicket Biome.

Despite its seemingly rigidity to deter impacts of humans, it is very vulnerable to changes in land use patterns, especially where it involves alterations in fire and herbivory regimes. Intensive agricultural practices and the impacts of the rampant development of towns and holiday resorts along the coast are extensive. The impacts of extensive stock and game farming are, however, not always clear-cut and the gradual degradation of the Thicket vegetation in these areas often go unnoticed, even by the landowners, despite the massive extent thereof. The establishment of "Game Reserves" often seem to be a more acceptable form of land use, but in many cases it is doubted that the impact of introduced game would be any less than those of domesticated stock in many cases. The few remaining intact areas of Thicket vegetation are further being eradicated and fragmented to build roads, water pipelines, etc., as if it were stands of alien vegetation. Here and elsewhere there seems to be a serious lack of understanding the vital importance (and sensitivity) of the Thicket vegetation to uphold the process so necessary to maintain the humans living within the Thicket Biome.

6.4.3.4 Fragmentation, Ecological Processes and Transitional Areas

Fragmentation, Edge Effects, Minimum viable area and connectivity between natural areas have a bearing on the functioning of ecological processes within natural areas:

- **Fragmentation** is the transformation of a continuous habitat into habitat patches that vary in size and configuration. Smaller patches of habitat typically contain fewer species, as well as fewer specialist species. Some species adapt to natural fragmentation, but most species are adversely affected by human induced fragmentation (Hilty, et al, 2006).
- **Edge Effects** result in ecological deterioration. The fragmentation of habitats causes an increase in edge areas, but a decrease in internal areas of ecosystems, leading to eventual loss of species from all affected ecosystems. Some species are also prone to avoiding edges of natural areas (edge avoiders) (Hilty, et al, 2006). Certain species however also favour edges.
- **Minimum Viable Area** is the minimum size of a patch that can support a specific species or community.
- **Connectivity of natural areas** is maintained through biological corridors, or areas of land set aside to facilitate ecological processes and species movement (Anderson and Jenkins, 2006).

Some species adapt to natural fragmentation, whilst it appears that many suffer adverse consequences from human-induced fragmentation. Edge effects along with other impacts can ultimately contribute to loss or turnover of species in remaining habitat patches, which in turn may alter the performance of the system. Weedy species and generalist predators become more prevalent, while rare and sensitive species tend to decline. Like plants, native fauna often disappear from small patches, which can also lead to cascading effects. Absolutely critical to the maintenance and long-term prospects of any meta-population is the dispersal of individuals among the habitat patches. Generally, land-use planning for conservation is concerned primarily with immediate goals such as saving species from imminent extinction and providing recreational opportunities. It is slowly being appreciated, however, that the special nature of meta-population genetics generates certain evolutionary tendencies. To the extent that we can anticipate these trends, and plan



accordingly, conservation planning will have a brighter future. Insights from landscape ecology reveal that what surrounds a potential corridor must be considered, in addition to the properties of the corridor itself (Hilty, et al, 2006).

Transitional areas, also called tension zones, have been identified as being ecologically important in terms of species processes and biological diversity within Thicket. Within the context of this report, the transitional zones are those areas bounded by the Thicket and either disturbed or transformed areas or areas of a grassy, karroid or fynbos nature. For the purposes of this report, this includes the numerous thicket mosaic units characteristic of non-solid thicket. They tend to contain a diverse combination of climax and pioneer woody species, which in turn provides an important habitat for faunal species such as birds and reptiles, especially tortoises, which tend to move between foraging in open areas and sheltering under thicket.

6.4.3.5 Species Endemic to Sundays Valley Thicket

Aloe bowiea, *Aloe gracilis*, *Brachystelma cummingii*, *Brachystelma schoenlandianum*, *Brachystelma tabularium*, *Ceropegia dubia*, *Ceropegia zeyheri*, *Encephalartos horrida*, *Euryops ericifolius*, *Gasteria baylissiana*, *Glottiphyllum grandiflorum*, *Haworthia arachnoidea* var. *xiphiophylla*, *Huernia longii*, *Lotononis micrantha*, *Orthopterum coegana*, *Pelargonium ochroleucum*, *Rhombophyllum rhomboideum*, *Strelitzia juncea* and *Tritonia dubia*.

6.4.3.6 Species of Special Concern

Within the study area a total of 216 plant species were identified during the site visits during March and May 2012, although the general area of the site has been sampled on previous occasions relating to other projects.

Initial investigations indicate that a total of 41 indigenous species of special concern, have either an elevated conservation status or are protected under the various relevant legislations occur within the site (Table 6.2):

- 34 species are protected i.t.o. the Provincial Nature Conservation Ordinance (PNCO) of 1974 (Refer to Table 6.2);
- 9 species are Red listed (IUCN) species categorised as follows (Refer to Table 6.2):
 - 2 species are Not Threatened (NT);
 - *Bergeranthus addoensis* (restricted to Uitenhage - Coega Area) and *Rhombophyllum rhomboideum* (occurs Port Elizabeth to Graaff-Reinet)
 - 2 species are Least Concern (LC);
 - *Sutera polyantha* and *Pentaschistis pallida* (both occurring within and outside of the Eastern Cape)
 - 3 species are Vulnerable (Vu);
 - *Euphorbia meloformis* (widespread EC endemic also occurring outside of IDZ), *Euryops ericifolius* (occurs Port Elizabeth to Sundays River), *Peucedanum typicum* (restricted to Uitenhage - Coega Area).
 - 2 species are Endangered (En)
 - *Cyrtanthus spiralis* and *Euphorbia globosa* - both of which are Eastern Cape endemics, occurring outside of both the site and the CDC IDZ. **Removal from the site will thus NOT directly result in either species becoming extinct in the wild.**
 - 1 species is Critically Endangered (Cr)
 - *Corpuscularia lehmannii*, endemic and restricted in distribution to the Coega and Uitenhage area. Specimens of this plant to be relocated to the designated nursery.



The species of special concern listed above and indicated in Table 6.2 require permits if any individuals are to be removed, translocated or trimmed according to the relevant legislation including the National Forests Act and the Provincial Nature Conservation Ordinance (refer to section 6.3 on permit requirements). Some important flora species are illustrated in Figure 6.14 to Figure 6.19. No unusually large specimen of trees were noted within the project area.

Table 6.2: Species having protection status under PNCO, NFA or IUCN occurring within the site.

Botanical Name*	Family	Status**	Regional Endemism*	Distribution/	Distribution within the site
<i>Aloe africana</i>	Asphodelaceae	PNCO	EC endemic, widespread		Widespread, in solid thicket, thicket clumps and scattered through Bontveld
<i>Aloe humilis</i>	Asphodelaceae	PNCO	EC, WC		Scattered clumps and individuals present
<i>Ammocharis coranica</i>	Amaryllidaceae	PNCO	SA, Angola, Zimbabwe		Few individuals noted, possibly not preferred habitat
<i>Anacampteros arachnoides</i>	Portulacaceae	PNCO	EC, WC		Widespread, in Bontveld
<i>Anginon rugosum</i>	Apiaceae	Endemic	EC endemic Kouga, Grahamstown		Scattered individuals throughout outcrops and matrix
<i>Aptenia cordifolia</i>	Mesembryanthemaceae	PNCO	EC weed		Scattered, in thicket
<i>Aristea anceps</i>	Iridaceae	PNCO	EC endemic, widespread		Widespread, in thicket clumps and scattered through Bontveld
<i>Bergeranthus addoensis</i>	Mesembryanthemaceae	PNCO, IUCN (NT)	EC, Uitenhage, Endemic		Scattered in outcrops
<i>Boophone disticha</i>	Amaryllidaceae	PNCO	Southern Africa, East Africa		Scattered and somewhat common in matrix
<i>Carpobrotus edulis</i>	Mesembryanthemaceae	PNCO	EC, WC, Widespread		Widespread
<i>Corpuscularia lehmannii</i>	Mesembryanthemaceae	PNCO, Endemic IUCN (CR)	PE, Uitenhage, Endemic		Bontveld outcrops and matrix
<i>Crassula perforata</i>	Crassulaceae	PNCO	EC, WC, KZN		Scattered in thicket clumps
<i>Crassula pyramidalis</i>	Crassulaceae	PNCO	EC, WC, widespread		Scattered in outcrops
<i>Cyrtanthus spiralis</i>	Amaryllidaceae	PNCO, IUCN (En), Endemic	EC endemic		Scattered in outcrops, seasonal
<i>Delosperma calycinum</i>	Mesembryanthemaceae	PNCO	EC Endemic		Scattered in thicket
<i>Drosanthemum lique</i>	Mesembryanthemaceae	PNCO, Endemic	EC, Humansdorp, Uitenhage, Endemic		Scattered in outcrops
<i>Euphorbia globosa</i>	Euphorbiaceae	PNCO, IUCN (En), Endemic	EC endemic		Few isolated specimens in outcrops
<i>Euphorbia meloformis</i>	Euphorbiaceae	PNCO, IUCN (VU), Endemic	EC endemic		Few isolated specimens in outcrops
<i>Euryops ericifolius</i>	Asteraceae	IUCN (VU), Endemic	PE, Sundays River		Few isolated specimens in outcrops
<i>Fockea edulis</i>	Apocynaceae	PNCO	EC, WC		Widespread, in thicket clumps
<i>Gasteria bicolor</i>	Asphodelaceae	PNCO	Widespread		Widespread, in thicket clumps

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Botanical Name*	Family	Status**	Regional Endemism ⁺	Distribution/	Distribution within the site
<i>Gasteria nitida</i>	Asphodelaceae	PNCO	EC, WC		Scattered in Bontveld
<i>Glottiphyllum longum</i>	Mesembryanthemaceae	PNCO	EC, WC, Karoo		Common in thicket
<i>Haemanthus coccineus</i>	Amaryllidaceae	PNCO	EC, WC, Namibia, Widespread		Scattered in Bontveld
<i>Haemanthus humilis</i> subsp. <i>humilis</i>	Amaryllidaceae	PNCO	EC		Scattered in Bontveld
<i>Haworthia attenuata</i>	Asphodelaceae	PNCO	EC, Patensie to Kei River, Endemic		Single clump identified in Bontveld matrix (+- 100 individuals)
<i>Haworthia cooperi</i>	Asphodelaceae	PNCO	EC endemic		Single population identified in Bontveld mosaic
<i>Mesembryanthemum aitonis</i>	Mesembryanthemaceae	PNCO	EC, WC		Widespread
<i>Osteospermum imbricata</i>	Asteraceae	PNCO	EC, WC, Widespread		Scattered in Bontveld
<i>Pachypodium bispinosum</i>	Apocynaceae	PNCO	EC, WC		Widespread, in thicket clumps and scattered through Bontveld mosaic
<i>Pentaschistis pallida</i>	Poaceae	IUCN (LC)	EC to Namaqualand		Occasionally present in outcrops
<i>Peucedanum typicum</i>	Apiaceae	IUCN (VU)	EC Endemic, Uitenhage area		Mosaic rare
<i>Raphionacme zeyheri</i>	Apocynaceae	PNCO	EC, Endemic		Outcrops and mosaic, scarce
<i>Rhombophyllum rhomboideum</i>	Mesembryanthemaceae	PNCO, IUCN (NT)	EC endemic, PE, Graaff-Reinet		Abundant in site, scattered in outcrops
<i>Ruschia cymbifolia</i>	Mesembryanthemaceae	PNCO	EC, WC		Outcrops, sparse
<i>Ruschia rigens</i>	Mesembryanthemaceae	PNCO	EC, WC		Locally common in outcrops and mosaic
<i>Sideroxylon inerme</i>	Sapotaceae	NFA	Widespread		Common in thicket clumps
<i>Sphalmanthus spinuliferus</i>	Mesembryanthemaceae	PNCO	WC, WC, NW		Scattered in Thicket
<i>Stapelia grandiflora</i>	Apocynaceae	PNCO	EC, WC, FS		Associated with thicket clumps
<i>Sutera polyantha</i>	Scrophulariaceae	IUCN (LC)	EC, WC		Thicket and Bontveld Matrix
<i>Trichodiadema bulbosum</i>	Mesembryanthemaceae	PNCO	EC, Endemic, PE area		Common in outcrops

*Highlighted Species are cited as being endemic to the Grassridge Bontveld or Sundays Valley Thicket

** PNCO Protected by the Provincial Nature Conservation Ordinance; NFA Protected by the National Forests Act of 1998

+EC - Eastern Cape, WC - Western Cape, KZN - Kwazulu-Natal,



CHAPTER 6: TERRESTRIAL ECOLOGY



Figure 6.14: *Rhombophyllum rhomboideum*



Figure 6.15: Young *Gasteria bicolor*



Figure 6.16: *Euphorbia clava*



Figure 6.17: *Tritonia securigera*



Figure 6.18: *Aloe humilis*



Figure 6.19: *Euphorbia meloformis*

6.4.4 Regional Planning Frameworks

The biodiversity planning documents (at national, provincial and local scale), with relevant vegetation units and their conservation status, are provided in Table 6.3. Implications of these frameworks for this proposed project are discussed in the sections below, together with key concepts such as offsets and ecological corridors, as well as the implications of the Coega IDZ Open Space Management Plan.

Table 6.3: Regional Planning Frameworks and vegetation units in the study area

BIODIVERSITY PLANNING RESOURCE	Vegetation Unit ²	Status
The Vegetation of South Africa Lesotho and Swaziland (VegMap; Mucina & Rutherford)	Coega Bontveld Sundays Thicket Albany Alluvial Vegetation	Least threatened Least Threatened Endangered
National Spatial Biodiversity Assessment (NSBA)	Coega Bontveld Sundays Thicket Albany Alluvial Vegetation	Least threatened Least Threatened Endangered (NEMBA)
Subtropical Thicket Ecosystem Project (STEP)	Grassridge Bontveld Sundays Valley Thicket Motherwell Karroid Thicket Sundays Doringveld	Currently NOT Vulnerable Currently NOT Vulnerable Endangered Vulnerable
Cape Action for People and the Environment (CAPE)	Sundays Mesic Succulent Thicket	N/A
Eastern Cape Biodiversity Conservation Plan (ECBCP)	CBA 1 (Natural Landscapes) CBA 2 (Near Natural Landscapes)	N/A
Nelson Mandela Bay Municipality - Conservation Assessment and Plan (NMBM CAP, 2010); and Nelson Mandela Bay Municipality - Draft Bioregional Plan (NMBM DBP, 2010)	Grassridge Bontveld Sundays Valley Thicket Motherwell Karroid Thicket Sundays Doringveld Thicket	Vulnerable Vulnerable Endangered Endangered

6.4.4.1 Eastern Cape Biodiversity Conservation Plan (ECBCP)

The Eastern Cape Biodiversity Conservation Plan (ECBCP) indicates that both designated CBA 1 and CBA 2 areas are present within the proposed development site as indicated in Figure 6.39. The ECBCP has no legal status. However, it has been designed to serve as the basic biodiversity layer in Strategic Environmental Assessments, State of Environment Reports, SDFs, EMFs and Bioregional Plans. It conforms to the requirements of the Draft Guideline regarding the Determination of Bioregions and the Preparation and Publication of Bioregional Plans (DEAT and SANBI 2007), as it contains maps of terrestrial and aquatic CBAs, as well as suggested land use guidelines. No fine-scale plans are yet available for the study area.

The terrestrial CBA's affected by the proposed project, include both CBA 1 and CBA 2 types. These are classed as a combination of degraded CBA Level 1 (T1), CBA Level 2 (T2) and CBA level 3 (T3) Biodiversity Land Management Classes, being a mixture of Natural Landscapes and Near Natural Landscapes. The ECBCP Guidelines recommendations are as follows:

BLMC 1 (Natural Landscapes)

- Refers to areas which are critical for biodiversity persistence and ecosystem functioning, and which should be kept in as natural a condition as possible
- Includes Critically endangered vegetation types and areas essential for meeting biodiversity targets for biodiversity features

² Synonyms: Grassridge Bontveld and Coega Bontveld. Sundays Thicket, Sundays Valley Thicket and Sundays Mesic Succulent Thicket



- Includes non-degraded CBA 1 areas.
- *Maintain biodiversity in as natural state as possible. Manage for no biodiversity loss.*

BLMC 2 (Near natural landscapes):

- Includes degraded CBA 1 areas;
- Includes Endangered vegetation types ; expert-mapped areas less than 25 000 ha in size, 1 km coastal buffer strip and ecological corridors identified by the ECBCP using an integrated corridor design ;
- *Maintain biodiversity in near natural state with minimal loss of ecosystem integrity.*
- *No transformation of natural habitat should be permitted.*

According to the Eastern Cape Biodiversity Conservation Plan (ECBCP), the Manganese Ore Export Facility will fall within CBA 1 and CBA 2 areas.

- The Compilation Yard, both Rail Link Line alternatives and the additional Railway Line will predominantly both fall within designated CBA 2 (T2 BLMC 2).
- The Stockyard and Conveyor will predominantly fall within designated CBA 1 (T1 BLMC 1) areas (Figure 6.39).

6.4.4.2 Nelson Mandela Bay Municipality Draft Bioregional Plan (NMBM DBP, 2011) and NMBM Conservation Assessment and Plan (NMBM CAP, 2010)

A systematic conservation planning approach was adopted to provide a scientifically defensible terrestrial conservation plan for Nelson Mandela Bay (Figure 6.40)

Sundays Valley Thicket

Distribution: Eastern Cape: From the surrounds of Uitenhage and the northern edge of Port Elizabeth into the lower Sundays River Valley to east of Colchester and northwards to the base of the Zuurberg Mountains and stretching westwards north of the Groot Winterhoek Mountains to roughly the Kleinpoort longitude. Also an extensive area north of the Klein Winterhoek Mountains including much of the Jansenville District and parts of the far-southern Pearston District and far-western Somerset East District.

Altitude: 0–800 m.

Vegetation and Landscape Features: Undulating plains and low mountains and foothills covered with tall, dense thicket, where trees, shrubs and succulents are common, with many spinescent species. The transition between lower and upper canopies is obscured by the presence of a wide variety of lianas. The local dominance of *Portulacaria afra* increases and the relative abundance of woody species decreases with increasing aridity. There is considerable structural heterogeneity within the vegetation unit. Few species emerge from the canopy, with *Euphorbia grandidens* and occasionally *Cussonia spicata* the only exceptions.

Geology and Soils: Mostly on deep (>1 m) red, loamy to clayey soils derived from the Sundays River and Kirkwood Formations (Mesozoic Uitenhage Group) in the south.

Conservation: Protected statutorily in Greater Addo Elephant National Park, Groendal Wilderness Area as well as in Swartkops Valley and Springs Nature Reserves. Private conservation areas, especially game farms (Kuzuko, Koedoeskop, Schuilpatdop, Tregathlyn, Citruslandgoed, and Voetpadskloof) and a couple of nature reserves contribute to conservation of this vegetation type as well. More than 6% already transformed (cultivated, urban development). Sundays Thicket has also been highly degraded through grazing by livestock. The degraded state resembles a secondary Thornveld or grassland, dominated by invasive weedy species. In this state most of the original thicket species are lost. Erosion is moderate to very low.

Important taxa: *Aloe africana* and *Euphorbia ledienii* are typical and reliable indicator species of this unit. Other species abundant and typical are *Azima tetracantha*, *Capparis sepiaria*, *Cotyledon*



velutina, *Crassula cordata*, *Crassula perfoliata* var. *coccinea*, *Crassula ovata*, *Crassula rogersii*, *Ehretia rigida*, *Euclea undulata*, *Euphorbia grandidens*, *Gymnosporia polyacantha*, *Kalanchoe rotundifolia*, *Maerua cafra*, *Plectranthus madagascariensis*, *Putterlickia pyracantha*, *Rhoicissus tridentata*, *Rhus longispina*, *Rhus pterota*, *Sansevieria aethiopica*, *Sansevieria hyacinthoides*, *Sarcostemma viminalis* and *Schotia afra*. The alien Prickly pear (*Opuntia ficus-indica*) is often also abundant and a good indicator of this unit. A number of rare and highly localised endemic species occur here, with some occurring within the Thicket clumps (e.g. *Aloe gracilis*, *Ceropegia zeyheri*, *Encephalartos horrida*, *Fockea gracilis*, *Lauridia reticulata*, *Orthopterum waltoniae* and *Strelitzia juncea*), while others occur in the patches between the Thicket clumps (e.g. *Brachystelma cummingii*, *Glottiphyllum grandiflorum*, *Orthopterum coegana*, *Pelargonium ochroleucum* and *Tritonia dubia*). At least one of the highly localized species, *Brachystelma schoenlandianum*, is extinct, probably due to urban development near Uitenhage. This may also be the fate of two other localized endemics from this area - *Ceropegia dubia* and *Ceropegia zeyheri*.

Biogeographically Important Taxa: Succulent climber: *Ceropegia ampliata* var. *ampliata* (southern limit); Herbaceous climber: *Fockea sinuata* (southern limit); Epiphytic Parasitic Herb: *Cuscuta bifurcata*; Geophytic Herb: *Pelargonium campestre*.

Endemic Taxa: Small tree: *Encephalartos horridus*; Succulent Shrubs: *Aloe bowiea*, *A. gracilis*, *Bergeranthus addoensis*, *Glottiphyllum grandiflorum*, *Orthopterum coegana*, *Ruschia aristata*, *Trichodiadema rupicola*; Succulent climbers: *Aptenia haeckeliana*, *Ceropegia dubia*; Succulent Herbs: *Haworthia arachnoidea* var. *xiphiophylla*, *H. aristata*, *Huernia longii* subsp. *longii*; Geophytic Herbs: *Brachystelma cummingii*, *B. schoenlandianum*, *B. tabularium*, *Pelargonium ochroleucum*, *Strelitzia juncea*, *Tritonia dubia*; Herbs: *Arctotis hispidula*, *Argyrolobium crassifolium*, *Lessertia carnosae*, *Lotononis monophylla*, *Senecio scaposus* var. *addoensis* and *Wahlenbergia oocarpa*.

Suitability for development in terms of NMBM DBP

- Vegetation of this type is categorized as Vulnerable, and 'can withstand only limited loss of natural area or limited disturbance through human activities and developments'.
- It is identified as being suited for activities 'of limited extent (e.g. small-scale housing or urban development).'
- This vegetation falls primarily along the banks of the Coega River.
- Proposed disturbance or developments should preferably take place on sites which have undergone disturbance or impacts rather than on sites that are undisturbed.

All separate components of the Manganese Ore Export Facility will have an impact on Sundays Valley Thicket, most notably the widening of the Railway Line reserve to accommodate an additional Line.

Grassridge Bontveld

Distribution: Eastern Cape Province: Northeast of Port Elizabeth just inland of Algoa Bay; mainly around Coega, but also in small patches in Addo (Zuurkop).

Altitude: 0–400 m.

Geology and Soils: Outcrops of limestone (Nanaga Formation) and calcareous Paleo-dune fields of the Cenozoic Algoa Group. The soils are shallow clay soils that are often lime-rich.

Vegetation and Landscape Features: On moderately undulating plains, where a mosaic of low Thicket (2 - 3 m) built mainly of bush clumps occurs. Secondary open grassland occurs over wide stretches. This unit is often restricted to 'islands' in a matrix of typical valley thicket. The species present are a mixture of Fynbos, Grassland and Succulent Karroo elements.

Conservation: A total of 10% of this vegetation unit is protected in the Greater Addo Elephant National Park and almost 4% in the private Grassridge Nature Reserve. Some 4% of Coega Bontveld has been altered by cultivation and 2% by urbanisation. The recent building of the traffic infrastructure around the new harbour near Port Elizabeth has encroached heavily into the area of the Coega Bontveld and the construction of an Industrial Development Zone in the area constitutes a serious threat to this vegetation type. Erosion is moderate to low.



Important Taxa: *Acmadenia obtusata*, *Aloe ferox*, *Euryops ericifolius*, *Lobostemon trigonus*, *Muraltia squarrosa*, *Osteospermum imbricatum*, *Pentaschistis pallida*, *Rhus pyroides* and *Themeda triandra*.

Biogeographically Important Taxa: Graminoids: *Ficinia truncata* (eastern limit), *Tribolium uniolae* (western limit); Herb: *Gibbaria scabra* (eastern limit)

Endemic Taxa: *Euphorbia globosa*; *Rhombophyllum rhomboideum*; *Anginon rugosum*; *Ledebouria sp. nov.* ('*coriacea*' S. Venter indet.), *Bulbine inae*, *Lotononis micrantha*.

Suitability for development in terms of NMBM DBP

- Vegetation of this type is categorized as Vulnerable, and 'can withstand only limited loss of natural area or limited disturbance through human activities and developments'.
- Proposed disturbance or developments should preferably take place on sites which have undergone disturbance or impacts rather than on sites that are undisturbed.
- It is identified as being suited for activities 'of limited extent (e.g. small-scale housing or urban development).'
- This vegetation would be suitable for development although some restrictions will be present.

The Grassridge Bontveld present within the site will be impacted upon primarily by the proposed Compilation Yard, Rail Link Line and some fragments along the additional Railway Line and Conveyor route.

Motherwell Karroid Thicket

Vegetation and Landscape Features: This unit is restricted to usually deep, red, loamy- to clayey soils, derived from the Alexandria and Bluewater Bay formations. It occurs mostly just above the floodplains of the local rivers and it is easily recognised by an abundance of *Pteronia incana*, often in combination with other Karroid shrubs such as *Felicia filifolia*. Fynbos elements are absent. A grass component (*Themeda triandra*) is usually present, but these grasses are dominant only soon after a fire. Under these conditions this unit can be recognised from Mosaic with Grassland by the absence of *Rhus pyroides*. It harbours a rich component of geophytes and succulents, many of which are rare or localised endemics such as *Apodolirion macowanii*, *Aloe bowiea* and *Euphorbia meloformis*. It also seems to be the favoured habitat of several tortoise species, e.g. Parrot-beak Tortoise and Angulate Tortoise.

Conservation Status: Endangered

The proposed Stockyard will result in the loss of Motherwell Karroid Thicket.

Sundays Doringveld

Vegetation and Landscape Features: This unit is restricted to the often deep, red, alluvial soils in the floodplains of the Coega, Sundays and Zwartkops rivers. *Acacia karroo*, *Aloe ferox* (often also with *A. ferox* X *A. africana* hybrids present) and *Pentzia incana* abundant. When pristine, the grass component (*Eragrostis* and *Panicum* species) is well developed. At present these grasses are largely absent, with only *Cynodon dactylon* abundant in the heavily grazed sites. Small succulents are usually abundant (e.g. *Cotyledon campanulata*, *Glottiphyllum longum*, *Malephora lutea*, etc.), especially amongst the woody shrubs (*Cadaba aphylla*, *Lycium cinereum*, *Lycium ferocissimum*, *Pentzia incana*, etc.). Some of these succulents are rare species (e.g. *Orbea pulchella*) or unique genotypes of uncommon species (e.g. *Euphorbia sp.nov. Palmer 1336*, *Haworthia sordida var. sordida*, etc.) that only occurs in this unit. A few very rare shrublets (e.g. *Amphiglossa callunoides*, *Thesium junceum*, etc.) occur in these floodplains, with at least one of the highly localised endemic species of this environment (*Brachystelma tabularium*) probably already extinct due to agricultural and urban development.

Conservation Status: Vulnerable



A short section of the railway line doubling will pass through Sundays Doringveld where it passes over the Coega River north of the Stockyard.

Table 6.4: STEP/NMBM DBP management recommendations.

Conservation Priority	III: Vulnerable
Vegetation types present	Sundays Valley Thicket Grassridge Bontveld Motherwell Karroid Thicket Sundays Doringveld
Brief Description	Ecosystems which cover much of their original extent but where further disturbance or destruction could harm their health and functioning.
General Rule	This Class III land can withstand limited loss of area through disturbance or development.
Procedures	<ol style="list-style-type: none"> 1. As a rule, developments with limited area or impacts should be allowed on Class III land. 2. In response to an application for a non-listed activity which will have severe or large-scale disturbance on a relatively undisturbed site (unspoilt by impacts). 3. Proposed disturbance or developments should preferably take place on sites which have undergone disturbance or impacts rather than on sites that are undisturbed. 4. For a proposed "listed activity", EIA authorisation is required by law.
Restrictions activities which decision makers should impose	<ol style="list-style-type: none"> 1. In general, Class III land can withstand only limited loss of natural area or limited disturbance through human activities and developments 2. Proposed disturbance or developments should preferably take place on sites which have undergone disturbance or impacts rather than on sites that are undisturbed. 3. In general, Class IV land should be developed in preference to Class III land.
Opportunities activities which decision makers should encourage	Depending on constraints (such as avoidance of spoiling scenery or wilderness, or infra-structure limitations), Class III land can withstand a limited loss of, or disturbance to natural areas. Within the constraints, this class may be suitable for a moderate range of activities that are either compatible with the natural environment (e.g. sustainable stock-farming, ecotourism, game farming and wilderness) or of limited extent (e.g. small-scale housing or urban development, small-scale cultivation).

Corridors and Ecological Process Areas

Ecological process areas (Figure 6.41) represent areas that, when functioning ecologically, will serve to sustain evolutionary processes. The extent of these areas within the metro were mapped as part of the NMBM DBP, and included riverine systems, sand movement corridors, and edaphic gradients. One such area is represented at the site by the Coega River Riverine corridor which runs in a north-south direction along the eastern and western bank of the Coega River and is incorporated in the IDZ OSMP. It is described as being an important corridor linking the coastal and inland areas, and the proposed Facility will traverse this corridor and further fragment the corridor. The additional Railway Line will traverse through this corridor (Figure 6.41).

Critical Biodiversity Areas

Areas designated as Critical Biodiversity Areas (Figure 6.41) should be retained to meet municipal conservation targets or offsets must be implemented, or offsets must be applied. Biodiversity Offsets to be applied as per the guidelines provided below.

The Railway Link Line and additional Railway line will pass through the designated Coega River Critical Biodiversity Area corridor (CBA1), which is required in order to meet municipal conservation targets and will result in the loss of some habitat designated to meet conservation targets.



Biodiversity offsets

Where land uses are proposed that will have a negative impact on biodiversity, such impacts must be assessed, minimised via a "planning with nature" approach, and mitigated to the greatest extent possible. Mitigation measures are extensively utilised in order to reduce the biodiversity impacts of developments or change in land use from a natural state. However, in many instances the impacts on biodiversity will be such that mitigatory measures will be inadequate. Under such conditions the application of biodiversity offsets is generally the most appropriate response. To date, biodiversity offsets have only been used in a few, isolated cases in the Municipality, but due to the extent of habitat loss during the last five years, the utilisation of biodiversity offsets is expected to increase substantially (Department of Environmental Affairs and Development Planning, 2007).

Biodiversity offsets are "conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects, so as to ensure 'no net loss' of biodiversity" (Department of Environmental Affairs and Development Planning, 2007).

The key issue is that biodiversity offsets should only be triggered if residual impacts of a medium or higher significance are identified. **Residual impacts relating to loss of Species of Special Concern and habitat for these species may be triggered in this case.**

Where development proposals will result in biodiversity impacts after mitigation that range from moderate to severe, biodiversity offsets should be considered to compensate for the residual impacts of the development. Biodiversity offsets, where appropriate, can compromise either a single or composite areas in order to compensate adequately for residual biodiversity loss. An acceptable measure of the residual loss is obtained as a point of departure for determining an appropriate biodiversity offset. Biodiversity offsets are calculated by multiplying this measure by a basic biodiversity offset ratio linked to the Ecosystem threat of the affected ecosystem.

The following ratios are recommended with regards to biodiversity offsets (DEA&DP, 2008):

- A 30:1 ratio for *Critically Endangered* Ecosystems Process Areas, where a biodiversity offset would be appropriate in exceptional circumstances only;
- A 20:1 ratio for *Endangered* ecosystems;
- A 10:1 ratio for *Vulnerable* ecosystems; and
- No biodiversity offset for Not Threatened ecosystems;

The area determined by the basic biodiversity offset ratio should then be adjusted by a range of context specific conditions, such as:

- The condition of the affected habitat;
- The significance of residual impacts on threatened species;
- The residual impacts on special habitats;
- The significance of residual impacts on important ecological corridors or process areas; and
- The significance of residual impacts on biodiversity underpinning valued ecosystem services.

For a biodiversity offset to contribute effectively to protected area expansion and biodiversity conservation in the Nelson Mandela Bay Municipality, biodiversity offsets should be located in a 'biodiversity receiving area', which in the context of the NMBM, will be the Critical Biodiversity Areas.

In this case it is recommended that biodiversity offsets are applied to areas that would increase the Open Space, Ecological Process Areas and Conservation value in areas linked to the IDZ. For example, reducing the reserve width (or increasing the corridor width) on the western side of the railway line could act as an offset for the loss on the eastern side.

Additional Landscape Attributes

In addition to various vegetation types, the NMBM Draft Bioregional Plan (2011) also mapped the spatial extent of certain landscape attributes within the Nelson Mandela Bay Municipality that may influence decision making with respect to biodiversity conservation in the metro. These include the following:

- Non-restorable and Degraded Areas;
- Protected Areas;
- Corridors and Ecological Process Areas, and
- Critical Biodiversity Areas.

The section below outlines the extent and location of such areas in relation to the site.

Non-Restorable and degraded areas

- Some areas of the Compilation Yard, Rail Link, additional Railway Line, Stockyards and Conveyor can be described as being transformed, through historical bush clearing for various uses, including cultivation and livestock grazing.
- The Non-restorable areas tend to be dominated by a mixture of grass species with some clumps of alien *Acacia* infestation and various weedy ephemeral and alien invasive species. The exact species composition of these areas tends to vary, but is dominated by a few key pioneer species.
- Any activity that will impact upon the terrestrial environment should target these non-restorable areas as a priority over intact vegetation.

Areas having recognized Species of Special Concern

- The NMBM DBP mapped the distribution within the Metro, of species listed in the Red Data Book and localised endemic species with very limited distributions.
- *Euryops ericifolius* is present in the site and adjacent area.
- The mapping is not exhaustive and it is possible and likely that these species area also present within the site. This data is incomplete and the specialist survey should supplement this information (see relevant section below).

Protected Areas

No formalised protected areas fall within the site or will be affected by the proposed activity. The Tankatara Conservancy will be affected where the Compilation Yard is situated within the boundary on Tankatara Farm. The Compilation Yard should be appropriately game fenced where it falls within the adjacent Conservancy. Other protected areas in the vicinity, where affected vegetation units are represented include the following:

- *The Springs Private Nature Reserve* - to the north (vegetation includes Sundays Valley Thicket & Grassridge Bontveld);
- *Grassridge Private Nature Reserve* - to the north (vegetation includes Grassridge Bontveld);
- *Tregathlyn Game Farm* - to the North (vegetation includes Sundays Valley Thicket);
- *Swartkops Nature Reserve* - to the east (vegetation includes Sundays Valley Thicket).
- *Addo Elephant National Park* - to the east and north (vegetation includes Sundays Valley Thicket and Grassridge Bontveld).

Refer to section 6.4.3.6 for information on protected plants.



6.4.4.3 Requirements of the Coega IDZ Open Space Management Plan

According to the CDC IDZ Record of Decision issued by Department of Environmental Affairs and Tourism (dated 06/03/2007), a number of conditions are applicable which should be referred to:

- The development should be placed so that as little disturbance as possible occurs within the sensitive vegetation types. Recommendations specific to habitat types include:
- All undisturbed Bontveld patches should be fenced and actively protected from illegal dumping and infestation with alien vegetation.
- The development in dense Mesic Succulent Thicket habitat on the steep slopes on banks of the Coega River should be kept to a minimum or avoided.
- Future development of the site and industrial precinct in the eastern section of the back-of-port area must ensure that viable corridors are maintained between Bontveld habitats.
- Linkages between habitat fragments should be maintained at all times
- The impact to threatened plants can be mitigated by identification and protection of the Red Data listed species prior to vegetation clearing. Where possible, areas containing Red Data listed species should not be cleared. If vegetation clearing is to take place, the species of special concern should be relocated to patches of similar vegetation in the surrounding area.
- All exposed areas must be stabilised against erosion and rehabilitated, using appropriate indigenous vegetation, in order to prevent the remobilisation of dunes and subsequent erosion.
- All slopes exceeding a 1:3 gradient should ideally not be developed but where development does take place the slopes must be stabilised and rehabilitated.
- The prevention of encroachment by alien plants and animals into undisturbed areas. There must be continual monitoring of the remaining pockets of natural vegetation for the presence of alien plants.
- Landscaping should be done using indigenous plants.
- All provisions of the National Water Act (Act 36 of 1998), National Forests Act (Act 122 of 1984) and the National Environment Management: Biodiversity Act (Act 10 of 2004) must be adhered to and permits must be obtained from relevant authorities for the destruction of any protected flora and fauna.

The currently approved Open Space Management Plan is version 9 (2003, Figure 6.42). A revision has been compiled (version 10, 2006), although it has not yet been formally approved. Pertinent differences relevant to the project are slight alterations to the designated boundaries of Mesic Succulent Thicket (Sundays Valley Thicket) and Bontveld conservation areas adjacent to the site.

Taking into account version 9 of the OSMP, the rail link of both alternatives (and return loops) fragment the Ecological Processes area (1.5) and a small portion of MST (1.6) and the additional railway line southwards is aligned slightly within the western 'edge line' of the MST (green) area within Zone 13 (Figure 6.42).

Looking at version 10 of the OSMP, the rail link alternative 1 fragments the designated Mesic Succulent Thicket, whilst the return loop fragments Ecological Processes area. The rail link alternative 2 fragments only the Ecological Processes, whilst the return loop only bisects peripheral 'fingers' of Ecological Processes area along drainage lines. The additional railway line is aligned slightly within the western 'edge line' of the Mesic Succulent Thicket area within Zone 13 (Figure 6.43).

Primary Network (Ecological Process) areas

The Railway link crosses through and fragments the MST (Primary network conservation area 1.6) and Ecological Processes (Primary network ecological process area 1.5) area north of the N2 (Figure



6.42). The Railway Line doubling passes on the eastern side of the existing line and results in some loss of MST (Primary network conservation area 1.6) along its edge within Zone 13.

The CDC IDZ Open Space Management Plan (CES, 2003) report stipulates the following management criteria for these areas:

- Development in the dense Mesic Succulent Thicket (MST) (Area 1.6) habitat on steep slopes on the banks of the Coega River is to be kept to a minimum or avoided. In accordance with the Rezoning EIA, the Coega OSMP proposes that the MST habitat falling outside of the areas reserved for quarrying, construction or electricity substations and high voltage lines and conveyer belts must be protected and conserved for ecological processes by preventing fragmentation of habitats. This can be achieved by ensuring that:
 - No vehicular access roads are planned across the habitats;
 - Fencing habitats if it is considered that they are under threat;
 - Keeping service infrastructure out of these areas (including pipelines and roads);
 - Only passive open space pursuits (picnic sites, boardwalks, trails, etc.) to be considered;
 - No clearing of vegetation to be allowed.

Secondary Network

"The need to provide adequate power to industrial enterprises, enable the efficient operation of the Port and source road construction materials in close proximity has necessitated encroachment of overhead high voltage lines, conveyer belts and railway lines, as well as borrow pits into the Mesic Succulent Thicket, Bontveld, Valley Floor and Coega Kop Areas. The Coega OSMP recognises that the proposed developments will have a significant impact on these habitats, and it is proposed that once the essential infrastructure is laid down, the affected areas are rehabilitated using indigenous species in accordance with EMP's to be prepared as part of the planning for these developments" (CES, 2003).

- Care should be taken to minimize clearing of vegetation during construction of power-lines, conveyer belts and railway lines.
- Species of special concern should be preserved and topsoil to be removed with care and stored for use during the rehabilitation process.
- Intact vegetation underneath power-lines will be important refuges for flora and fauna and must be rehabilitated, plant species removed before construction must be re-introduced after completion of the powerline phases.

Disturbed areas to be incorporated into the CDC IDZ defined Open Space or Buffer Zones shall be rehabilitated using locally indigenous vegetation, including annual and perennial indigenous grasses, locally indigenous geophytes, bulbs, aloes and other plant species.

Removal of plants on site for rehabilitation purposes

- Conservation worthy/ horticultural valuable plant species within areas to be cleared that are able to survive translocation, and as indicated by a suitably qualified and trained botanical specialist and the Engineer, shall be removed prior to site clearing for later use for rehabilitation purposes. The person or organisation responsible for the relocation of these species shall work in advance of the vegetation clearing team, and locate as well as relocate individual plant specimens. Removed plants shall be excavated by hand in such a way that the plants, especially the roots are not damaged. Plants shall be temporarily planted out either in plastic bags or in-situ in an area that is not affected by the proposed development. Should bags be used, they shall be large enough to contain the entire plant's root system. Bags shall be filled with local top material. Plants shall be watered regularly, protected from damage and otherwise maintained to ensure healthy growth. On completion of the civil work plants shall be re-planted out in scattered clumps at areas of the Site to be rehabilitated as directed by the Engineer.



- Individuals of all removed species will need to be housed in a nursery until such time as relocation areas have been identified.

6.4.4.4 EMP and Rehabilitation Specification Guideline

Objective

To provide guidelines for vegetation clearing and rehabilitation during all phases of construction and operation, including any preconstruction activities such as temporary road construction and borehole drilling.

Vegetation Clearing

It is recommended that Transnet ensure that their management plans and specifications are aligned with the **CDC Standard Specification for Construction Report (CDC, 2005)** which cover the requirements for site clearance. The following important points relevant to this project are highlighted:

The method statement (clause 5.1.1) and Site clearance requirements refer to requirements dealing with the *removal of rare, endemic or endangered species*.

The method statement (clause 5.1.1) states '*detail the name and qualification of the sub-contractor undertaking this, the timing methodologies, equipment, storage, maintenance procedures, transport and any other relevant information.*'

The following clauses (CDC, 2005) are relevant to the clearing of the site:

Clause 5.2 Site Clearance

Clause 5.2.1 Removal of rare, endemic or endangered species

Site clearance (Clause 5.2.1) stipulates that '*The Contractor shall contact a botanical specialist with previous experience of the vegetation on the site and approved by the Engineer at least three weeks before Site clearance to provide this specialist with the opportunity to visit the Site. The appointed specialist shall advise the Contractor within one week if it is necessary to remove endemic or rare plant species prior to Site clearance.*'

Given that the designated Coega IDZ nursery is no longer operational, it is recommended to rescue and relocate plants into areas of the OSMP where rehabilitation is required or can be used for rehabilitation of non permanent areas disturbed during construction.

In addition, should any plant species that are rare, endangered or vulnerable be found that have not been reported previously from the Coega IDZ, these should be reported to the relevant authorities and upon their instruction, translocation should proceed as for the listed species. An additional list of potentially occurring species is provided in Table 6.5, which may not have been observed due to seasonal sampling times. Other species that are deemed suitable for rehabilitation and landscaping within the greater IDZ should also be collected, as determined by the nursery manager. Due to the extent of the site it is recommended that at least 6 months notice should be given as three weeks is unlikely to be sufficient time to allow for adequate removal of SSC.



Table 6.5: Potential list of protected species occurring in the CDC MST and Bontveld (Source: CES, 2005).

Botanical Name	Botanical Name
<i>Acrolophia micrantha</i>	<i>Delosperma pruinatum</i>
<i>Aloe africana</i>	<i>Dietes grandiflora</i>
<i>Aloe ferox</i>	<i>Drosanthemum ambiguum</i>
<i>Aloe humilis</i>	<i>Drosanthemum brevifolium</i>
<i>Aloe lineata</i>	<i>Drosanthemum hispidum</i>
<i>Aloe maculata</i>	<i>Drosanthemum parvifolium</i>
<i>Aloe pluridens</i>	<i>Duvalia caespitosa</i>
<i>Aloe striata</i>	<i>Erica cerinthoides</i>
<i>Apodolirion macowani</i>	<i>Erica glumiflora</i>
<i>Aristea anceps</i>	<i>Eulophia tuberculata</i>
<i>Aristea cognata</i>	<i>Euphorbia bupleurifolia</i>
<i>Aristea pusilla</i>	<i>Euphorbia globosa</i>
<i>Asclepias crispa</i>	<i>Euphorbia meloformis</i>
<i>Asclepias fruticosa</i>	<i>Fockea edulis</i>
<i>Astephanus marginatus</i>	<i>Freesia corymbosa</i>
<i>Babiana patersoniae</i>	<i>Gladiolus maculatus subsp. meridionalis</i>
<i>Bergeranthus addoensis</i>	<i>Gladiolus permeabilis</i>
<i>Bergeranthus longisepalus</i>	<i>Glottiphyllum depressum</i> (<i>G. heggii</i>)
<i>Bergeranthus scapiger</i>	<i>Haemanthus albiflos</i>
<i>Bonatea speciosa</i>	<i>Haemanthus coccineus</i>
<i>Boophone disticha</i>	<i>Haemanthus humilis</i>
<i>Brachystelma sp.</i>	<i>Haworthia cooperi</i>
<i>Brunsvigia gregaria</i>	<i>Haworthia translucens</i>
<i>Carpobrotus sp.</i>	<i>Huernia sp.</i>
<i>Ceropegia ampliata</i>	<i>Kniphofia citrina</i>
<i>Ceropegia carnosa</i>	<i>Lampranthus hollandii</i>
<i>Ceropegia dubia</i>	<i>Lampranthus productus</i>
<i>Chasmanthe aethiopica</i>	<i>Lampranthus spectabilis</i>
<i>Chondropetalum microcarpum</i>	<i>Micranthus alopecuroides</i>
<i>Crassula perfoliata var. obtusifolium</i>	<i>Microloma tenuifolium</i>
<i>Crassula pyramidalis</i>	<i>Orbea pulchra</i>
<i>Cynanchum gerrardii</i>	<i>Orthopterum coegana</i>
<i>Cynanchum natalitium</i>	<i>Pachypodium bispinosum</i>
<i>Cynanchum obtusifolium</i>	<i>Pachypodium succulentum</i>
<i>Cyrtanthus clavatus</i>	<i>Platythyra haeckeliana</i>
<i>Cyrtanthus spiralis</i>	<i>Rhombophyllum rhomboideum</i>
<i>Delosperma ecklonis</i>	<i>Ruschia congesta</i>
<i>Delosperma lehmannii</i>	<i>Ruschia cymbifolia</i>
<i>Delosperma litorale</i>	<i>Sarcostemma viminalis</i>



Botanical Name	Botanical Name
<i>Satyrium membranaceum</i>	<i>Stapelia grandiflora</i>
<i>Scadoxus puniceus</i>	<i>Stenoglottis fimbriata</i>
<i>Secamone alpini</i>	<i>Strumaria gemmata</i>
<i>Secamone filiformis</i>	<i>Trichodiadema bulbosum</i>
<i>Sideroxylon inerme</i>	<i>Tritonia lineata</i>
	<i>Veltheimia bracteata</i>

Clause 5.2.1 further stipulates that *'If no response confirming the presence of any of these species is received from the specialist within one week, the Contractor may proceed with the clearance of the Site. If plants are identified for removal, an appropriately qualified specialist approved by the Engineer must then be appointed by the Contractor to remove and subsequently maintain the species at the central holding nursery for the duration of the project until such time that they can be re-planted elsewhere in the Coega Industrial Development Zone (IDZ) as directed by the Engineer.'*

- *Translocation of these species shall take place strictly in accordance with the translocation procedure detailed for each species in the Project Specification. If the Project Specification does not detail how to translocate the specific species, then the Contractor must get instructions from the Engineer as to how the species are to be translocated.*
- *The CDC nursery operator of the Coega Development Corporation central holding nursery should be contacted timeously (at least six months) before clearance commences to commence translocation of the identified plants*
- *Small trees and other plants not required to be translocated could potentially be utilized during rehabilitation, but this is not required nor addressed in the CDC IDZ Standard re-Vegetation Specification (2005) document. Once clearing is completed a site clearance certificate will be issued and construction activities can commence.*
- *Suitable plant species, other than those stipulated in the above list and identified by the Engineer for general re-vegetation purposes, must be relocated prior to clearing of the vegetation to a suitable holding site or directly to areas being landscaped.*
- *Except to the extent necessary for the carrying out of the Works, existing vegetation on site shall not be removed, damaged or disturbed.*
- *A Method Statement detailing the removal of rare, endemic or endangered species including the name and qualifications of the suitably qualified sub-contractor proposed to undertake this must be submitted to the Engineer for his approval.'*

Clause 5.2.2 stipulates the requirements for topsoil removal and stockpiling and should be adhered to as per the Standard re-Vegetation Specification (2005) document.

Clause 5.2.3 stipulates the requirements for stabilisation of steep slopes, where relevant.

Clause 5.3 dealing with Removal of Alien vegetation stipulates that *The Contractor shall appoint a suitably qualified or experienced contractor, able to distinguish between invasive alien plant species and indigenous species to clear all alien invasive vegetation as defined in Table 3 of the Regulation 15 of Conservation of Agricultural Resources Act No. 43 of 1983 from areas within the demarcated Site that are to be landscaped or which fall within the open space or buffer zones.*

The contractor shall remove alien invasive vegetation as per the methodology specified for each respective plant species in the Project Specifications or if not detailed in the Project specifications in a manner approved by the Engineer. Care is to be taken during the alien clearing operations to ensure that vegetation that is to be retained on site, is not damaged in any way. The Contractor shall ensure that the Site remains free of all scheduled alien invasive plant species for the duration of the construction works contract.'



In terms of these requirements, a few scattered Prickly Pear (*Opuntia ficus-indica*) and some small clumps of Rooikrantz (*Acacia cyclops*) occur on site. It is important that the Prickly Pear be removed before topsoil clearing commences and all reasonable attempts must be made to ensure that the seeds of *Acacia cyclops* trees present on site are removed so that they are not transported in the topsoil, where they may spread to another area when the topsoil is later utilised.

Clause 5.4 regarding rehabilitation states that 'Any areas that are disturbed during construction that are not part of the construction footprint, occur in environmentally sensitive areas and/or form part of the official IDZ Open Space System shall be rehabilitated with appropriate vegetation indigenous to the area to the satisfaction of the Engineer at the Contractors cost. The Contractor shall appoint an appropriately qualified botanical specialist with experience of the vegetation at hand, approved by the Engineer, to prepare the proposed method of rehabilitation. The Contractor shall also appoint an appropriately qualified sub-contractor, approved by the Engineer, to undertake the rehabilitation work. Where rehabilitation is necessary a Method Statement must be submitted by the Contractor to the Engineer for approval.

Clauses 5.5 through 5.11 relate to stabilisation, erosion control, pesticide use, traffic over vegetated areas and Establishment and Maintenance of vegetated areas and should be adhered to by the contractor as per the Standard re-Vegetation Specification (2005) document, should they be appropriate to the site.

6.4.5 Fauna occurring in the study area

The faunal diversity of the central and western regions of the Eastern Cape, including Port Elizabeth, is relatively well-known. However, this diversity has been affected by the long history of human impact in the region and the currently degraded state of much of the area surrounding the study site. The proposed development involves actions that will compound this transformation. There is evidence of historical livestock farming in the site. Two distinct habitats can be distinguished with associated fauna, namely Bontveld and Sundays Valley Thicket (including Motherwell Karroid Thicket).

6.4.5.1 Bontveld

Bontveld (Figure 6.22 and Figure 6.23) is characteristic of areas underlain with calcrete, which is often exposed in areas and termite mounds. This together with subterranean cracks in the outcrops provides habitat for various **reptiles** and invertebrates (Figure 6.22 to Figure 6.27). Reptiles such as the rhombic skaapestekers (*Psammophylax rhombeatus*), a diurnal species, use these rocks for shelter during the heat of the day. Other nocturnal snakes such as the Brown house snake (*Lamprophis capensis*) and Cape wolf snake (*Lycophidion capense*), use the subterranean rock during the day for shelter. Other reptile species which inhabit Bontveld are lizards such as red sided skink (*Trachylepis homalocephala*) and cape skink (*Trachylepis capensis*). An important factor relating to Bontveld in this area is the presence of termite mounds, which often provide shelter for many species. The vacant termite mounds not only provide habitat for reptiles such as rhombic egg-eaters (*Dasypeltis scabra*) but also provide micro habitat for invertebrates such *Ectrichodia crux*. *Harpactira sp.* (protected species under T.O.P.S.). *Harpactira sp* also occur under the loose calcrete stones. Tasman's girdles lizard (*Cordylus tasmani*); listed as vulnerable, occurs in Bontveld where they frequent the dry dead leaves of *Aloe africana*. Gecko species such as *Pachydactylus maculatus* use these types of micro habitats for the cluster-laying of eggs. The Least dwarf shrew (*Suncus infinitesimus*), which is an endangered species is found in the area and also uses vacant termite mounds as nest sites. The Bontveld vegetation together with the calcrete rock is indicative for the habitat of the Albany adder (*Bitis albanica*), which is a critically endangered species. Although rarely recorded within the IDZ, it is possible that this species may occur in the area. Amphibians such as



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the raucous toad (*Amietophrynus rangeri*) also frequent the area even though permanent water is not available. Tortoises such as Angulate tortoises (*Chersina angulata*) and leopard tortoises (*Stigmochelys pardalis*) are also common throughout the area.



Figure 6.20: Typical Bontveld habitat.



Figure 6.21: Calcrete rock outcrops.

Small **mammals** such as striped mouse (*Rhabdomys pumilio*) reside amongst the grasses present on the site. Medium sized mammals use the open grassy areas for the excavation of burrows and larger mammals such as grysbok (*Raphicerus melanotis*) use this area for foraging. Small carnivores such as small grey mongoose (*Galerella pulverulenta*) also frequent this vegetation type for foraging and shelter. Invertebrates such as *Parabuthis granulatus* (T.O.P.S.) are recorded to occur.

In terms of the proposed development reptiles such as puff adders (*Bitis arietans*) will be attracted to the development site as this type of development; i.e.: concrete and gravel surfaces in proximity to grassy areas provide a favourable habitat for these snakes. Puff adders utilise the concrete areas to bask during the mornings, and then use the same surface in the evening to keep warm since the concrete absorbs heat during the day and slowly releases it in the evenings. Similarly conflicts between humans and snakes such as Boomslang (*Dispholidus typus*) when the structures are erected may occur as Boomslang frequent high structures; often attracted by birds nesting on these structures.



Figure 6.22: Moribund termite mound, typical habitat for various faunal species.



Figure 6.23: Habitat for Tasman's Girdled Lizard.



Figure 6.24: Nest of *Suncus infinitesimus*.



Figure 6.25: Baboon Spider *Harpactira* sp (T.O.P.S.)



Figure 6.26: Scorpion (T.O.P.S.)



Figure 6.27: Hatchling leopard tortoise

6.4.5.2 Sundays Valley Thicket and Motherwell Karroid Thicket

The vegetation of the proposed rail link line and railway line corridor consists predominantly of Sundays Valley Thicket (Figure 6.28), comprising species such as *Portulacaria cafra* (Spekboom), *Scotia afra* (Boerboom), *Sideroxylon inerme* (Milkwood) etc. Due to the fact that this vegetation is so dense, reptile presence tends to be reasonably low. Open grassy patches within this thicket; along edges usually have a higher reptilian and small mammal presence as opposed to within the thicket. Tortoises such as Angulate tortoises *Chersina angulata* (Ordinance 19 of 1974 and C.I.T.E.S. protected species) reside in such areas. Snakes such as crossed marked sand snakes (*Psammophis crucifer*) will frequent the grassy areas for feeding and Tasman's girdled lizard (*Cordylus tasmani*); listed as vulnerable, also occurs in this habitat where they frequent the dry dead leaves of *Aloe Africana*.



Figure 6.28: Sundays Valley Thicket



Figure 6.29: *Bradypodion ventrale* (Chameleon)

Where areas have been encroached by *Acacia cyclops*, *Bradypodion ventrale* (T.O.P.S. and Ordinance 19 of 1974 protected species) may occur on the small *Acacia cyclops* trees (Figure 6.29). *Lygodactylus capense* may also use alien trees as habitat. Small mammals that will frequent this habitat include scrub hares (*Lepus saxatilis*).

Where permanent fresh water is present Amphibians such as raucous toads and eastern leopard toads will migrate from higher grounds for the purpose of breeding during periods of high rainfall. Small frogs such as the painted reed (*Hyperolius marmoratus*) frog may occur within the thicket, often found on the reverse side of the plant species such as *Chrysanthemoides monilifera*. Larger mammals such as blue dicker (*Philantomba monticola*) (T.O.P.S. protected) and grysbok (*Raphicerus melanotis*) rely on this habitat for food and shelter.

6.4.5.3 Terrestrial Mammals

Only two mammal species are endemic to the wider Coega area: Duthie's golden mole (*Chlorotalpa duthiae*) and the pygmy hairy-footed gerbil (*Gerbillurus paeba exilis*), which occur in dune thicket (CES, 2001). Both of these species are protected in terms of the conditions attached to the Rezoning EIA and the Port of Ngqura EIA. The remaining 13 Red Data listed mammal species are widespread species not restricted to the Coega area. Despite the emphasis placed on large mammals in the conservation literature they make up less than 15 percent of the total mammal diversity in South Africa. The majority of mammals are small or medium-sized, with rodents being the most successful of all living mammals. Swanepoel (1988) noted that of 292 terrestrial mammal species in southern Africa, 128 (44%) were recorded from the Eastern Cape. Although these figures are now out of date they do demonstrate the mammalian diversity of the Province. Few of the large and medium-sized mammal fauna that previously occurred in the region now occur naturally in the wild. Most are locally extinct or occur in small, fragmented populations usually in forest reserves or in protected areas. Species that have been extirpated within historical times in the Eastern Cape include the cheetah, hunting dog, hippopotamus, lion, red hartebeest and warthog. Most have been extensively re-introduced into provincial and private game reserves, whilst the latter has escaped from many reserves and threatens to become a problem animal in some areas. Among the medium- to large-sized mammals, buffalo are restricted to reserves, whilst reedbuck, brown hyena, spotted hyena, leopard and Serval are extremely rare in the wild. Tankatara Farm, part of the Sundays River Conservancy has a number of large mammals, including kudu present.



6.4.5.4 Birds (Seed dispersal)

Bird diversity and abundance is relatively high in the Thicket vegetation and birds are important seed-dispersal agents for thicket flora. However, bird populations are comprised mostly of relatively common and widespread passerine and bush dwelling species. Please refer to the Bird specialist study for further details (Chapter 7).

6.4.5.5 Reptiles

The reptile fauna of the Coega area is particularly diverse, with 56 species of lizards, chameleons, snakes, tortoises and sea turtles represented. Most of these species occur in the Succulent Thicket and riverine habitats, whilst fewer species are noted in the coastal dunes and estuarine habitats. Of these 56 species, 22 species are either Red Data taxa, listed under the Convention on the Illegal Trade in Endangered Species (CITES), or are endemic to the area or peripheral to the usual range of the species. These include eight lizards, two monitors, one gecko, one chameleon, three snakes, three tortoises and the four globally endangered sea turtle species. The species with the most restricted range is the Albany dwarf adder (*Bitis albanica*).

6.4.5.6 Amphibians

Amphibians are an important and often neglected component of terrestrial vertebrate faunas. They are well represented in sub-Saharan Africa, from which approximately 600 species have been recorded (Frost, 1985). Currently amphibians are of increasing scientific concern as global reports of declining amphibian populations continue to appear (Phillips, 1994). Although there is no consensus on a single cause for this phenomenon there is general agreement that the declines in many areas even in pristine protected parks are significant and do not represent simple cyclic events. Frogs have been aptly called bio-indicator species, whose abundance and diversity is a poignant reflection of the general health and well-being of aquatic ecosystems. They are important components of wetland systems, particularly ephemeral systems from which fish are either excluded or of minor importance. In these habitats, they are dominant predators of invertebrates, many of which may impact significantly on humans (e.g. as vectors of disease).

Research indicates that the Eastern Cape contains a rich amphibian population, which is estimated at almost a third of the known species in South Africa (CES, 2001). However, the amphibian population in the Coega area is not well known, and is limited to the specimens kept in museums (CES, 2001). Previous studies estimate a total of 17 amphibian species recorded in the Coega IDZ (CES, 2001). However, four species, namely the Natal puddle frog, the bullfrog, the yellow striped reed frog, and the bubbling Kassina, are listed as peripheral, with none of them being threatened internationally (SRK, 2006).

6.4.5.7 Invertebrates

Information on the invertebrate fauna, apart from butterflies, is scarce. One endemic grasshopper and three butterflies of interest have been recorded from the Coega area. The grasshopper, *Acrotylos hirtus*, is endemic to the dunefields of Algoa Bay. Three Lycaenid butterflies (coppers and blues) have been identified as rare or have very restricted distributions in the Coega area. These are *Aloeides clarki* and *Peocilimitis pyroeis* (small coppers) and *Lepidochrysops bacchus* (a small blue). Scorpions and Baboon Spiders are also relatively abundant in the area.



The vegetation of the Manganese Ore Export Facility contains Bontveld mosaic vegetation, predominantly within the Compilation Yard and Rail Link Line area (Zone 11); which consists of grasses, small shrubs/ forbs and interspersed between thicket clumps of varying size.

6.5 IDENTIFICATION OF KEY ISSUES

The key issues regarding the potential impact of the proposed project on terrestrial ecology are presented in the Final Scoping Report (CSIR, 2012). These issues are unpacked in this section.

6.5.1 *Direct Loss of vegetation*

- The construction of the Manganese export terminal infrastructure will result in the blanket clearing of vegetation and Endorheic pans within the required footprint;

6.5.2 *Direct Loss of species of special concern and SSC habitat*

- A number of flora Species of Special Concern occur within the project footprint, predominantly within the Grassridge Bontveld, but to a lesser extent in the Sundays Valley Thicket and Motherwell Karroid Thicket.

6.5.3 *Increased risk of alien plant invasion in disturbed areas*

- Alien plant species (and other exotic weed) could be introduced during the construction and operational phases, especially along the access road and rail link reserve and areas disturbed during construction

6.5.4 *Change in natural fire regime*

- Fire regime changes may also be possible as a result of increased vehicular and other traffic into the area during and post construction, especially during dry periods.
- The fragmentation of habitat (mainly Bontveld but also Sunday Valley Thicket) and proliferation of grasses in disturbed areas such as rail reserves and service roads, can increase accidental fire risk.

6.5.5 *Long-term effects of Manganese dust on adjacent vegetation*

- Windborne Manganese dust, from various sources along within the facility may accumulate on surrounding vegetation and soils as per the Air Quality specialist report (Chapter 5).
- Direct accumulation of Manganese dust on plant surfaces (especially leaves) could affect photosynthesis and result in stunted growth and other effects. The butterfly reserves to the south west and north west of the Stockyard may be prone to Mn ore dust accumulation, although the long-term effect is unknown.



6.5.6 Fragmentation of Ecological Corridors and disruption of Ecological processes as a result of artificial barriers

- The components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in both the fragmentation of ecological corridors and artificial disruptions to ecological processes.
- The IDZ Open Space Management Plan incorporates an ecological corridor along the banks of the Coega River (on the eastern side south of the N2 and on both sides north of the N2) that allows for some permanent connectivity between the coastal and inland areas.

6.5.7 Faunal mortality as a result of bush clearing and earthmoving activities during site preparation

- The clearing of vegetation will result in the loss of habitat for fauna (mammals, reptiles and amphibians) and will result in mortality of faunal species, especially less mobile species.

6.5.8 Habitat destruction may affect faunal diversity and composition

- The construction of the Manganese Ore Export Facility and related infrastructure (including roads) will permanently destroy existing habitats.
- Mobile fauna will move out of the affected area, but habitat for less mobile species will be permanently lost.

6.5.9 Road mortality of fauna from trucks, trains and other service vehicles

- Frequent truck/vehicle road and train activity will result in an increase in mortality of reptiles.

6.5.10 Faunal mortalities resulting from fences (mammals and reptiles);

- Fauna may enter fenced off areas around the Compilation Yard and Stockyard and get trapped.
- Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards. They may be harmed or killed by electrocution when trying to pass through such fences.
- Palisade fences may be harmful to large mammals such as kudu, which are present in Tankatara Farm, part of the Sundays River Conservancy.

6.5.11 Mortalities resulting from poaching (mammals).

- Workers may set snares to trap animals for food etc during construction and operational phases, which could result in faunal mortalities or severe disabilities.



6.6 IMPACT ASSESSMENT

This section discusses the potential impacts and assesses them with and without mitigation measures. Table 6.6 provides a summary assessment of impacts and mitigation measures during construction and operational phases. Table 6.7 provides a summary of monitoring guidelines.

6.6.1 Direct Loss of Vegetation

Within the context of the original vegetation of the area, the range of Sundays Valley Thicket, Grassridge Bontveld, Motherwell Karroid Thicket, Sundays Doringveld and saltmarsh (manmade) vegetation communities covers the proposed Manganese Ore Export Facility. These areas, although largely intact or semi-intact, have in some areas been transformed and degraded predominantly through agricultural cultivation and some alien plant infestation, with the Sundays Valley Thicket along the slopes adjacent to the Coega River relatively pristine. Although the NMBM vulnerable status recommends that only disturbed areas are to be developed, the site (excluding the portion of the Compilation yard extending into Tankatara Farm) has however been designated as an Industrial Development Zone.

The components of the Manganese Ore Export Facility (Compilation Yard, Rail Link, Manganese Stockyard and Conveyor) all require the clearing of land which will be almost irreversibly altered from the natural state. In particular the Stockyard will occupy an area of Motherwell Karroid Thicket that is rated "Endangered" (NMBM BCP, 2011). This Motherwell Karroid Thicket is however degraded with a portion transformed. Some infrastructure is sited within Endangered Albany Alluvial Vegetation (NEMBA).

The proposed Manganese Ore Export Facility will result in the following contribution to the loss of vegetation units (original extent) within the NMBM:

- Bontveld: approximately 163 Ha (0.8%) for the compilation yard and link lines and which includes invaded Bontveld areas
- Sundays Valley Thicket: approximately 51 Ha (0.1%) of which about half is severely degraded and transformed
- Motherwell Karroid thicket: approximately 105 Ha (1 %) of which about 30 Ha is transformed
- Sundays Doringveld Thicket: approximately 8.5 Ha (3.7 %)
- Coega Saltpans: approximately 6.8 Ha (2.8 %)

These figures will not significantly differ between the preferred and alternative layouts for the compilation yard and preferred and alternative routes for the conveyor.

The Compilation Yard and Rail Link are situated predominantly in an area of Grassridge Bontveld, the condition of which varies between natural and degraded to varying degrees as a result of historical agricultural use and alien invasion. The preferred option occupies a larger footprint than the alternative option. Endorheic Pans are situated within the footprint of the Compilation yard and will be lost (refer to Chapter 9 Aquatic ecology specialist study).

- The Link Line Alternative 1 connecting the preferred Compilation Yard to the existing railway line passes through Bontveld adjacent to the Compilation Yard and a band of intact solid thicket. The return loop of the link line will pass through similar vegetation, but to a lesser extent.
- The Link line alternative 2 will result in the loss of Bontveld and to a lesser extent than the preferred option through some solid Sundays Valley Thicket. Alternative 2 will pass through a number of Endorheic pans.



The rail link doubling will result in the widening of the railway line corridor between the rail link line and the existing Marshalling Yard. Clearing of vegetation for the line as well as earthworks will result in the loss of portions of intact vegetation, predominantly Sundays Valley Thicket, but to a lesser extent some Bontveld, Sundays Doringveld and Motherwell Karroid Thicket.

Some peripheral man-made saltmarsh and riparian habitat may also be affected by the rail line and the Conveyor, although mostly in already disturbed or transformed areas. The alternative conveyor route will result in a significantly lower loss of intact vegetation than the preferred route.

The site vulnerability varies across the site, largely dependent on the level of transformation and degradation from a variety of activities, including historical agricultural activities, mostly being moderate (Bontveld) to High (Thicket) – refer to Figures 6.44 to 6.48.

- Degradation in the form of invasive alien plant infestations tends to be very limited and patchy on the site. Large scale clearing was conducted in Zone 11 in the recent past.
- Some degradation from historical agriculture is present, but the area can be described as being transformed for the saltpans; near natural for Bontveld and natural for Sundays Valley Thicket.
- Areas indicated as having a high to very high vulnerability include Vulnerable Sundays Valley Thicket, where it falls within the designated Critical Biodiversity area and especially where it forms part of the designated IDZ Open Space Management Plan.
- Areas with a moderate sensitivity include those having intact vegetation but with a Least threatened or Vulnerable conservation status (Bontveld).
- Areas having a low sensitivity include areas transformed, severely degraded and heavily invaded areas, and areas having a low conservation status.

Given all the aspects above:

- Alternative 2 of the compilation yard has a smaller footprint than the preferred option, hence the overall loss of vegetation will be lower.
- Alternative 2 of the rail link will result in a lower impact to Sundays Valley Thicket within the Open Space Corridor, however it will result in the loss of more Endorheic Pans than the preferred option. Note: The alternative layout of the compilation will not allow the increase in throughput on the long-term that the preferred layout would allow.
- The Alternative conveyor route will have a significantly lower impact and loss of habitat than the preferred option.

Significance rating

Due to the loss of vegetation being restricted to the development footprint, this impact is assessed to be *site specific/localised* and of *permanent* duration. The intensity of the impact is assessed to be *medium*. Given the above, the significance associated with the loss of habitat ((due to the construction of the facility with the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Clearing of vegetation must be limited to the footprint and the minimum required to undertake construction activities;
- Any additional lay-down and similar areas that may be required outside of the development footprint must be sited in transformed or degraded areas;
- “No-go” areas must be demarcated clearly (using fencing and appropriate signage) before construction commences.



- Contractors and construction workers must be informed of the “no-go” areas and held accountable for any infringements that may occur.
- No access to the demarcated areas must be permitted during construction and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.
- Activities including, but not restricted to the following, must not be permitted in designated “no-go” areas:
 - Dumping of any material during and after construction;
 - Turning of vehicles;
 - Trampling and urination by construction workers; and
 - Lighting fires.
- Pre construction site clearing must be kept to the minimum area required;
- All vehicular/construction activities must be restricted to the demarcated construction area;

With effective mitigation, the residual impact (*for the Preferred and Alternative layouts for the compilation yard and the conveyor route*) of the project associated with the loss of:

- Grassridge Bonteveld habitat is predicted to be of *low* significance.
- Sundays Valley Thicket habitat is predicted to be of *low to medium* significance.
- Motherwell Karroid Thicket habitat is predicted to be of *medium* significance.
- Sundays Doringveld habitat is predicted to be of very *low* significance.
- Saltmarsh (Saltpan) habitat is predicted to be of very *low* significance.

6.6.2 Loss of Flora SSC and SSC habitat

The components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in the destruction of a number of floral Species of Special Concern and SSC habitat, predominantly within the Grassridge Bontveld, but to a lesser extent in the Sundays Valley Thicket and Motherwell Karroid Thicket. Coega Bontveld is known for its diversity of numerous endemic species and other protected flora, mostly succulent species. Milkwood trees are also an important component of Sundays Valley Thicket. It is unlikely that any SSC are present in the Riparian areas and the man-made Saltpans.

The loss of SSC habitat will therefore mostly occur during construction and will persist for the duration of the project, although post construction rehabilitation and natural regeneration is likely to occur in time.

Given all the aspects above, the alternative Compilation Yard layout (Alternative 2), due to its smaller footprint will most likely result in the overall loss of fewer SSC and SSC habitat, although the residual impact is not likely to be significant. The alternative conveyor route will result in a significantly lower loss of SSC and SSC habitat.

Significance rating

Due to the loss of species being restricted to the development footprint, this impact is assessed to be *site specific/localised* and of *permanent* duration. The intensity of the impact is assessed to be *low*. Given the above, the significance associated with the loss of SSC and SSC habitat (*for the Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:



- Vegetation clearing must be limited to the required development footprint.
- Permission must be obtained from the relevant authorities to destroy or remove any protected plant species.
- Relocation of protected flora must be undertaken with necessary permits by an appointed professional service provider.
- Protected flora (refer to Tables 6.2 and 6.5) and, where possible, endemic flora must be removed from the affected site footprint to be safeguarded from destruction and relocated either to undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists. Given that the designated Coega IDZ nursery is no longer operational, it is recommended to rescue and relocate plants into areas of the OSMP where rehabilitation is required or can be used for rehabilitation of non permanent areas disturbed during construction.
- Extensive plant rescue and relocation operation must be conducted timeously before any site clearing occurs, especially within areas having intact vegetation

By implementing the above mitigation measures, loss of species of special concern will be reduced significantly, although all individuals are unlikely to be relocated. Rehabilitation of peripherally disturbed areas will also reinstate some lost SSC habitat. With effective mitigation, the residual impact of the project associated with the destruction of SSC is predicted to be of *low* significance for all the options (Preferred and Alternatives).

6.6.3 Increased risk of alien plant invasion in disturbed areas

The potential risk of increased alien invasive (and other exotic weed) invasion will persist during construction and operational phases as a result of the introduction and dispersal of plant propagules (seeds) from outside the site via increased traffic through these reserves. This will be especially prevalent along disturbed road/railway reserves and in areas disturbed during construction where weedy and invasive species tend to proliferate. There is unlikely to be any significant difference in risk of alien invasion between the alternative options.

Significance rating

Due to this being restricted to specific area within the development footprint (i.e. road and rail reserves), this impact is assessed to be *site specific* and of *long-term duration*. The intensity of the impact is assessed to be *low*. Given the above, the significance of the risk to introduced alien plant invasion (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- A long-term alien plant management plan to control invasive plant species must be implemented within the Manganese Ore Export Facility, particularly within the Railway and Conveyor reserves, including measures to appropriately remove alien invasives during construction. Particular care must be given to seed bearing material minimising potential spread into surrounding areas. The removal of alien invasive plant species from the site surrounds and Railway and Conveyor reserves will reduce the spread of these species into surrounding areas.
- The Manganese Ore Export Facility rail reserves must be kept free of alien species for its duration.
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist);
- Cleared vegetation must be removed from site or mulched for use in rehabilitation of the reserves cleared during construction. Any mulched material must be weed seed free.



- Any seed bearing alien plant material should be removed from site to prevent the spread of seed.
- Chopped brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities;
- Kikuyu grass and other invasive or exotic grasses must not be utilised during regrassing of any areas affected by the development particularly adjacent to riparian and/wetland habitats. CDC IDZ Revegetation guidelines, or similar approved management plans to be adhered to.
- Rehabilitation should be implemented in a phased manner directly after construction.

By implementing the above mitigation measures, alien invasion risk will be reduced significantly. With effective mitigation, the residual impact of the project associated with the increased risk of alien proliferation is predicted to be of *low to very low* significance for all the options (Preferred and Alternatives).

6.6.4 Change in natural fire regime

Fire regime changes may be possible as a result of increased vehicular and other traffic into the area during and post construction. Fire is also a natural component of Bontveld ecology due to the dominance of grasses in Bontveld. This makes it prone to fire, especially during dry periods and infrequent fires are likely to occur.

Although Sundays Valley Thicket is fire resistant to some extent, fragmentation and proliferation of grasses in disturbed areas, can result in it being fire prone and accidental fires can rapidly spread into areas where fire would not normally occur, especially during dry periods.

Accidental fire risk is likely to increase in the rail/conveyor reserves, where grasses will be dominant, which could result from for example discarded cigarette butts or other means.

Therefore, fire risk will increase as a result of fragmentation of habitats during the construction and operational phases, especially along rehabilitated access road and rail link reserves verges, where grasses will proliferate. There is unlikely to be any significant difference in risk fire between the alternative options.

Significance rating

Due to this being restricted to the specific area within the development footprint (i.e. road and rail reserves), this impact is assessed to be *site specific* and of *long-term* duration. The intensity of the impact is assessed to be *low*. Given the above, the significance associated with the increased fire risks (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- A fire management plan and awareness signage must be implemented as part of the EMP, including a action plan for accidental fires;
- Areas where dry grasses may accumulate of vegetation becomes moribund can be burned periodically under controlled conditions to reduce the risk of runaway fires;
- Grassy Road and railway verges outside of rehabilitated areas can be regularly mowed to reduce risk.



- Flammable litter and discarded glass bottles should be removed regularly, especially along rail and conveyor reserves;
- Implement fire fighting strategy as part of EMP, especially in cleared and maintained rail and conveyor reserves, in line with any IDZ fire management strategies.

BY implementing the above mitigation measures, fire risk will be reduced significantly and with effective mitigation, the residual impact of the project associated with increased fire risk is predicted to be of *low to very low* significance for all the options (Preferred and Alternatives).

6.6.5 Long-term effects of Manganese dust on adjacent vegetation.

Contamination of vegetation adjacent to the Manganese Ore Export Facility with windborne Mn ore dust emanating most notably from the Stockyard will be prevalent during the Operational Phase. The dust suppression measures described in the Air Quality Specialist Report (Chapter 5), will significantly reduce the amount of Mn ore dust.

Direct accumulation of manganese ore dust on plant surfaces (especially leaves) could affect photosynthesis in the long term and may result in stunted growth and other effects. Information regarding plant responses, plant sensitivities and tolerances, and the substrate factors affecting plant responses to manganese ore in the local context are unknown. In Mn toxicity, symptoms include chlorosis of older leaves, necrotic spotting (as a result of accumulation of insoluble Mn) and a symptom on young foliage known as crinkle leaf.

Periodic rains are likely to wash residual dust off of plant matter, but this may accumulate in the soils. Although Manganese is considered a micronutrient for plants, in high concentrations it could cause toxicity effects, which could be detrimental to plant growth and survival in the long term, although the long-term effect is unknown.

Another particular concern is the potential effect of the proposed facility on two rare butterfly species that occur within the boundaries of the IDZ, *Aloeides clarki* and *Lepidochrysops bacchus*. The butterfly reserves to the south west and north west of the Stockyard may be prone to Mn ore dust accumulation, although the long-term effect is unknown.

Impacts resulting from Mn ore dust are unlikely to be of significance in the long-term given the low dust emissions under full mitigation as per the air quality specialist study findings

Significance rating

Due to this being restricted to specific areas adjacent to the development footprint (i.e. the IDZ), this impact is assessed to be *site specific/localised* and of *permanent* duration. The intensity of the impact is assessed to be *medium*. Given the above, the significance associated with the increased fire risks (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Measures as per the Air Quality Specialist Report (Chapter 5) must be implemented to reduce the likelihood of wind borne Manganese dust.



- Long-term visual monitoring (for change in vegetation health, e.g. chlorosis, etc.) of the effect of Mn ore dust on the vegetation should be undertaken, especially butterfly host plants within the Butterfly reserve(s) and designated Open Space network for excessive accumulation and severe toxicity effects on fauna and flora. Should severe long term effects be noted, then remedial measures will need to be further investigated.

By implementing the mitigation measures described in Chapter 5, Manganese dust contamination will be reduced significantly and the residual impact of the project associated with Manganese dust contamination is predicted to be of *Low to Very Low* significance for all the options (Preferred and Alternatives).

6.6.6 Fragmentation of Ecological Corridors and disruption of Ecological processes and animal movement as a result of artificial barriers

The components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in both the fragmentation of ecological corridors and artificial disruptions to ecological processes (Figure 6.37). The IDZ Open Space Management Plan incorporates an ecological corridor along the banks of the Coega River (on the eastern side south of the N2 and on both sides north of the N2) that allows for some permanent connectivity between the coastal and inland areas.

The construction of roads and railway lines can act as barriers to long-term ecological processes necessary to sustain evolutionary and ecological processes and to faunal movement thus disrupting these movement corridors, especially within the designated Open Space Network.

Railway link line (including the return loop)

- The proposed Railway link passes through designated CDC IDZ Open Space areas, NMBM DBP Critical Biodiversity and Ecological Process Areas, which will be further fragmented and may act as a barrier to ecological processes and movement of faunal species (mammals, reptiles and amphibians). The rail link will consist of two loops, hence bisecting the corridor in two places and also isolating the internal triangle between the two loops and the existing line from the surrounding area.
- The railway link reserve will be 30 – 50 m wide to allow for the rail link line as well as an adjacent access road, and will be fenced off with stock proof fencing. This will also act as a significant permanent barrier to faunal movement within the Corridor. The railway Link line will be constructed on top of a raised platform and it will pass through ephemeral drainage lines between the compilation yard and the existing railway line. As such, Box Culverts (3 m wide by 2 m high) are proposed where drainage features require (Figure 6.30 and 6.31). However, these do not constitute an acceptable measure to promote free faunal movement within an Ecological Corridor. Open Lattice bridge structures have been considered at strategic points along the route within the designated Open Space corridor to improve connectivity and reduce fragmentation effects.



Figure 6.30: Example of box-culverts that don't allow for corridor continuity.



Figure 6.31: Example of box-culverts that don't allow for corridor continuity.

Line Doubling

- The existing Railway line passes more or less through the centre of the designated CDC IDZ Open Space areas, NMBM DBP Critical Biodiversity and Ecological Process Areas, which will be further fragmented and reduced in extent and may also act as a barrier to ecological processes and movement of faunal species (mammals, reptiles and amphibians). It will also pass through ephemeral drainage lines and watercourses between the Compilation Yard and Stockyard.

The Sundays Valley Thicket ecological corridor (OSMP) will become an important movement corridor for fauna, increasing as the IDZ becomes more developed and faunal species move out of developed areas. Throughout the rail link reserve as a whole, there are numerous movement corridors (pathways) which may be altered, manipulated or destroyed, including natural animal movement paths within the Thicket vegetation.

Changes in seed dispersal due to dispersal agent mortalities are likely to be low to very low, as thicket tends to favour bird pollination and dispersal.

- Fragmentation of intact habitat will also affect faunal diversity and abundance, as many species have a specific home range or area in which they live and forage. The rail link and road network will further fragment this habitat, which will impact on fauna.
- Fragmentation of intact habitats within and along the designated IDZ OSMP (via railway line and railway link line reserves) will result in a notable reduction in and changes to ecological connectivity and ecological processes, including reduced patch sizes which may affect the home-ranges of faunal species.
- Since the IDZ OSMP has sought to conserve a corridor of intact vegetation on the eastern side of the river as a 'trade off' for the IDZ development; any significant disturbance that could undermine its ecological integrity will effectively reduce the effectiveness of the OSMP concept and reduce the value of this 'trade off'.
- The IDZ OSMP does however allow for reserves of this nature, and with effective management the long-term impacts need to be reduced to acceptable levels, depending on final railway line, culvert and bridge crossing and fence placement and design.

New forms of habitat will be created on either side of the cleared reserves. Grasses, small succulent shrubs and ground covers will replace the thicket in this situation. This will create grazing for small to medium mammals and tortoises and will increase the availability of hunting grounds and thus the presence of grass dwelling lizards and snakes.



The *Alternative* Rail Link line is likely to have a lower impact on ecological functioning of the designated Open space system, since they will be less disruptive to the solid thicket component. The preferred route has however been re-aligned significantly from the original position in consultation with the consultant and has thus been minimised as far as technically possible for that particular layout option. Should the preferred rail link route be implemented multiple strategically sited Open Lattice Structure bridges will be required, whereas the alternative will most likely require fewer lattice structure bridges.

The proposed *Preferred and Alternative conveyor routes* will pass through designated IDZ OSMP MST lost habitat (version 9 and 10). No designated Open Space areas will be affected by either route. Both routes will however pass through NMBM DBP Ecological Process and Critical Biodiversity Areas. The alternative route will have a lower short term impact as most of the route passes through already transformed areas. However, since this area is designated to be developed in the IDZ masterplan, the long-term effect will be insignificant.

Significance rating

Since the reserve is within an important bioregional corridor, this impact is assessed to be *regional* and of *long term* to *permanent* duration. The intensity of the impact is assessed to be *high*. Given the above, the significance associated with the fragmentation and disruption of Ecological Corridors for the *Preferred options* and for the *Alternative conveyor route* is rated to be *medium* to *high* before mitigation. The significance associated with the fragmentation and disruption of Ecological Corridors for the *Alternative 2 Compilation yard* is predicted to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Railway and Conveyor reserves must be kept to a minimum width to minimise disruptions to ecological processes. New reserves will need to be registered as per relevant guidelines.
- Railway line and access road design must be such that it does not impede these corridors unnecessarily or completely. Design measures, including appropriate fencing, bridge lattice structures, box culverts and drainage pipes, must be implemented to allow migration of fauna.
- Extensive and detailed final railway link line and additional Railway Line design plans should be approved by a suitably qualified ecologist as well as the appointed EO and CDC Environmental Unit and/or DEDEAT before final implementation. The design information for approval is to include at least detailed design specifications regarding railway line, fencing, culvert and bridge design as well as placement to minimise long term disruptions to ecological processes.
- The rail link route impacts can be reduced to acceptable levels by including the two open, Lattice Bridge crossing structures in the design as proposed by Transnet as well as box-culvert (or stormwater pipes) design and placement to minimise fragmentation and maximise corridor continuity (refer to Chapter 2, Table 2.1 and Figure 2.7). Open lattice bridge structures (Figure 6.32 & Figure 6.33) are far superior regarding promoting and allowing the free movement of fauna as compared to 30 - 50 m long Box culverts and must be implemented to significantly reduce the disruption and fragmentation of corridors to acceptable levels. The final design of the proposed lattice bridges will need to be verified by a suitably qualified ecologist or specialist.



Figure 6.32: Example of lattice type structures that will allow for corridor continuity.



Figure 6.33: Example of lattice type structures that will allow for corridor continuity.

- Post construction rehabilitation and planting of trees and thicket clumps in areas around the lattice bridges can promote an environment conducive to re-establishing a corridor for displaced fauna. Post construction areas not required during operational phase to be rehabilitated.
- Fencing and railway line berms will serve to guide fauna (such as tortoises) towards the underpass areas. Service roads will need to move out of the rail line reserve to cross areas where lattice bridges are constructed. Narrow culverts can be utilised for the width of the road requirements.
- Construction of roads over stormwater drainage infrastructure must be designed so that the water is allowed to flow under the road, to secure corridor continuity for amphibians, without exposing them to excessive vehicular traffic.
- Fencing of railway line reserves (both the Rail link line and the central additional railway line) will reduce mortality rates of faunal species (mammals) and use of embankments may also serve to discourage mammals, reptiles and amphibians from crossing over roads and railway lines. These will however disrupt the movement corridors of these species as well and allowances must be made for free movement corridors via culvert and preferably suitably placed open bridge structures along the ecological corridor on the eastern side of the railway line as well as within the central railway corridor, which splits the west and east MST corridors.
- Prevent using electric fencing as far as is practically feasible.
- Any areas disturbed or cleared for construction that are not required during operational phases are to be timeously and adequately rehabilitated under supervision of suitably qualified specialist to enhance corridor connectivity.
- These movement corridors must be revegetated appropriately to provide shelter to faunal species moving through the corridor.
- Riparian areas should be spanned as far as possible
- Any disturbance occurring within 500 m of any wetland (including dams) requires the necessary WULA permissions (refer to Chapter 9 Aquatic ecology specialist study).
- Disturbances to seep areas (drainage lines) will require detailed surveying before any construction commences so that appropriate design measures can be implemented to facilitate lateral water flow, especially where roads may traverse such areas.
- Trade-offs and Biodiversity Offsets requirements must be adhered to.
 - NMBM DBP Critical Biodiversity Areas should be avoided, but if loss is unavoidable, offsets will be required in adjacent areas with same ecological likeness as per NMBM DBP recommendations.



- Should any loss of CDC Open Space area be required (version 9 of the OSS), offsets will be required in consultation with CDC environmental management unit as per Regional Biodiversity offset guidelines;
- Fire and alien management plan to be implemented during construction.
- Materials, such as rocks, removed during the construction phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals, where rehabilitating in Open Space areas and areas outside of operational area..
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles.

By implementing the above mitigation measures, disruptions and fragmentation will be reduced to some extent, although residual effects that are likely to persist are predicted to be of *medium to low* significance for the *Preferred options and Alternative conveyor route/Alternative compilation yard layout (Alternative 2)*.

6.6.7 Faunal mortality as a result of bush clearing and earthmoving activities during site preparation

Site clearing (e.g. bush clearing and earthmoving activities) will have a direct impact on less mobile species (e.g. reptiles, mammals, amphibians and small invertebrates. Fauna may also be harmed with habitat destruction due to earth moving activities (e.g. termite mound destruction and excavation of calcrete outcrops).

Reptiles such as tortoises may be harmed by vehicles/machinery traversing through grassy areas. Chameleons may be harmed during bush clearing.

Displaced snakes may come into conflict with the workers on site when trapped for example in trenches, portable toilets etc.

Significance rating

Due to this being restricted to the Manganese Ore Export Facility development footprint, this impact is assessed to be *site specific/localised* and of *short-term duration*. The intensity of the impact is assessed to be *medium*. Given the above, the significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.
- Search and rescue operations must be conducted before construction phase begins.
- Animals (Amphibians, Reptiles & Mammals) must be relocated to places similar to those where they were found;
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be appointed when removing and relocating a reptile.

By implementing the above mitigation measures, faunal mortality will be reduced significantly. With effective mitigation, the residual impact of the project associated with Faunal mortality resulting from site clearance is predicted to be of *low (Medium for Amphibians)* significance for all the options (Preferred and Alternatives).



6.6.8 *Habitat destruction may affect faunal diversity and composition*

The construction of the Manganese Ore Export Facility and related infrastructure (including roads) will permanently destroy existing habitats. This impact involves the direct permanent removal and destruction of habitat and consists of short and long term impacts. As a consequence, mobile fauna will move out of the affected area. The edges of the development footprint do however often create new habitats for reptiles.

Significance rating

Due to this being restricted to the Manganese Ore Export Facility development footprint, this impact is assessed to be *site specific/localised* and of *short-term duration*. The intensity of the impact is assessed to be *medium*. Given the above, the significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium (High for Amphibians)* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Restrict road development to the required footprint;
- Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles

By implementing the above mitigation measures, loss of faunal diversity will be reduced significantly. With effective mitigation, the residual impact of the project associated with loss of faunal diversity is predicted to be of *low* significance for all the options (Preferred and Alternatives).

6.6.9 *Road mortality of fauna from trucks, trains and other service vehicles*

Frequent truck/vehicle road and train activity will result in an increase in mortality of reptiles (Figure 6.35). Reptiles frequent roads (and railway lines) for various reasons including foraging for food, basking during the day, “moon basking” which occurs when reptiles lie on roads at night to absorb warmth from the road surface, or merely to traverse the road or railway line. Amphibians frequent roads mainly to cross between wetlands or from aestivation places to wetlands during migrations, most prevalent during rainy periods.

Leopard toads will migrate simultaneously from aestivation grounds to the nearest breeding grounds (i.e. seasonal wetlands) and inevitably have to cross roads. For example, as many as 298 Leopard toads were killed within an hour along a 50-metre stretch of road near Lake Farm in Port Elizabeth during one such event. Many carnivorous mammals are also attracted to roads to search for food. These factors all contribute to the fauna being subjected to road mortality

The road and railway line infrastructure associated with the Manganese Ore Export Facility, will result in a permanent increase in vehicle and train traffic. This impact involves the potential increase in faunal road and railway mortalities and consists of permanent impacts.



Significance rating

Due to this being restricted to the Manganese Ore Export Facility road and railway line footprint, this impact is assessed to be *site specific* and of *long-term* duration. The intensity of the impact is assessed to be *medium*. Given the above, the significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* (Amphibians = *High* when raining and *Low* when not raining) before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity.
- The design of culverts and pipes must allow for fauna to pass through and fencing and rail platform to steer fauna towards underpasses.
- Amphibians which enter the construction zone must be relocated as soon as possible from the site.
- Mammals which enter the construction zone must be relocated as soon as possible from the site.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles
- Care must be taken to ensure slow driving on the site; speed limits should be enforced, especially during rainfall periods.
- Do not encourage wet areas, through construction, next to the road; or a road between two wetlands closely connected to aestivation sites unless the road is not directly on the ground surface.
- Keep the grass/vegetation short next to the road to reduce mammal activity near the road. This will also allow the vehicle driver and mammal to see the danger early enough to avoid a negative impact.
- Already killed animals must be removed from the road as this will attract scavengers which may also be harmed on the road.
- Do not feed animals on or near the roads. Conditions in the EMP should pay attention to this impact. Strict control by the appointed EO must ensure that this impact is addressed.

By implementing the above mitigation measures, loss of faunal diversity will be reduced significantly. With effective mitigation, the residual impact of the project associated with road mortalities is predicted to be of *low* significance (Amphibians = *Medium* when raining and *Very Low* when not raining) for all the options (Preferred and Alternatives).

6.6.10 Faunal mortalities resulting from fences (mammals and reptiles)

Fauna may enter fenced off areas around the Compilation Yard and Stockyard and get trapped. Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards which can be electrocuted.

Mammals such as grysbok may enter fenced off areas around the Compilation Yard and Stockyard and get trapped (Figure 6-36). The site will be fenced off during the operational phase or certain “no go” areas may be fenced off during construction. For example animals such as the blue duiker and grysbok will run against a fence until they find an escape route and can thus get injured.

Palisade fences may be harmful to large mammals such as kudu, which are present in Tankatara Farm, part of the Sundays River Conservancy.

Significance rating

Due to this being restricted to the Manganese Ore Export Facility footprint, where fences are constructed this impact is assessed to be *site specific/localised* and of *long-term* duration. The intensity of the impact is assessed to be *low*. Given the above, the significance (for the *Preferred* or the *Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The following key mitigations/management actions are recommended:

- Access gates into the fenced off areas to be closed at all times.
- Prevent using electric fencing as far as is practically feasible.
- Fenced off areas that are directly adjacent to or within animal movement corridors (i.e. the IDZ Open Space corridor) must not have barbed wire strands or mesh and must either provide facilities for smaller faunal species (tortoises) to pass through or must direct them to underpass or culvert areas.
- Palisade fences should not be used in areas where large mammals may be present. The Compilation Yard should be separated from the Sundays River Conservancy with a suitable game proof fence (2,4 m high with 21 fence wires). Internal palisade fencing can still be utilised if required for security.

By implementing the above mitigation measures, fence related mortalities will be reduced significantly. With effective mitigation, the residual impact of the project associated with road and rail mortalities is predicted to be of low significance for all the options (Preferred and Alternatives).

6.6.11 Mortalities resulting from poaching (mammals).

Workers may set snares to trap animals for food etc during construction and operational phases, which could result in faunal mortalities or severe disabilities.



Figure 6.34: Example of widespread clearing for construction.



Figure 6.35: Puff adder (*Bitis orientans*), killed on road



Figure 6.36: Example of water monitor trapped in a fence.



Figure 6.37: Disruptions to Thicket corridor continuity

Significance rating

Due to this being restricted to the Manganese Ore Export Facility footprint, where fences are constructed this impact is assessed to be site *specific/localised* and of *long-term* duration. The intensity of the impact is assessed to be *low*. Given the above, the significance (for the *Preferred* or the *Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

Recommended management actions

The key mitigation actions to reduce this impact are:

- The workers on site must be educated about the laws protecting wildlife. Penalties should be used as a deterrent. Regular fence inspections need to be conducted to remove any snares.

By implementing the above mitigation measures, poaching related mortalities will be reduced significantly. With effective mitigation, the residual impact of the project associated with poaching mortalities is predicted to be of *low* to *very low* significance for all the options (Preferred and Alternatives).

6.6.12 Decommissioning Phase

Should the Manganese Ore Export Facility be decommissioned, and all infrastructures be removed and appropriate rehabilitation measures implemented, the loss of habitat, especially specialised habitat such as Coega Bontveld will be permanent and non-reversible (without extreme cost implications), although some ecological function can be re-instated.

Disruptions to the ecological corridor would in the very long-term re-establish themselves to a certain extent with appropriate but costly rehabilitation measures although it would unlikely be equivalent to the predevelopment conditions and would be of *medium* significance after mitigation.

6.6.13 Cumulative impacts

1) Impacts on SA's conservation obligations & targets

Due to the project being restricted to the Manganese Ore Export Facility footprint and the vegetation units either fairly widespread, or having a minimal impact on vegetation units that have an elevated conservation status, the cumulative impact of the Manganese Ore Export Facility



will not significantly affect South Africa's conservation obligations and targets. Coega Bontveld is an important vegetation unit with a restricted distribution, and the Coega area is an important area i.t.o. the Bontveld biodiversity. However at the current time the Conservation status is not sufficiently elevated nor is the remaining extent such that the proposed facility will have any significant impacts on its conservation status.

2) Increase in local and regional fragmentation/ loss of landscape connectivity

The proposed facility (Rail Link lines) will result in fragmentation and disruptions to the Coega River Ecological Corridor, and the cumulative effect, in conjunction with existing and potential future impacts to this corridor are of concern. However, through the implementation of the proposed mitigation measures (rehabilitation and open lattice bridges), the impact can be reduced to allow for some connectivity to be retained.

3) Increase in environmental degradation and loss of ecosystem function.

The proposed Manganese Ore Export Facility will result in environmental degradation, and the cumulative effect, in conjunction with existing and potential future impacts to IDZ are of concern. However, bearing in mind that it is within a designated Industrial Development Zone, the contribution of the facility footprint to the overall degradation of the IDZ environment is insubstantial. Importantly, the necessary measures to minimise the impact of the proposed facility to the environment, especially where there is an overlap or conflict with the designated Open Space Network, must be implemented.

6.6.14 Assessment of Reversibility after mitigation

Vegetation and Flora impacts:

- **For the Compilation Yard and Stockyard:** loss of habitat will be *none reversible* without extreme cost implications. For other hard standing surfaces and roads (i.e. with removal of surface and replacement of topsoil), impacts are likely to have a *low* reversibility but dependant on potential rehabilitation budget, this could be elevated to *moderate* reversibility.
- **For the Railway and Conveyor reserves:** loss of habitat will be *none reversible* without extreme cost implications, although some connectivity will come back over time.

Fauna:

- **For the Compilation Yard and Stockyard:** loss of habitat will be *none reversible* without excessive cost implications. For other hard standing surfaces and roads, impacts are likely to have a *low* reversibility but dependant on potential rehabilitation budget (i.e. with removal of road surface and replacement of topsoil); this could be elevated to *moderate* reversibility.

Artificial habitat will however be created for reptile habitat, which would result in a *moderate to high* reversibility, but this would also be budget dependant and limited to specific faunal species.

- **For the Railway and conveyor reserves:** loss of habitat will be *none reversible* without extreme cost implications, although some connectivity will come back over time.

6.6.15 Assessment of Irreplaceability after mitigation

Fauna and Vegetation:

- Since most of the site is currently intact natural vegetation, the resources mostly have a moderate irreplaceability. However, the ecological process areas (designated OSMP) could be seen as *highly irreplaceable*.



Fauna

- Since most of the site is intact natural vegetation, and specialised faunal habitat is extensive, the resources are mostly moderately to highly irreplaceable, especially where ecological process areas (corridors) might be affected, where irreplaceability will be *moderate*.

Table 6.6: Assessment of impacts of the proposed project on terrestrial ecology (flora and fauna)

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE									
1)Direct Loss of Vegetation (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Localised	Permanent	Medium	Definite	Medium	Clearing of vegetation must be limited to the footprint and the minimum required to undertake construction activities; "No-go" areas must be demarcated clearly (using fencing and appropriate signage) before construction commences. (Refer to Section 6.6.1 for detailed list)	Medium to Very Low	High
2)Direct loss of Flora SSC concern and SSC habitat (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Localised	Permanent	Low	Definite	Medium	Vegetation clearing must be limited to the required development footprint. Permission must be obtained from the relevant authorities to destroy or remove any protected plant species. Relocation of protected flora to be undertaken with necessary permits by an appointed professional service provider timeously before construction commences (Refer to Section 6.6.2 for detailed list)	Low	High
3)Increased risk of alien plant invasion in disturbed areas (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Site	Long-term	Low	Probable	Medium	A long-term alien plant management plan to control invasive plant species must be implemented (Refer to Section 6.6.3 for detailed list)	Low/Very Low	High

³ Refer to listed mitigation measures described in Section 6.6 above for more detailed recommendations.

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
4)Change in natural fire regime (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Site	Long-term	Low	Probable	Medium	A fire management plan and awareness signage must be implemented as part of the EMP, including a action plan for accidental fires (Refer to Section 6.5.4 for detailed list)	Low/Very Low	High
5) Fragmentation of Ecological Corridors and disruption of Ecological processes and animal movement as a result of artificial barriers									
Vegetation and Flora (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Regional	Permanent	Medium	Definite	Medium	Reserves must be kept to a minimum width Railway line and access road design should be such that it does not impede these corridors unnecessarily.	Low	High
Mammals	Negative	Regional	Long-term	High	Probable	High (preferred) Medium (Alt Comp yard) High (Alt Conveyor)	Design measures to be implemented to allow migration of fauna (i.e. lattice bridges, fencing, etc.). Final plans must be approved by a suitably qualified ecologist and relevant authorities Post construction areas not required during operational phase to be rehabilitated.	Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium
Reptiles Amphibians	Negative	Site	Long-term	High	Probable	High (preferred) Medium (Alt Comp yard) High (Alt Conveyor)	Incorporate Regional Biodiversity Planning Guidelines requirement in proposed project layout (Refer to Section 6.5.6 for detailed list)	Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
Invertebrates	Negative	Site	Long-term	High	Possible	High (preferred) Medium (Alt Comp yard) High (Alt Conveyor)		Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium
6) Faunal mortality as a result of bush clearing and earthmoving activities during site preparation (Preferred or Alternative options (Compilation yard/Conveyor route))									
Mammals	Negative	Site	Permanent	Medium	Definite	Medium	Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas. Search and rescue operations conducted before construction phase begins (Refer to Section 6.6.7 for detailed list)	Low	High
Reptiles	Negative	Site	Permanent	Medium	Definite	Medium		Low	High
Amphibians	Negative	Site	Permanent	High	Definite	Medium		Medium	Medium
Invertebrates	Negative	Site	Permanent	Medium	Definite	Medium		Low	High
7) Habitat destruction may affect faunal diversity and composition									
Mammals	Negative	Site	Permanent	Medium	Probable	Medium	Restrict road development to the required footprint; Habitats near the construction site where no construction is to take place must be clearly demarcated as no-go areas (Refer to Section 6.6.8 for detailed list)	Low	High
Reptiles	Negative	Site	Permanent	Medium	Definite	Medium		Low	High
Amphibians	Negative	Site	Permanent	Medium	Definite	Medium		Low	Medium
Invertebrates	Negative	Site	Permanent	Medium	Probable	Medium		Low	Medium
8) Road mortality of fauna from trucks and other construction vehicles (Preferred or Alternative options (Compilation yard/Conveyor route))									
Mammals	Negative	Site	Long-term	Medium	Improbable	Medium	Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity. The design of culverts and pipes must allow for fauna to pass through and fencing and rail platform to steer fauna towards underpasses (Refer to Section 6.6.9 for detailed list)	Low	High
Reptiles	Negative	Site	Long-term	Medium	Improbable	Medium		Low	High
Amphibians	Negative	Site	Long-term	Medium	Definite	High (raining)		Medium (raining) Very Low (Not raining)	High
Invertebrates	Negative	Site	Long-term	Medium	Definite	Medium		Low	Medium

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
9) Faunal mortalities resulting from fences (mammals and reptiles) (Preferred or Alternative options (Compilation yard/Conveyor route))									
Reptiles/ Mammals	Negative	Site	Long-term	Low	Probable	Medium	Prevent using electric and palisade where they may conflict with fauna, as far as is practically feasible (Refer to Section 6.6.10 for detailed list)	Low	Medium
10) Mortalities resulting from poaching (mammals) (Preferred or Alternative options (Compilation yard/Conveyor route))									
Mammals	Negative	Site	Long-term	Low	Probable	Medium	Regular fence inspections need to be conducted to remove any snares (Refer to Section 6.6.11 for detailed list)	Low	Medium

OPERATIONAL PHASE

1) Increased risk of alien plant invasion in disturbed areas (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Site	Long-term	Low	Probable	Medium	A long-term alien plant management plan to control invasive plant species must be implemented (Refer to Section 6.6.3 for detailed list)	Low/Very Low	High
2) Change in natural fire regime (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Site	Long-term	Low	Probable	Medium	A fire management plan and awareness signage must be implemented as part of the EMP, including an action plan for accidental fires (Refer to Section 6.6.4 for detailed list)	Low/Very Low	High
3) Long-term effects of Manganese dust on adjacent vegetation (for Preferred or Alternative options)	Negative	Site/ Localised	Long-term	Medium	Probable	Medium	Measures as per the Air Quality Specialist Report (Chapter 5) to be implemented to reduce the likelihood of wind borne Manganese dust (Refer to Section 6.6.5 for detailed list)	Low/Very Low	Medium

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
(Compilation yard/Conveyor route))									
4) Fragmentation of Ecological Corridors and disruption of Ecological processes and animal movement as a result of artificial barriers									
Vegetation and Flora (for Preferred or Alternative options (Compilation yard/Conveyor route))	Negative	Regional	Permanent	Medium	Definite	Medium	Reserves must be kept to a minimum width Railway line and access road design should be such that it does not impede these corridors unnecessarily. Design measures to be implemented to allow migration of fauna (i.e. lattice bridges, fencing etc.). Final plans must be approved by a suitably qualified ecologist and relevant authorities Post construction areas not required during operational phase to be rehabilitated (Refer to Section 6.6.6 for detailed list)	Low	High
Mammals	Negative	Regional	Long-term	High	Probable	High (Preferred) Medium (Alt Comp yard) High (Alt Conveyor)		Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium
Reptiles, Amphibians	Negative	Site	Long-term	High	Probable	High (Preferred) Medium (Alt Comp yard) High (Alt Conveyor)		Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium
Invertebrates	Negative	Site	Long-term	High	Possible	High (Preferred) Medium (Alt Comp yard) High (Alt Conveyor)		Medium (Preferred) Medium to Low (Alt Comp yard) Medium (Alt Conveyor)	Medium
5) Road mortality of fauna from trucks, trains and other service vehicles (Preferred or Alternative options (Compilation yard/Conveyor route))									
Mammals	Negative	Site	Long-term	Medium	Improbable	Medium	Placing of structures under roads to allow	Low	High

Nature of impact	Status (Negative or positive)	Extent	Duration	Intensity	Probability	Significance (no mitigation)	Mitigation/Management Actions ³	Significance (with mitigation)	Confidence level
Reptiles	Negative	Site	Long-term	Medium	Improbable	Medium	reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity. The design of culverts and pipes must allow for fauna to pass through and fencing and rail platform to steer fauna towards underpasses (Refer to Section 6.6.9 for detailed list)	Low	High
Amphibians	Negative	Site	Long-term	Medium	Definite	High (raining)		Medium (raining) Very Low (Not raining)	High
Invertebrates	Negative	Site	Long-term	Medium	Definite	Medium		Low	Medium
6) Faunal mortalities resulting from fences (mammals and reptiles) (Preferred or Alternative options (Compilation yard/Conveyor route))									
Reptiles/ Mammals	Negative	Site	Long-term	Low	Probable	Medium	Prevent using electric fencing as far as is practically feasible (Refer to Section 6.6.10 for detailed list)	Low	Medium
7) Mortalities resulting from poaching (mammals) (Preferred or Alternative options (Compilation yard/Conveyor route))									
Mammals	Negative	Site	Long-term	Low	Probable	Medium	Regular fence inspections need to be conducted to remove any snares (Refer to Section 6.6.11 for detailed list)	Low	Medium
DECOMMISSIONING PHASE (Preferred or Alternative options (Compilation yard/Conveyor route))									
Temporary loss of habitat	Negative	Regional	Long-term	Medium	Definite	Medium	Limit clearing to the necessary areas	Low	Medium
Partial restoration of habitat due to rehabilitation of the site	Positive	Regional	Permanent	Low	Definite	Low	Measures to remove infrastructure, replace topsoil (including calcrete) and rehabilitate cleared areas to be implemented	Low	Medium
Partial reestablishment of disrupted Ecological Processes	Postive	Regional	Permanent	Low	Definite	Low	Measures to remove infrastructure, replace topsoil (including calcrete) and thicket trees and rehabilitate cleared areas to be implemented.	Low	Medium



6.7 CONCLUSIONS

Within the context of the original vegetation of the area the range of Sundays Valley Thicket, Grassridge Bontveld, Motherwell Karroid Thicket, Sundays Doringveld and saltmarsh (manmade) vegetation communities cover the proposed Manganese Ore Export Facility. These areas, although largely intact or semi-intact, have in some areas been transformed and degraded predominantly through agricultural cultivation and some alien plant infestation, with the Sundays Valley Thicket along the slopes adjacent to the Coega River relatively pristine. Amongst others, the following was considered in this assessment:

- Vulnerability varies across the site, largely dependent on the level of transformation and degradation from a variety of activities, including historical agricultural activities, mostly being moderate (Bontveld) to High (Thicket).
- Degradation in the form of invasive alien plant infestations tends to be very limited and patchy on the site. Large scale clearing was conducted in Zone 11 in the recent past.
- Some degradation from historical agriculture is present, but the area can be described as being transformed for the salt pans; near natural for Bontveld and natural for Sundays Valley Thicket.
- Areas indicated as having a high to very high vulnerability include Vulnerable Sundays Valley Thicket, where it falls within the designated Critical Biodiversity area and especially where it forms part of the designated IDZ Open Space Management Plan.
- Areas with a moderate sensitivity include those having intact vegetation but with a Least threatened or Vulnerable conservation status (Bontveld).
- Areas having a low sensitivity include areas transformed, severely degraded and heavily invaded areas, and areas having a low conservation status.
- The site does fall within a designated IDZ, negating certain impacts at a regional level, some impacts however to occur within designated Open Space conservation areas within the IDZ.

Eleven ecological impacts have been identified to vegetation flora and fauna relating to the proposed Manganese Ore Export facility and the significance of each of these are summarised below:

6.7.1 Direct Loss of Vegetation

During construction, the components of the Manganese Ore Export Facility (Compilation Yard, Rail Link, Manganese Stockyard and Conveyor) all require the clearing of land which will be almost irreversibly altered from the natural state.

The *Alternative 2 of the Compilation Yard* has a smaller footprint than the preferred option, hence the overall loss of vegetation will be lower. The *Rail Link of the Alternative 2 layout* will result in a lower impact to Sundays Valley Thicket within the Open Space Corridor, however it will result in the loss of more Endorheic Pans than the preferred option.

The *Alternative conveyor route* will result in a lower loss of vegetation than the preferred option, as it is located in already disturbed areas.

The significance associated with the loss of vegetation habitat (due to the construction of the facility with the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation.

With effective mitigation, the residual impact (*for the Preferred and Alternative layouts for the compilation yard and the conveyor route*) of the project associated with the loss of:



- Grassridge Bonteveld habitat is predicted to be of *low* significance.
- Sundays Valley Thicket habitat is predicted to be of *medium* significance.
- Motherwell Karroid Thicket habitat is predicted to be of *medium* significance.
- Sundays Doringveld habitat is predicted to be of very *low* significance.
- Saltmarsh habitat is predicted to be of very *low* significance.

6.7.2 Loss of Flora SSC and SSC habitat

During construction, the components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in the destruction of Species of Special Concern and SSC habitat. The loss of SSC habitat will therefore mostly occur during construction and will persist for the duration of the project, although post construction rehabilitation and natural regeneration is likely to occur in time.

The *Preferred layout for the Compilation Yard (Alternative 2)* will most likely result in the overall loss of fewer SSC and SSC habitat due to its smaller footprint, although the residual impact is not likely to be significant.

The *Preferred conveyor route* option will result in a significantly greater loss of SSC and SSC habitat than the alternative option which passes through disturbed areas and the saltpans which are not important habitat for terrestrial fauna and flora SSC.

The loss of flora SSC and SSC habitat associated with the construction of the facility with the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route* is predicted to be of *medium* significance before mitigation. After mitigation the residual impact of the project associated with the destruction of SSC is predicted to be of *low* significance for all options (*Preferred and Alternatives*).

6.7.3 Increased risk of alien plant invasion in disturbed areas

Alien plant species could be introduced during the construction and operational phases, especially along the access road and rail link reserve and areas disturbed during construction. There is unlikely to be any significant difference in risk of alien invasion between the alternative options.

The significance of the risk to introduced alien plant invasion (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. After mitigation the increased risk of alien proliferation is predicted to be of *low to very low* significance for all options (*Preferred and Alternatives*).

6.7.4 Change in natural fire regime

Fire risk will increase as a result of fragmentation of habitats during the construction and operational phases, especially along rehabilitated access road and rail link reserve verges, where grasses will proliferate. There is unlikely to be any significant difference in risk fire between the alternative options.

The change in natural fire regime (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is predicted to be of *medium* significance before mitigation and *low to very low* significance after mitigation for all options (*Preferred and Alternatives*).



6.7.5 Long-term effects of Manganese dust on adjacent vegetation.

Contamination of vegetation with wind borne Mn ore dust adjacent to the Manganese Ore Export Facility emanating most notably from the Stockyard will be prevalent during the Operational Phase. The dust suppression measures described in the Air Quality Specialist Report (Chapter 5), will significantly reduce the amount of Mn ore dust.

The significance of the impact (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is assessed to be medium before mitigation and low to very low after mitigation for all options (*Preferred and Alternatives*).

6.7.6 Fragmentation of Ecological Corridors and disruption of Ecological processes as a result of artificial barriers

The components of the Manganese Ore Export Facility all require the clearing of vegetation which will result in both the fragmentation of ecological corridors and artificial disruptions to ecological processes during the construction and the operational phases. The rail link line (rail link and line doubling) will traverse the designated IDZ open space network as well as designated NMBM DBP (2011), resulting in barriers to ecological processes and increased fragmentation.

The *Alternative* Rail Link line is likely to have a lower impact on ecological functioning of the designated Open space system, since they will be less disruptive to the solid thicket component. The preferred route has however been re-aligned significantly from the original position in consultation with the Terrestrial Ecology specialist and has thus been minimised as far as technically possible for that particular layout option. Should the preferred rail link route be implemented, multiple strategically sited Open Lattice Structure bridges will be required, whereas the alternative will most likely require fewer lattice structure bridges.

The *preferred conveyor route* will result in a greater disruption to ecological process areas in the short term than the alternative route, especially as a result of the earthworks required. However since the affected area is designated for development in the long-term, the long term impact will be insignificant.

Before mitigation, the significance associated with the fragmentation and disruption of Ecological Corridors is predicted to be *medium to high* for the *Preferred* and for the *Alternative conveyor route* and *medium* for the *Alternative compilation yard*. Residual effects that are likely to persist are predicted to be of *medium to low* significance for all options (*Preferred and Alternatives*).

6.7.7 Faunal mortality as a result of bush clearing and earthmoving activities during site preparation

Site clearing (e.g. bush clearing and earthmoving activities during construction) will have a direct impact on less mobile reptiles and Invertebrates. Before mitigation the significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium*. After mitigation the significance is rated to be of *low* (*Medium* for Amphibians) for all options (*Preferred and Alternatives*).

6.7.8 Habitat destruction may affect faunal diversity and composition

The construction of the Manganese Ore Export Facility and related infrastructure (including roads) will permanently destroy existing habitats. The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* (*High* for Amphibians) before mitigation. The residual impact after mitigation is predicted to be of *low* significance for all options (*Preferred and Alternatives*).



6.7.9 Road mortality of fauna from trucks, trains and other service/construction vehicles

Frequent truck/vehicle road and train activity will result in an increase in mortality of reptiles. The road and railway line infrastructure associated with the Manganese Ore Export Facility, will result in a permanent increase in vehicle and train traffic.

The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* (Amphibians = *High* when raining and *Low* when not raining) before mitigation. With effective mitigation, the residual impact is predicted to be of *low* significance (Amphibians = *Medium* when raining and *Very Low* when not raining) for all options (Preferred and Alternatives).

6.7.10 Faunal mortalities resulting from fences (mammals and reptiles)

Fauna may enter fenced off areas around the Compilation Yard and Stockyard and get trapped. Electrified fences can also be dangerous to mammals, tortoises and larger reptiles such as water monitor lizards which can be electrocuted.

The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. Fence related mortalities will be reduced significantly with mitigation and the residual impact is predicted to be of *low* significance for all options (Preferred and Alternatives).

6.7.11 Mortalities resulting from poaching (mammals).

Workers may set snares to trap animals for food etc during construction and operational phases, which could result in faunal mortalities or severe disabilities.

The significance (for the *Preferred or the Alternative compilation yard layout (Alternative 2)/conveyor route*) is rated to be *medium* before mitigation. The residual impact after mitigation is predicted to be of *low to very low* significance for all options (Preferred and Alternatives).

6.7.12 Potential Trade-offs and Biodiversity Offsets

- Due to the required loss of CDC Open Space area , offsets will be required in consultation with CDC environmental management unit;
- NMBM DBP Critical Biodiversity Areas should be avoided, but if loss cannot be avoided, then offsets will be required in adjacent areas with same ecological likeness as per NMBM DBP recommendations and ratios.

6.7.13 Recommendations

The important recommendations to avoid or minimise negative impacts on flora and fauna as a result of the proposed project are summarised below:

1) Measures to minimise loss of habitat and Species of Special Concern

- Clearing of vegetation must be limited to the footprint and the minimum required to undertake construction activities;
- Any additional lay-down and similar areas that may be required outside of the development footprint should be sited in transformed or degraded areas;
- “No-go” areas must be demarcated clearly (using fencing and appropriate signage) before construction commences.



- Contractors and construction workers must be informed of the “no-go” areas and held accountable for any infringements that may occur.
- No access to the demarcated areas should be permitted during construction and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.
- Activities including, but not restricted to the following, must not be permitted in designated “no-go” areas:
 - Dumping of any material during and after construction;
 - Turning of vehicles;
 - Trampling and urination by construction workers; and
 - Lighting fires.
- Pre construction site clearing to be kept to a minimum required.
- All vehicular/construction activities to be restricted to the demarcated construction area;
- Permission must be obtained from the relevant authorities to destroy or remove any protected plant species.
- Relocation of protected flora to be undertaken with necessary permits by an appointed professional service provider.
- Protected flora (Refer to Tables 6.2 and 6.5) and where possible, endemic flora must be removed from the affected site footprint to be safeguarded from destruction and relocated either to undeveloped areas or off-site in consultation with conservation authorities and relevant botanical specialists. Given that the designated Coega IDZ nursery is no longer operational, it is recommended to rescue and relocate plants into areas of the OSMP where rehabilitation is required or can be used for rehabilitation of non permanent areas disturbed during construction.
- Extensive plant rescue and relocation operation must be conducted timeously before any site clearing occurs, especially within areas having intact vegetation.
- Animals must be relocated to places similar to those where they were found.
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be appointed when removing and relocating a reptile.
- Amphibians must be relocated to a place similar to the place where they were found and Amphibians which enter the construction zone must be relocated as soon as possible from the site.
- Reptiles must be relocated to a place similar to the place where they were found.
- Mammals must be relocated to a place similar to the place where they were found and Mammals which enter the construction zone must be relocated as soon as possible from the site.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Construction materials which could attract reptiles must not be left on site, this will increase the presence of reptiles.
- Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity. The design of culverts and pipes must allow for fauna to pass through and fencing and rail platform to steer fauna towards underpasses.
- Amphibians and mammals which enter the construction zone must be relocated as soon as possible from the site.
- Materials which will attract reptiles must not be left on site after construction is completed, this could increase the presence of reptiles.
- Care must be taken to ensure slow driving on the site; speed limits should be enforced, especially during rainfall periods.
- Do not encourage wet areas, through construction, next to the road; or a road between two wetlands closely connected to aestivation sites unless the road is not directly on the ground surface.



- Keep the grass/vegetation short next to the road to reduce mammal activity near the road. This will also allow the vehicle driver and mammal to see the danger early enough to avoid a negative impact.
- Already killed animals must be removed from the road as this will attract scavengers which may also be harmed on the road.
- Animals should not be fed on or near the roads or other infrastructure.
- Access gates into the fenced off areas to be closed at all times.
- Prevent using electric fencing as far as is practically feasible.
- Fenced off areas that are directly adjacent to or within animal movement corridors (i.e. the IDZ Open Space corridor) must not have barbed wire strands or mesh and must either provide facilities for smaller faunal species (tortoises) to pass through or must direct them to underpass or culvert areas.
- Palisade fences should not be used in areas where large mammals may be present. The Compilation Yard should be separated from the Sundays River Conservancy with a suitable Game Fence. Internal palisade fencing can still be utilised around the Compilation Yard if required for security.
- The workers on site must be educated about the laws protecting wildlife. Penalties should be used as a deterrent. Regular fence inspections need to be conducted to remove any snares.

2) Measures to minimise disruptions and fragmentation of Ecological corridors

- Railway and Conveyor reserves must be kept to a minimum width to minimise disruptions to ecological processes. New rail reserves will need to be registered as per relevant guidelines.
- Railway line and access road design must be such that it does not impede these corridors unnecessarily or completely. Design measures, including appropriate fencing, bridge lattice structures, box culverts and drainage pipes, must be implemented to allow migration of fauna.
- Extensive and detailed final railway link line and additional Railway Line design plans should be approved by a suitably qualified ecologist as well as the appointed EO and CDC Environmental Unit and/or DEDEAT before final implementation. The design information for approval is to include at least detailed design specifications regarding railway line, fencing, culvert and bridge design as well as placement to minimise long term disruptions to ecological processes.
- The rail link route impacts can be reduced to acceptable levels by including the two open, Lattice Bridge crossing structures in the design as proposed by Transnet as well as box-culvert (or stormwater pipes) design and placement to minimise fragmentation and maximise corridor continuity (refer to Chapter 2, Table 2.1 and Figure 2.7). Open lattice bridge structures (Figure 6-32 & Figure 6-33) are far superior regarding promoting and allowing the free movement of fauna as compared to 30 - 50 m long Box culverts and must be implemented to significantly reduce the disruption and fragmentation of corridors to acceptable levels. The final design of the proposed lattice bridges will need to be verified by the a suitably qualified ecologist or specialist.
- Post construction rehabilitation and planting of trees and thicket clumps in areas around the lattice bridges can promote an environment conducive to re-establishing a corridor for displaced fauna. Post construction areas not required during operational phase to be rehabilitated.
- Fencing and railway line berms will serve to guide fauna (such as tortoises) towards the underpass areas. Service roads will need to move out of the rail line reserve to cross areas where lattice bridges are constructed. Narrow culverts can be utilised for the width of the road requirements.
- Construction of roads over stormwater drainage infrastructure must be designed so that the water is allowed to flow under the road, to secure corridor continuity for amphibians, without exposing them to excessive vehicular traffic.
- Fencing of railway line reserves (both the Rail link line and the central additional railway line) will reduce mortality rates of faunal species (mammals) and use of embankments may also



serve to discourage mammals, reptiles and amphibians from crossing over roads and railway lines. These will however disrupt the movement corridors of these species as well and allowances must be made for free movement corridors via culvert and preferably suitably placed open bridge structures along the ecological corridor on the eastern side of the railway line as well as within the central railway corridor, which splits the west and east MST corridors.

- Prevent using electric fencing as far as is practically feasible.
- Any areas disturbed or cleared for construction that are not required during operational phases are to be timeously and adequately rehabilitated under supervision of suitably qualified specialist to enhance corridor connectivity.
- These movement corridors must be revegetated appropriately to provide shelter to faunal species moving through the corridor.
- Riparian areas should be spanned as far as possible
- Any disturbance occurring within 500 m of any wetland (including dams) requires the necessary permissions from the Department of Water Affairs and construction or any other disturbance should be avoided within a 32 m buffer around any watercourse, wetland features, pans and dams. Where unavoidable the required General Authorisation permits will be required from the Department of Water Affairs **before** any construction activities commence. The Department of Water Affairs **must** be involved as an interested and affected party and should be involved in the planning phase of the project.
- Disturbances to seep areas and areas will require detailed surveying before any construction commences so that appropriate design measures can be implemented to facilitate lateral water flow, especially where roads may traverse such areas.
- Trade-offs and Biodiversity Offsets requirements must be considered to.
 - NMBM DBP Critical Biodiversity Areas should be avoided, but if loss is unavoidable, offsets will be required in adjacent areas with same ecological likeness as per NMBM DBP recommendations.
 - Should any loss of CDC Open Space area be required, offsets will be required in consultation with CDC environmental management unit as per Biodiversity offset guidelines;
- Fire and alien management plan to be implemented during construction.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles.

3) Measures to minimise invasion of disturbed areas by alien invasive species

- A long-term alien plant management plan to control invasive plant species must be implemented within the Manganese Ore Export Facility, particularly within the Railway and Conveyor reserves, including measures to appropriately remove alien invasives during construction. Particular care must be given to seed bearing material minimising potential spread into surrounding areas. The removal of alien invasive plant species from the site surrounds and Railway and Conveyor reserves will reduce the spread of these species into surrounding areas.
- The Manganese Ore Export Facility reserves must be kept free of alien species for its duration.
- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist);
- Cleared vegetation must be removed from site or mulched for use in rehabilitation of the rail and conveyor reserves cleared during construction. Any mulched material must be seed free.
- Any seed bearing alien plant material should be removed from site to prevent the spread of seed.
- Chopped brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities;



- Kikuyu grass and other invasive or exotic grasses must NOT be utilised during regrassing of any areas affected by the development particularly adjacent to riparian and/wetland habitats. CDC IDZ Revegetation guidelines to be adhered to.
- Rehabilitation to be implemented in a phased manner directly after construction.

4) Measures to minimise accidental fire

- A fire management plan and awareness signage must be implemented as part of the EMP, including a action plan for accidental fires;
- Areas where dry grasses may accumulate of vegetation becomes moribund can be burned periodically under controlled conditions to reduce the risk of runaway fires;
- Grassy Road and railway verges outside of rehabilitated areas can be regularly mowed to reduce risk.
- Flammable litter and discarded glass bottles should be removed regularly, especially along rail and conveyor reserves;
- Implement fire fighting strategy as part of EMP, especially in cleared and maintained rail and conveyor reserves, in line with any IDZ fire management strategies.

5) Measures to minimise Mn ore dust pollution

- Measures as per the Air Quality Specialist Report (Chapter 5) to be implemented to reduce the likelihood of wind borne Manganese dust.
- Long-term monitoring of Mn ore dust to be undertaken, especially within the Butterfly reserve(s) and designated Open Space network for excessive accumulation and severe toxicity effects on fauna and flora. Should severe long term effects be noted, then remedial measures will need to be further investigated.

6.8 BEST MANAGEMENT PRACTICES

The following section provides some more detailed best practice measures that should be incorporated into the Construction and Operational Environmental Management Plan.

6.8.1 Guidelines for inclusion in the Environmental Management Programme (EMP):

- IDZ Open Space Management guidelines must be incorporated into the EMP to manage areas adjacent to the site.
- The development of a plant relocation plan must be incorporated into the EMP and submitted with permit applications. Comprehensive rescue for plants deemed to require rescue for replanting, and for plants that will be useful during rehabilitation;
- The Construction EMP should contain clear guidelines for clearing of vegetation where construction activities are to commence;
- The Operational EMP must contain management measures to be implemented during operation of the facility. These measures should cover alien plant control and fire management plans.
- A detailed revegetation and rehabilitation plan must be implemented during the post-construction and operational phase as per the CDC IDZ Standard Revegetation Specification Document.
- Since the site is located in a catchment area, activities may have an impact on downstream areas. Removal of alien vegetation, rehabilitation of natural vegetation and long-term erosion management are important aspects that must be addressed in the EMP.



6.8.2 “No-Go” Areas

- “No-go” areas must be demarcated clearly (using fencing or appropriate measures and signage) before construction commences.
- Contractors and construction workers must be informed of the “no-go” areas and held accountable for any infringements that may occur.
- No access to the demarcated areas should be permitted during construction and contractors must be informed of the location of these areas. A suitable control measure (such as a penalty system) must be implemented to discourage infringement by contractors.

6.8.3 Plant Relocation Plan and Species of Special Concern Search and Rescue

- A suitable timeframe must be allowed *before* construction commences to undertake the plant rescue and relocation operation;
- Plants that can be used during rehabilitation should be identified and stored appropriately off-site for use after construction and alien vegetation clearing;
- Plants identified as being suitable for relocation can either be removed from the site or replanted within the proposed buffer areas.

6.8.4 Permit applications for the destruction, relocation and/or removal of protected plant species

- Species indicated as being protected would require permits from the respective department **before** any site clearing/removal commences.
- The person or organisation responsible for the relocation of these plant species must work in advance of the vegetation clearing team, and locate as well as relocate individual plant specimens.
- All individuals of the protected indigenous species should be avoided if possible, if not they should be translocated or utilized during rehabilitation and landscaping. If neither is possible permits will be required to either trim or remove individuals.
- Removed plants must be excavated by hand in such a way that the plants, especially the roots are not damaged.
- Plants should be temporarily planted out either in plastic bags or in-situ in an area that is not affected by the proposed development. Should bags be used, they shall be large enough to contain the entire plant’s root system. Bags must be filled with local top soil material. Plants must be watered regularly, protected from damage and otherwise maintained to ensure healthy growth.
- On completion of the civil work the plants must be re-planted out in scattered clumps at areas on the site to be rehabilitated as directed by a suitably qualified specialist.
- Individuals of all removed species will need to be housed in a nursery until such time as relocation areas have been identified.

6.8.5 Rehabilitation potential and processes

- A detailed environmental rehabilitation specification guideline should be compiled and included in the construction EMP.

6.8.6 Alien Vegetation Management Plan

- An alien vegetation removal programme must be implemented to remove alien vegetation from within areas that have been rehabilitated after construction is completed and should run concurrently with construction activities;
- Specific eradication and management procedures should be stipulated in the EMP in terms of the methods to be implemented to remove and control the various alien invasive species as they



tend to require species specific techniques. Introduced weed species do not require removal but management is advised to prevent proliferation as a result of disturbance (i.e. on road verges, etc).

- Cleared alien vegetation must not be dumped on adjacent intact vegetation during clearing but should be temporarily stored in a demarcated area (in consultation with the relevant botanical specialist);
- Cleared vegetation must be removed from site or mulched for use in rehabilitation of the rail and conveyor reserves cleared during construction. Any mulched material must be seed free.
- Any seed bearing alien plant material should be removed from site to prevent the spread of seed.
- Chopped brushwood can be used to stabilise steep areas that may be susceptible to erosion during clearing activities;
- A suitable revegetation or rehabilitation plan must be implemented after alien vegetation clearing.
- A long-term alien vegetation maintenance plan, including monitoring and removal of new invasive plants, must be designed and implemented in conjunction with a suitably qualified expert.

6.8.7 River/stormwater crossings

- Lattice Bridge and culvert design must be such that it minimises impact to the riparian areas with minimal alterations to water flow and must permit the movement of fauna;
- Bridge/culvert construction must be completed as timeously as possible and efforts must be in place to minimise the erosion risk and sedimentation of the stream during construction, especially during high rainfall events.

6.8.8 Fauna

- The construction zone and “no-go” areas must be clearly marked.
- Search and rescue operations conducted before construction phase begins.
- Animals must be relocated to places similar to those where they were found;
- Animals which enter the construction zone must be relocated as soon as possible.
- A professional reptile handler must be appointed when removing and relocating a reptile.
- Construction of roads over stormwater drainage infrastructure must be designed so that the water is allowed to flow under the road, this will secure corridor continuity for amphibians
- Railway line design should be such that it does not impede these corridors unnecessarily or completely;
- Prevent using electric fencing as far as is practically feasible.
- Placing of structures under roads to allow reptiles such as tortoises and terrapins to cross under the road will promote corridor continuity.
- Materials, such as rocks, removed during the constructional phase must be kept aside and used later for the rehabilitation. This will be beneficial for the re-creation of habitat for small mammals.
- Materials which will attract reptiles must not be left on site, this will increase the presence of reptiles
- Care must be taken to ensure slow driving on the site; speed limits should be enforced, especially during rainfall periods.
- Do not encourage wet areas, through construction, next to the road; or a road between two wetlands closely connected to aestivation sites unless the road is not directly on the ground surface.
- Keep the grass/vegetation short next to the road to reduce mammal activity near the road. This will also allow the vehicle driver and mammal to see the danger early enough to avoid a negative impact.



- Already killed animals must be removed from the road as this will attract scavengers which may also be harmed on the road.
- Do not feed animals on or near the roads. Conditions in the EMP should pay attention to this impact. Strict control by the appointed EO must ensure that this impact is addressed.

6.8.9 Fencing, lattice bridges and culverts

- For internal fencing along the railway line doubling and rail link line from the Stockyard to the Compilation Yard:
 - The type of fencing to be used is expected to be 6 to 8 strand wire “stock” fence with a height of approximately 1.35 to 1.5 m. There will be a spacing of approximately 300 mm between the strands and the distance between the bottom strands can vary to allow animals to pass through, but will keep out cattle and sheep. 75 mm vermin proof diamond diagonal mesh and barbed wire are optional.
- For external site fencing:
 - Security Palisade fencing can be used around facilities such as the Stockyard, CONveyoy and Compilation Yard, but where the Compilation Yard bounds Tankatara farm on the eastern side of the boundary, standard game fencing should be used rather than palisade fencing.
- Box culverts as drainage line crossing structures over drainage lines along the route of the rail link and line doubling should be 3 m wide and 2 m high where possible.
- Lattice type structure bridges (faunal underpasses) are also proposed where the railway crosses over gulleys and drainage lines along sections of Open Space. These should have a span of approximately 20 m to allow for a continuity of the open space system corridor and for small animals to cross the railway line
- The rail link/return loop route impacts may be reduced to acceptable levels by including open, lattice bridge crossing structures in the design as well as box-culvert (or stormwater pipes) design and placement to minimise fragmentation and maximise corridor continuity. Open lattice bridge structures (Figure 6-32 & Figure 6-33) are far superior regarding promoting and allowing the free movement of fauna as compared to 30 – 50 m long Box culverts and will significantly reduce the disruption and fragmentation of corridors to acceptable levels. The use of lattice structures are required to mitigate impacts to open space.
- Post construction rehabilitation and planting of trees and thicket clumps in areas around the lattice bridges can promote an environment conducive to re-establishing a corridor for displaced fauna. Post construction areas not required during operational phase to be rehabilitated.
- Fencing and railway line berms will serve to guide fauna (such as tortoises) towards the underpass areas. Service roads will need to move out of the rail line reserve to cross areas where lattice bridges are constructed. Narrow culverts can be utilised for the width of the road requirements.

6.9 REFERENCES

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6.10 APPENDICES

APPENDIX 6.A FAUNA AND FLORA SPECIES LIST

APPENDIX 6.B VEGETATION VULNERABILITY ASSESSMENT

APPENDIX 6.C MAPS



APPENDIX 6.A

FAUNA AND FLORA SPECIES LIST

Flora Species List

Table 6.7: List of floral species recorded or likely to occur in the general study area, together with the conservation status.

Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Abutilon sonneratianum</i>	Malvaceae			+		
<i>Acacia cyclops</i>	Mimosoideae	CARA 2	+		+	+
<i>Acacia natalitica</i>	Mimosoideae				+	+
<i>Aizoon rigidum</i>	Aizoaceae		+			+
<i>Albuca sp</i>	Hyacinthaceae			+		
<i>Allophylus decipiens</i>	Sapindaceae			+	+	
<i>Aloe africana</i>	Asphodelaceae	PNCO		+		
<i>Aloe ferox</i>	Asphodelaceae	PNCO	+	+	+	
<i>Aloe humilis</i>	Asphodelaceae	PNCO	+			
<i>Ammocharis coranica</i>	Amaryllidaceae	PNCO			+	
<i>Anacampseros arachnoides</i>	Portulacaceae	PNCO	+			
<i>Anginon rugosum</i>	Apiaceae	PR	+			
<i>Aptenia cordifolia</i>	Mesembryanthemaceae	PNCO		+		
<i>Arctotheca calendula</i>	Asteraceae				+	+
<i>Aristea anceps</i>	Iridaceae	PNCO	+			
<i>Aristida congesta</i>	Poaceae		+			
<i>Asclepias sp</i>	Apocynaceae	PNCO			+	
<i>Aspalathus chortophila</i>	Papilionoideae				+	
<i>Asparagus asparagoides</i>	Asparagaceae			+		
<i>Asparagus capensis</i>	Asparagaceae		+	+		
<i>Asparagus crassiusculus</i>	Asparagaceae			+		
<i>Asparagus densiflorus</i>	Asparagaceae		+		+	
<i>Asparagus racemosus</i>	Asparagaceae			+		
<i>Asparagus striatus</i>	Asparagaceae		+	+	+	
<i>Asparagus subulatus</i>	Asparagaceae			+		
<i>Azima tetraacantha</i>	Salvadoraceae			+	+	

⁴ IUCN STATUS: CE: Critically endangered; E: Endangered; VU: Vulnerable; LC: Least concern. PNCO: Provincial Nature Conservation Ordinance; NFA: National Forests Act.



Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Barleria irritans</i>	Acanthaceae		+			
<i>Becium burchellianum</i>	Lamiaceae		+		+	+
<i>Berkheya heterophylla</i>	Asteraceae		+			
<i>Blepharis procumbens</i>	Acanthaceae		+			
<i>Boophone disticha</i>	Amaryllidaceae	PNCO	+			
<i>Brachiaria serrata</i>	Poaceae				+	
<i>Brachylaena ilicifolia</i>	Asteraceae			+	+	
<i>Buddleja saligna</i>	Buddlejaceae				+	
<i>Bulbine filifolia</i>	Asphodelaceae		+		+	
<i>Bulbine frutescens</i>	Asphodelaceae		+		+	
<i>Bulbine inae</i>	Asphodelaceae				+	
<i>Bulbine latifolia</i>	Asphodelaceae			+		
<i>Capparis sepiaria</i>	Capparaceae			+		
<i>Carissa bispinosa</i>	Apocynaceae			+	+	
<i>Centella asiatica</i>	Apiaceae				+	
<i>Ceterach cordatum</i>	Aspleniaceae			+		
<i>Chaetacanthus setiger</i>	Acanthaceae		+			
<i>Chascanum cuneifolium</i>	Verbenaceae		+		+	
<i>Cheilanthes hirta</i>	Pteridaceae			+		
<i>Cheilanthes viridis</i>	Pteridaceae		+			
<i>Chenopodium album</i>	Chenopodiaceae					+
<i>Chenopodium mucronatum</i>	Chenopodiaceae					+
<i>Chironia baccifera</i>	Gentianaceae				+	
<i>Chrysanthemoides monilifera</i>	Asteraceae		+		+	
<i>Clausena anisata</i>	Rutaceae			+	+	
<i>Clutia daphnoides</i>	Euphorbiaceae			+	+	
<i>Commelina africana</i>	Commelinaceae		+		+	
<i>Commelina benghalensis</i>	Commelinaceae					+
<i>Conyza canadensis</i>	Asteraceae	Undeclared weed				+
<i>Cotyledon barbeyi</i>	Crassulaceae			+		
<i>Crassula capitella</i>	Crassulaceae			+		
<i>Crassula cotyledonis</i>	Crassulaceae		+			
<i>Crassula ericoides</i>	Crassulaceae		+			
<i>Crassula expansa</i>	Crassulaceae		+			+
<i>Crassula mesembryanthoides</i>	Crassulaceae			+		
<i>Crassula muscosa</i>	Crassulaceae		+	+	+	
<i>Crassula pellucida</i>	Crassulaceae			+		



Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Crassula perfoliata</i>	Crassulaceae			+		
<i>Crassula perforata</i>	Crassulaceae	PNCO		+		
<i>Crassula pyramidalis</i>	Crassulaceae	PNCO	+			
<i>Cussonia spicata</i>	Araliaceae			+	+	
<i>Cussonia thyrsoiflora</i>	Araliaceae			+		
<i>Cyanotis speciosa</i>	Commelinaceae		+		+	
<i>Cymbopogon pospischilii</i>	Poaceae		+		+	
<i>Cynodon dactylon</i>	Poaceae				+	+
<i>Cyphia heterophylla</i>	Lobeliaceae				+	
<i>Cyrtanthus spiralis</i>	Amaryllidaceae	PNCO, IUCN - EN	+			
<i>Delosperma calycina</i>	Mesembryanthemaceae	PNCO		+	+	
<i>Delosperma lehmannii</i>	Mesembryanthemaceae	PNCO	+			
<i>Dianthus thunbergii</i>	Caryophyllaceae		+			
<i>Diospyros dichrophylla</i>	Ebenaceae		+		+	
<i>Disparago ericoides</i>	Asteraceae		+		+	
<i>Dolichos hastaeformis</i>	Papilionoideae			+	+	
<i>Drimia anomala</i>	Hyacinthaceae		+		+	
<i>Drimia elata</i>	Hyacinthaceae		+		+	
<i>Drimia exuviata</i>	Hyacinthaceae		+			
<i>Drosanthemum parviflorum</i>	Mesembryanthemaceae	PNCO	+	+		
<i>Duvalia sp</i>	Apocynaceae	PNCO	+			
<i>Ehretia rigida</i>	Boraginaceae			+	+	
<i>Ehrharta calycina</i>	Poaceae		+			
<i>Elytropappus rhinocerotis</i>	Asteraceae				+	
<i>Eragrostis capensis</i>	Poaceae		+		+	
<i>Eragrostis obtusa</i>	Poaceae		+		+	
<i>Eriospermum brevipes</i>	Ruscaceae		+			
<i>Euclea crispa</i>	Ebenaceae		+		+	
<i>Euclea natalensis</i>	Ebenaceae				+	
<i>Euclea undulata</i>	Ebenaceae			+	+	
<i>Euphorbia fimbriata</i>	Euphorbiaceae			+		
<i>Euphorbia globosa</i>	Euphorbiaceae	PNCO, IUCN - EN				
<i>Euphorbia ledienii</i>	Euphorbiaceae			+		
<i>Euphorbia mauritanica</i>	Euphorbiaceae			+	+	
<i>Euphorbia meloformis</i>	Euphorbiaceae	PNCO, IUCN - VU	+		+	
<i>Euphorbia rhombifolia</i>	Euphorbiaceae		+		+	
<i>Euphorbia stellata</i>	Euphorbiaceae				+	



Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Euphorbia triangularis</i>	Euphorbiaceae			+		
<i>Euphorbia woodii</i>	Euphorbiaceae		+		+	
<i>Euryops algoensis</i>	Asteraceae		+			
<i>Euryops ericifolius</i>	Asteraceae	IUCN - VU	+			
<i>Exomis microphylla</i>	Chenopodiaceae	Undeclared weed				+
<i>Felicia filifolia</i>	Asteraceae			+		
<i>Ficinia truncata</i>	Cyperaceae		+			
<i>Fockea edulis</i>	Apocynaceae	PNCO		+		
<i>Gasteria bicolor</i>	Asphodelaceae	PNCO		+		
<i>Gazania krebsiana</i>	Asteraceae		+			
<i>Gerbera piloselloides</i>	Asteraceae				+	
<i>Grewia occidentalis</i>	Tiliaceae			+	+	
<i>Grewia robusta</i>	Tiliaceae			+		
<i>Gymnosporia capitata</i>	Celastraceae			+		
<i>Gymnosporia heterophylla</i>	Celastraceae			+	+	
<i>Haplocarpha lyrata</i>	Asteraceae		+			
<i>Haworthia cooperi</i>	Asphodelaceae	PNCO	+			
<i>Helichrysum anomalum</i>	Asteraceae		+		+	
<i>Hermannia althaeoides</i>	Sterculiaceae		+	+	+	
<i>Hermannia flammea</i>	Sterculiaceae		+			
<i>Hermannia velutina</i>	Sterculiaceae		+			
<i>Heteropogon contortus</i>	Poaceae		+		+	
<i>Hibiscus pusillus</i>	Malvaceae		+	+	+	
<i>Hippobromus pauciflorus</i>	Sapindaceae			+	+	
<i>Hypoestes forskalii</i>	Acanthaceae			+		
<i>Hypoxis stellipilis</i>	Hypoxidaceae		+		+	
<i>Indigofera denudata</i>	Papilionoideae		+	+	+	
<i>Indigofera heterophylla</i>	Papilionoideae		+			
<i>Indigofera pungens</i>	Papilionoideae		+	+	+	
<i>Jasminum angulare</i>	Oleaceae			+		
<i>Justicia capensis</i>	Acanthaceae			+		
<i>Kalanchoe rotundifolia</i>	Crassulaceae			+		
<i>Kedrostis nana</i>	Cucurbitaceae			+	+	
<i>Lantana rugosa</i>	Verbenaceae			+		
<i>Lauridia tetragona</i>	Celastraceae			+	+	
<i>Lebeckia psiloloba</i>	Papilionoideae			+		
<i>Ledebouria ensifolia</i>	Hyacinthaceae		+		+	



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Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Leucas capensis</i>	Lamiaceae			+		
<i>Lobostemon trigonus</i>	Boraginaceae		+			
<i>Lycium ferocissimum</i>	Solanaceae			+	+	+
<i>Maerua cafra</i>	Capparaceae			+		
<i>Melilotus sp</i>	Papilionoideae	Undeclared weed				+
<i>Merxmuellera disticha</i>	Poaceae		+	+	+	
<i>Monsonia emarginata</i>	Geraniaceae		+	+		
<i>Moraea thomsonii</i>	Iridaceae	PNCO	+		+	
<i>Mystroxydon aethiopicum</i>	Celastraceae			+	+	
<i>Nylandtia spinosa</i>	Polygalaceae		+			
<i>Oedera genistifolia</i>	Asteraceae		+			
<i>Olea europaea sp africana</i>	Oleaceae			+	+	
<i>Ophioglossum polyphyllum</i>	Ophioglossaceae		+		+	
<i>Opuntia ficus-indica</i>	Cactaceae	CARA 1		+		+
<i>Osteospermum imbricatum</i>	Asteraceae		+			
<i>Osyris compressa</i>	Santalaceae				+	
<i>Oxalis imbricata</i>	Oxalidaceae		+		+	
<i>Oxalis punctata</i>	Oxalidaceae		+		+	
<i>Pachypodium bispinosum</i>	Apocynaceae	PNCO	+			
<i>Panicum deustum</i>	Poaceae			+		
<i>Pappea capensis</i>	Sapindaceae			+	+	
<i>Passerina falcifolia</i>	Thymelaeaceae		+		+	
<i>Pelargonium alchemilloides</i>	Geraniaceae		+			+
<i>Pelargonium lobatum</i>	Geraniaceae		+		+	
<i>Pelargonium odoratissimum</i>	Geraniaceae			+		
<i>Pelargonium peltatum</i>	Geraniaceae			+		
<i>Pelargonium reniforme</i>	Geraniaceae		+		+	
<i>Pennisetum clandestinum</i>	Poaceae	Undeclared weed				+
<i>Pentaschistis pallida</i>	Poaceae	IUCN - LC	+			
<i>Pentzia incana</i>	Asteraceae	IUCN - LC	+			
<i>Peucedanum typicum</i>	Apiaceae	IUCN - VU			+	
<i>Phyllanthus incurvus</i>	Euphorbiaceae		+		+	
<i>Plectranthus madagascariensis</i>	Lamiaceae			+		
<i>Plumbago auriculata</i>	Plumbaginaceae			+		
<i>Pollichia campestris</i>	Illecebraceae					+
<i>Polygala asbestina</i>	Polygalaceae		+		+	
<i>Portulacaria afra</i>	Portulacaceae			+		



CHAPTER 6: TERRESTRIAL ECOLOGY

Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Ptaeroxylon obliquum</i>	Ptaeroxylaceae			+		
<i>Pterocelastrus tricuspidatus</i>	Celastraceae				+	
<i>Pteronia incana</i>	Asteraceae				+	+
<i>Putterlickia pyracantha</i>	Celastraceae			+	+	
<i>Raphionacme zeyheri</i>	Apocynaceae	PNCO	+		+	
<i>Relhania speciosa</i>	Asteraceae		+			
<i>Relhania speciosa</i>	Asteraceae		+			
<i>Rhoiacarpus capensis</i>	Santalaceae			+		
<i>Rhoicissus tridentata</i>	Vitaceae			+	+	
<i>Rhombophyllum rhomboideum</i>	Mesembryanthemaceae	PNCO	+			
<i>Rhus incisa</i>	Anacardiaceae				+	
<i>Rhus longispina</i>	Anacardiaceae		+			
<i>Rhus lucida</i>	Anacardiaceae			+		
<i>Rhus pallens</i>	Anacardiaceae		+	+		+
<i>Rhus refracta</i>	Anacardiaceae			+		
<i>Rhus sp</i>	Anacardiaceae		+		+	
<i>Rhynchosia capensis</i>	Papilionoideae		+			
<i>Ruschia cymbifolia</i>	Mesembryanthemaceae	PNCO	+			
<i>Ruschia rigens</i>	Mesembryanthemaceae	PNCO	+		+	+
<i>Salvia scabra</i>	Lamiaceae			+		
<i>Sansevieria hyacinthoides</i>	Ruscaceae			+	+	
<i>Sarcostemma viminalis</i>	Apocynaceae			+	+	
<i>Schinus molle</i>	Anacardiaceae	Undeclared weed				+
<i>Schotia afra</i>	Caesalpinoideae			+	+	
<i>Scutia myrtina</i>	Rhamnaceae			+	+	
<i>Senecio angulatus</i>	Asteraceae			+		
<i>Senecio inaequidens</i>	Asteraceae					+
<i>Senecio odontophyllus</i>	Asteraceae			+		
<i>Senecio radicans</i>	Asteraceae			+	+	
<i>Sideroxylon inerme</i>	Sapotaceae	NFA		+	+	
<i>Solanum hermanii</i>	Solanaceae			+		+
<i>Sphalmanthus plenifolius</i>	Mesembryanthemaceae	PNCO		+		
<i>Sporobolus africanus</i>	Poaceae					+
<i>Sutera microphylla</i>	Scrophulariaceae		+		+	
<i>Tephrosia capensis</i>	Papilionoideae		+		+	
<i>Themeda triandra</i>	Poaceae		+		+	
<i>Trachyandra hirsuta</i>	Asphodelaceae		+			

Botanical Name	Family	Status ⁴	Calcrete Outcrops	Thicket Clumps	Bontveld Grassy Mosaic	Degraded Bontveld
<i>Tragus berteronianus</i>	Poaceae					+
<i>Tribolium uniolae</i>	Poaceae		+			
<i>Trichodiadema bulbosum</i>	Mesembryanthemaceae	PNCO	+			
<i>Viscum obscurum</i>	Viscaceae			+	+	
<i>Viscum rotundifolium</i>	Viscaceae			+	+	

Fauna Species List

Table 6.8: List of faunal species recorded or likely to occur in the general study area, together with the conservation status.

Scientific Name	Common Name	Conservation Status ⁵	Observed/Likely to Occur
Amphibians			
<i>Amietophrynus pardalis</i>	Eastern leopard toad	PNCO, LC	L
<i>Amietophrynus rangeri</i>	Raucous toad	PNCO, LC	L
<i>Breviceps adpersus pentheri</i>	Penthers rain frog	PNCO, LC	L
<i>Cacosternum boettgeri</i>	Common caco	PNCO, LC	L
<i>Cacosternum nanum</i>	Bronz caco	PNCO, LC	L
<i>Hyperolius horstockii</i>	Arum lily frog	PNCO, LC	L
<i>Hyperolius marmoratus</i>	Painted reed frog	PNCO, LC	L
<i>Kassina senegalensis</i>	Kassina	PNCO, LC	L
<i>Semnodactylus wealii</i>	Rattling frog	PNCO, LC	L
<i>Strongylopus fasciatus</i>	Striped stream frog	PNCO, LC	L
<i>Strongylopus grayii</i>	Clicking stream frog	PNCO, LC	L
<i>Tomopterna delalandii</i>	Cape sand frog	PNCO, LC	L
<i>Vandijkophrynus angusticeps</i>	Cape sand toad	PNCO, LC	L
<i>Xenopus laevis</i>	Common platanna	PNCO, LC	L
Reptiles			
<i>Acontias gracilicauda gracilicauda</i>	Thin tailed legless skink	LC	L
<i>Acontias lineicauda</i>	Algoa legless skink	NC	L
<i>Acontias meleagris orientalis</i>	Eastern legless skink	LC	L
<i>Acontias percivali tasmani</i>	Tasman's legless skink	LC	O
<i>Agama atra</i>	Southern rock agama	LC	O
<i>Aspidelapse lubricus lubricus</i>	Cape coral snake	LC	L
<i>Bitis arietans</i>	Puff adder	LC	O
<i>Bradypodion ventrale</i>	Southern dwarf chameleon	LC, CITES, Appendix 2	O
<i>Causus rhombeatus</i>	Night adder	LC	
<i>Chersina angulata</i>	Angulate tortoise	LC, PNCO, CITES APPENDIX 2 PROTECTED	O
<i>Cordylus cordylus</i>	Cape girdled lizard	LC, CITES, Appendix 2	O
<i>Cordylus tasmani</i>	Tasman's girdled lizard	VU	L

⁵ IUCN STATUS: CE: Critically endangered; E: Endangered; VU: Vulnerable; LC: Least concern. T.O.P.S: Threatened or Protected Species.



Scientific Name	Common Name	Conservation Status ⁵	Observed/Likely to Occur
<i>Crotaphopeltis hotamboeia</i>	Herald snake	LC	O
<i>Dasypeltis scabra</i>	Rhombic egg eater	LC	L
<i>Dispholidus typus</i>	Boomslang	LC	L
<i>Duberria lutrix</i>	Slug eater	LC	O
<i>Gerrhosaurus flavigularis</i>	Yellow throated plated lizard	LC	L
<i>Hemachatus haemachatus</i>	Rinkhals	LC	L
<i>Hemidactylus mabouia</i>	Tropical house gecko	LC	O
<i>Homopus areolatus</i>	Parrot beaked Padloper	LC, PNCO, CITES APPENDIX 2 PROTECTED	L
<i>Homorolapse lacteus</i>	Harlequin snake	LC	O
<i>Lamprophis aurora</i>	Aurora house snake	LC	L
<i>Lamprophis capensis</i>	Brown house snake	LC	O
<i>Lamprophis fuscus</i>	Yellow bellied house snake	PNCO, NT	L
<i>Lamprophis guttatus</i>	Spotted house snake	LC	L
<i>Lamprophis inornatus</i>	Olive house snake	LC	L
<i>Leptotyphlops nigricans</i>	Black thread snake	PNCO, LC	L
<i>Lycodonomorphus laevisissimus</i>	Dusky bellied water snake	LC	L
<i>Lycodonomorphus rufulus</i>	Brown water snake	LC	L
<i>Lycophidion capense</i>	Cape wolf snake	LC	O
<i>Lygodactylus capensis capensis</i>	Cape dwarf gecko	LC	O
<i>Naja nivea</i>	Cape cobra	LC	L
<i>Nucras lalandii</i>	Delalandes sandveld lizard	LC	L
<i>Pachydactylus maculatus</i>	Spotted thick toed gecko	LC	O
<i>Pedioplanis pulchella</i>	Pulchell's sand lizard	LC	L
<i>Pelomedusa subrufa</i>	Marsh terrapin	PNCO, LC	O
<i>Philothamnus hoplogaster</i>	Green water snake	LC	L
<i>Philothamnus natalensis occidentalis</i>	Natal green snake	LC	O
<i>Philothamnus semivariegatus</i>	Spotted bush snake	LC	L
<i>Prosymna sundevallii</i>	Sundsvall's shovel snout	LC	L
<i>Psammophis crucifer</i>	Crossed marked sand snake	LC	O
<i>Psammophis notostictus</i>	Karoo whip snake	LC	O
<i>Psammophylax rhombeatus</i>	Rhombic skaapsteker	LC	O
<i>Pseudaspis cana</i>	Mole snake	LC	L
<i>Pseudocordylus m. microlepidotus</i>	Cape crag lizard	LC	L
<i>Rhinotyphlops lalandei</i>	Delalandes beaked blind snake	PNCO, LC	O
<i>Scelotes anguineus</i>	Algoa dwarf burrowing skink	LC	L
<i>Scelotes caffer</i>	Cape dwarf burrowing skink	LC	L
<i>Stigmochelys pardalis</i>	Leopard tortoise	LC, PNCO, CITES APPENDIX 2 PROTECTED	O
<i>Tetradactylus fitzsimonsi</i>	FitzSimon's long tailed seps	VU	L
<i>Tetradactylus seps</i>	Short legged seps	LC	L
<i>Trachylepis capensis</i>	Cape skink	LC	O
<i>Trachylepis homalcephala</i>	Red sided skink	LC	O
<i>Trachylepis varia varie</i>	Variable skink	LC	L
<i>Varanus albigularis albigularis</i>	Rock monitor	LC	L
<i>Varanus niloticus</i>	Water monitor	LC	L
			L
Mammals			
<i>Amblysomus corriae</i>	Fynbos golden mole	NT	L



Scientific Name	Common Name	Conservation Status ⁵	Observed/Likely to Occur
<i>Amblysomus hottentotus</i>	Hottentot golden mole	DD	L
<i>Aonyx capensis</i>	African clawless otter	LC	L
<i>Atilax paludinosus</i>	Marsh mongoose	LC	L
<i>Caracal caracal</i>	Caracal	LC	L
<i>Cercopithecus pygerythrus</i>	Vervet monkey	LC	O
<i>Chlorotalpa duthieae</i>	Duthie's golden mole	LC	L
<i>Crocidura cyanea</i>	Reddish-grey musk shrew	DD	L
<i>Crocidura flavescens</i>	Greater red musk shrew	DD	L
<i>Cryptomys hottentotus</i>	African mole rat	LC	L
<i>Cynictis penicillata</i>	Yellow mongoose	LC	L
<i>Dendromus melanotis</i>	Grey climbing mouse	LC	L
<i>Dendromus mesomelas</i>	Brant's climbing mouse	LC	L
<i>Epomophorus wahlbergi</i>	Wahlberg's epauletted fruit bat	LC	L
<i>Felis catus</i>	Feral cat	Feral (Alien)	L
<i>Felis silvestris</i>	African wild cat	LC	L
<i>Galerella pulverulenta</i>	Cape grey mongoose	LC	L
<i>Genetta genetta</i>	Small spotted genet	LC	L
<i>Genetta tigrina</i>	Large spotted genet	LC	L
<i>Georchus capensis</i>	Cape mole rat	LC	L
<i>Graphiurus murinus</i>	Woodland dormouse	LC	L
<i>Graphiurus ocellatus</i>	Spectacled dormouse	LC	O
<i>Herpestes ichneumon</i>	Large grey mongoose	LC	L
<i>Hystrix africaeaustralis</i>	Cape porcupine	LC	O
<i>Ictonyx striatus</i>	Striped polecat	LC	L
<i>Lepus saxatilis</i>	Scrub hare	LC	O
<i>Macroscelides proboscideus</i>	Round eared elephant shrew	LC	L
<i>Mastomys natalensis</i>	Natal multimammate mouse	LC	L
<i>Mellivora capensis</i>	Honey badger	NT	L
<i>Micaelamys namaquensis</i>	Namaqua rock mouse	LC	L
<i>Mus minutoides</i>	Pygmy mouse	LC	L
<i>Mus musculus</i>	House mouse	Alien	L
<i>Myosorex varius</i>	Forest shrew	DD	L
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	L
<i>Nycteris thebaica</i>	Egyptian Slit-Faced Bat	LC	L
<i>Orycteropus afer</i>	Aardvark	LC	O
<i>Otocyon megalotis</i>	Bat eared fox	LC	O
<i>Otomys irroratus</i>	Vlei rat	LC	O
<i>Otomys unisulcatus</i>	Bush vlei rat	LC	L
<i>Panthera pardus</i>	Leopard	LC	L
<i>Papio cynocephalus ursinus</i>	Chacma baboon	LC	L
<i>Philantomba monticola</i>	Blue duiker	VU, VU TOPS Protected	L
<i>Poecilogale albinucha</i>	African striped weasel	DD	L
<i>Potamochoerus larvatus</i>	Bush pig	LC	L
<i>Procavia capensis</i>	Rock hyrax	LC	L
<i>Pronolagus saundersiae</i>	Hewitt's red rock rabbit	LC	L
<i>Raphicerus campestris</i>	Steenbok	LC	L
<i>Raphicerus melanotis</i>	Grysbok	LC	O
<i>Rattus rattus</i>	House rat	LC	L
<i>Rhabdomys pumilio</i>	Four striped grass mouse	LC	O
<i>Saccostomus campestris</i>	Pouched mouse	LC	O
<i>Suncus infinitesimus</i>	Least Dwarf Shrew	E	L
<i>Sylvicapra grimmia</i>	Common duiker	LC	O



Scientific Name	Common Name	Conservation Status ⁵	Observed/Likely to Occur
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat	LC	L
<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	LC	L
<i>Tragelaphus scriptus</i>	Bush buck	LC	O
<i>Vulpes chama</i>	Cape fox	LC	L

APPENDIX 6.B VEGETATION VULNERABILITY ASSESSMENT

An overall vulnerability assessment, incorporating key vegetation and ecological indicators was compiled and it includes the following key criteria:

- relative levels of *intactness* in terms of overall loss of indigenous vegetation cover;
- presence, diversity and abundance of *species of special concern* (weighted in favour of local endemic species);
- extent of *invasion* (severity and overall ecological impact), as well as the degree to which successful rehabilitation could take place;
- overall degradation incorporating above factors;
- Relative importance of the vegetation communities relative to regional conservation status - indicated as vulnerability of the area as a result of loss.

Intactness

Three basic classes are differentiated as follows:

- **Low:** < 25 % of original vegetation has been removed or lost; and/or no species of special concern present that are critically endangered, endangered or highly localised endemism.
- **Moderate:** 25 - 75 % of original vegetation has been removed/lost; and/or presence of species of special concern but not having high conservation status or high levels of endemism.
- **High:** > 75 % of original vegetation has been removed or lost; and/or presence of species with a highly endemism and or high conservation status (endangered or critically endangered).

Alien Invasion

Three classes are differentiated as follows:

- **Low:** no or few scattered individuals;
- **Moderate:** individual clumps of invasives present, but cover less than 50% of original area;
- **High:** dense, impenetrable stands of invasives present, or cover > 50 % of area with substantial loss functioning. Rehabilitation will most likely require specialised techniques over an extended time period (> 5 years).

Degradation

Overall Degradation is determined from the above alien invasion and intactness scores, according to the following matrix:

Table 6.9: Degradation Score matrix

Degradation	Invasion		
	Low	Moderate	High
Low	Pristine	Near Pristine	Moderately Degraded
Moderate	Near Pristine	Moderately Degraded	Severely Degraded
High	Moderately Degraded	Severely Degraded	Transformed

Overall Vulnerability score

Overall vulnerability (or Sensitivity) of the vegetation within the site is calculated according to the following matrix which combines degradation and overall conservation status of the vegetation units of the site.



Table 6.10: Vulnerability Score Matrix

Degradation	Conservation Status			
	Currently Vulnerable	NOT Vulnerable	Endangered	Critically Endangered
Severely degraded/ Transformed	Very Low	Low	Moderate	Moderate - High
Moderately degraded	Low	Moderate	High	High
Ecologically Pristine or near Pristine	Moderate	Moderate - High	High	Very High (No-Go Area)

Areas scoring an overall VERY LOW and LOW Vulnerability are those areas that:

- Includes areas that have a low conservation status.
- Are highly degraded or transformed and it is unlikely that they could be rehabilitated to a normal functioning ecological state without extreme effort and expense.
- *This includes the portions of the site that are associated with extensive blanket vegetation clearing, or where there is very dense alien infestation. Loss of these areas is unlikely to significantly compromise the current conservation status of the vegetation unit, unless part of a designated critical biodiversity or ecological support area.*

Areas scoring an overall MODERATE Vulnerability are those areas that:

- contain intact to moderately intact habitat;
- have moderate, low or no alien infestation;
- Have a high diversity of faunal and floral species of special concern;
- Have a *Vulnerable* or lower conservation score and with minimal loss of ecological functioning.
- Excludes designated critical biodiversity or ecological support areas;
- *On site the areas classified as Sundays Valley Thicket, Grassridge Bontveld tends to have a moderate sensitivity score, unless within a designated ecological support area.*

Areas scoring an overall HIGH Vulnerability or VERY HIGH Vulnerability are those having:

- an important ecological function (including ephemeral wetland pans), having specialized habitats (rocky outcrops with associated specialised flora and/or fauna) or erosion prone steep slopes;
- Have a high diversity of faunal and floral species of special concern, including endemics and endangered or critically endangered species;
- A critically endangered or an endangered conservation status where ecological processes have not been irreversibly compromised.
- *in the case where intact Sundays Valley Thicket within the designated OSMP (MST 1.6) and Critical Biodiversity Area as also part of the IDZ Open Space Management Plan will be affected, this is designated VERY HIGH.*
- *These areas should be considered potential No-Go areas and specific mitigation measures and/or offsets will be required to keep impact significance within acceptable levels.*



APPENDIX 6.C MAPS

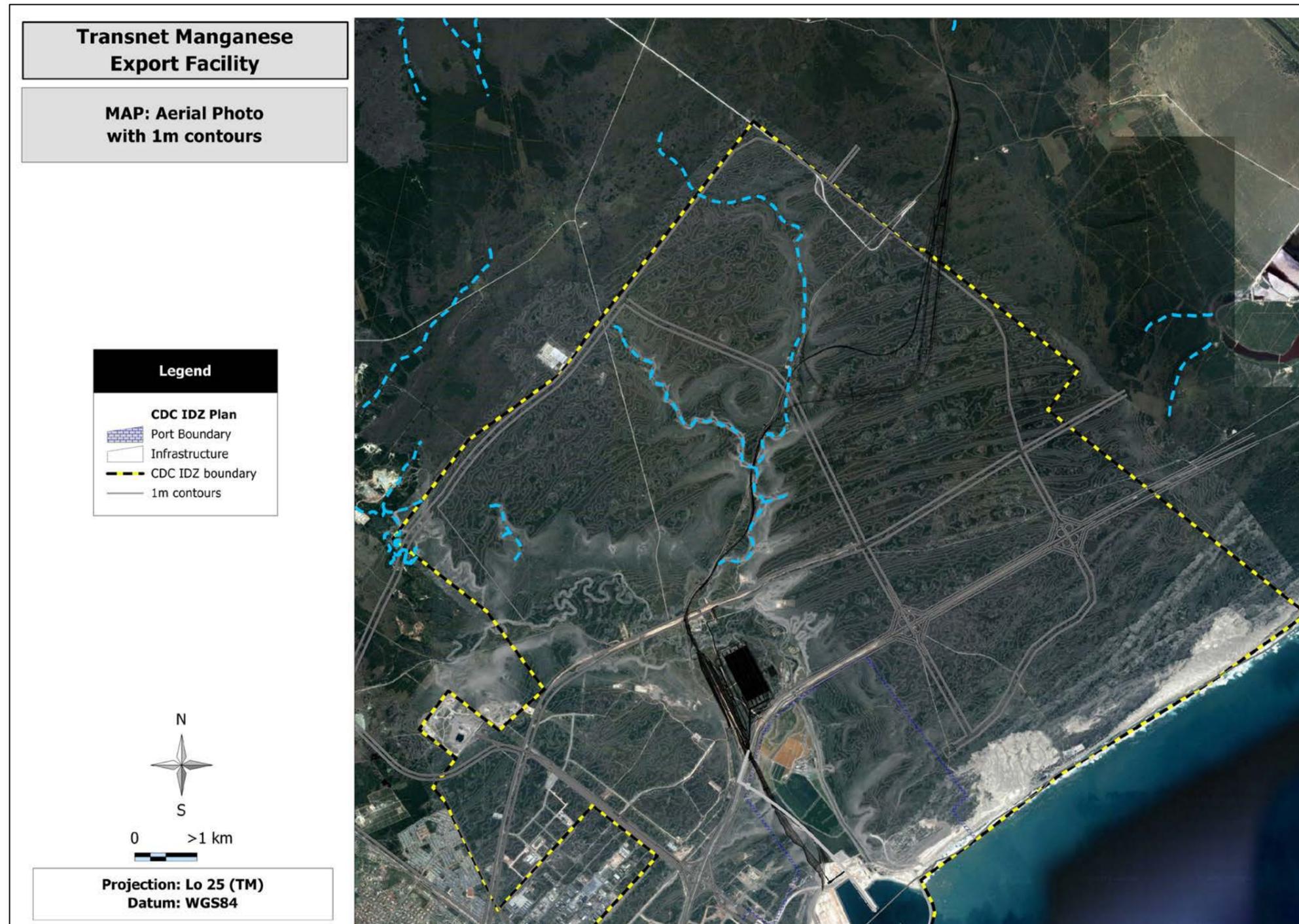


Figure 6.38: Proposed Manganese Ore Export Facility locality, within zones 8, 9, 11 and 13 of the Coega IDZ, east of Port Elizabeth, with 1m contours and rivers indicated in light grey and blue respectively.

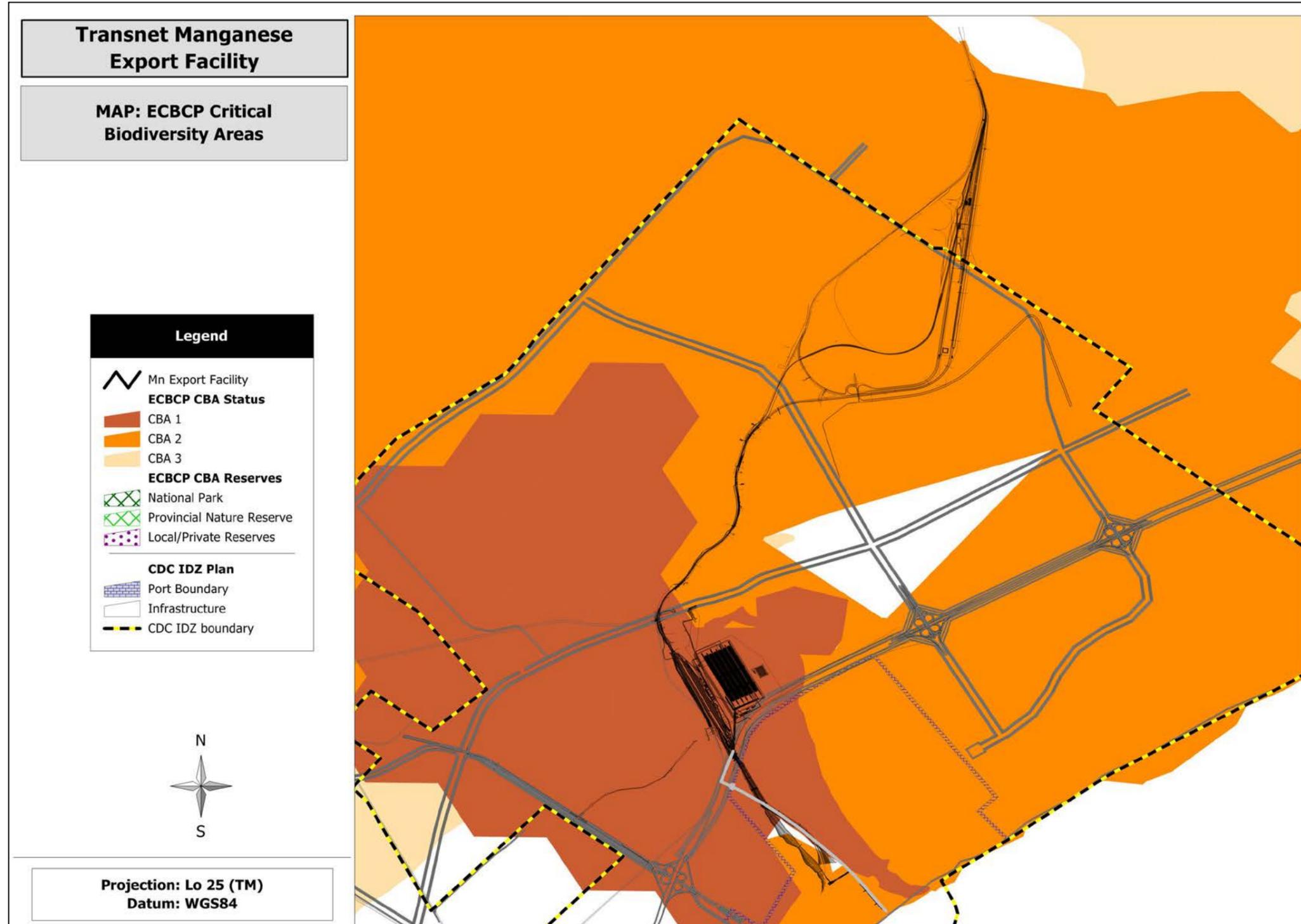


Figure 6.39: Eastern Cape Biodiversity Conservation Plan: Critical Biodiversity Status.

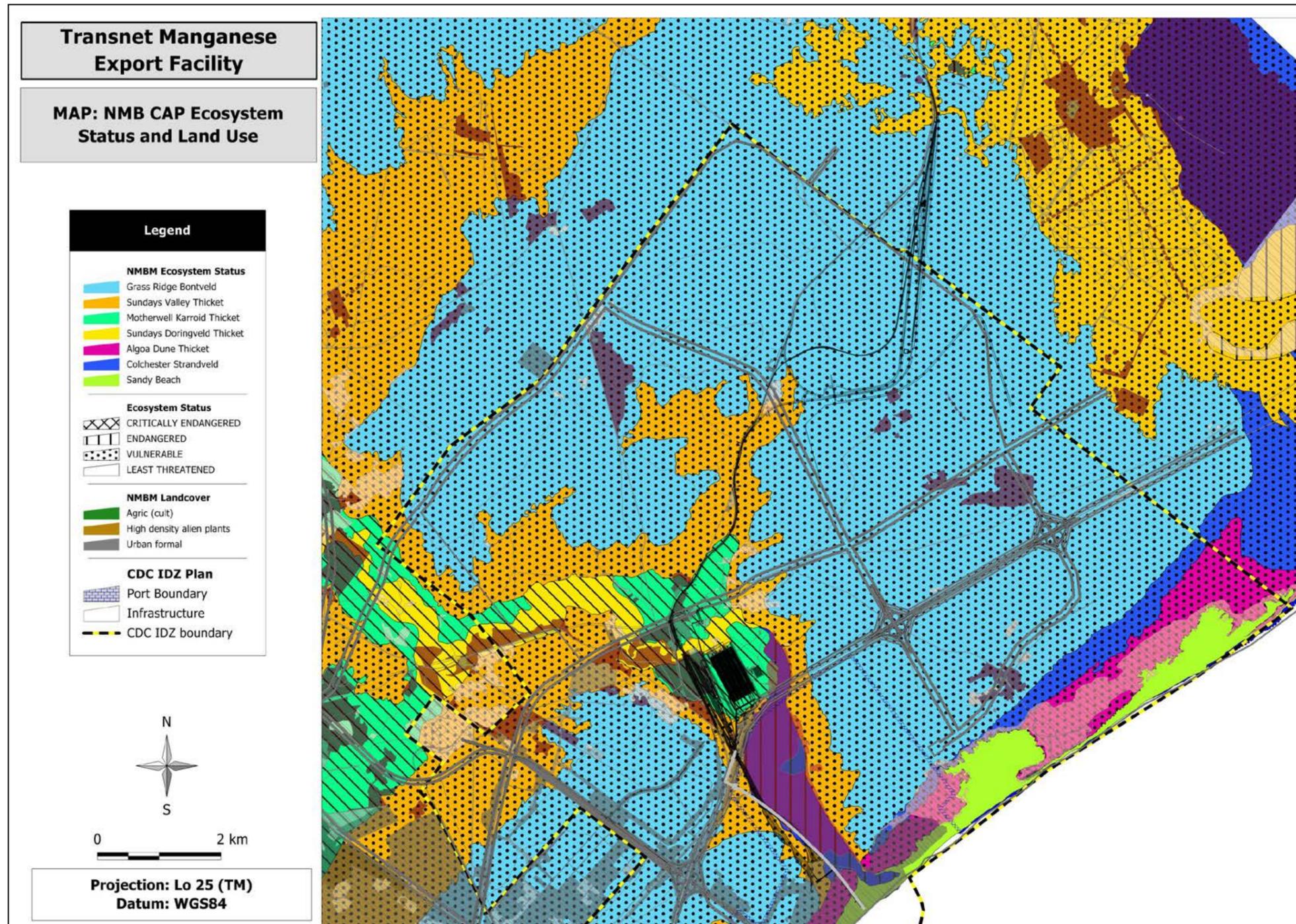


Figure 6.40: NMBM DBP Vegetation units and conservation status.

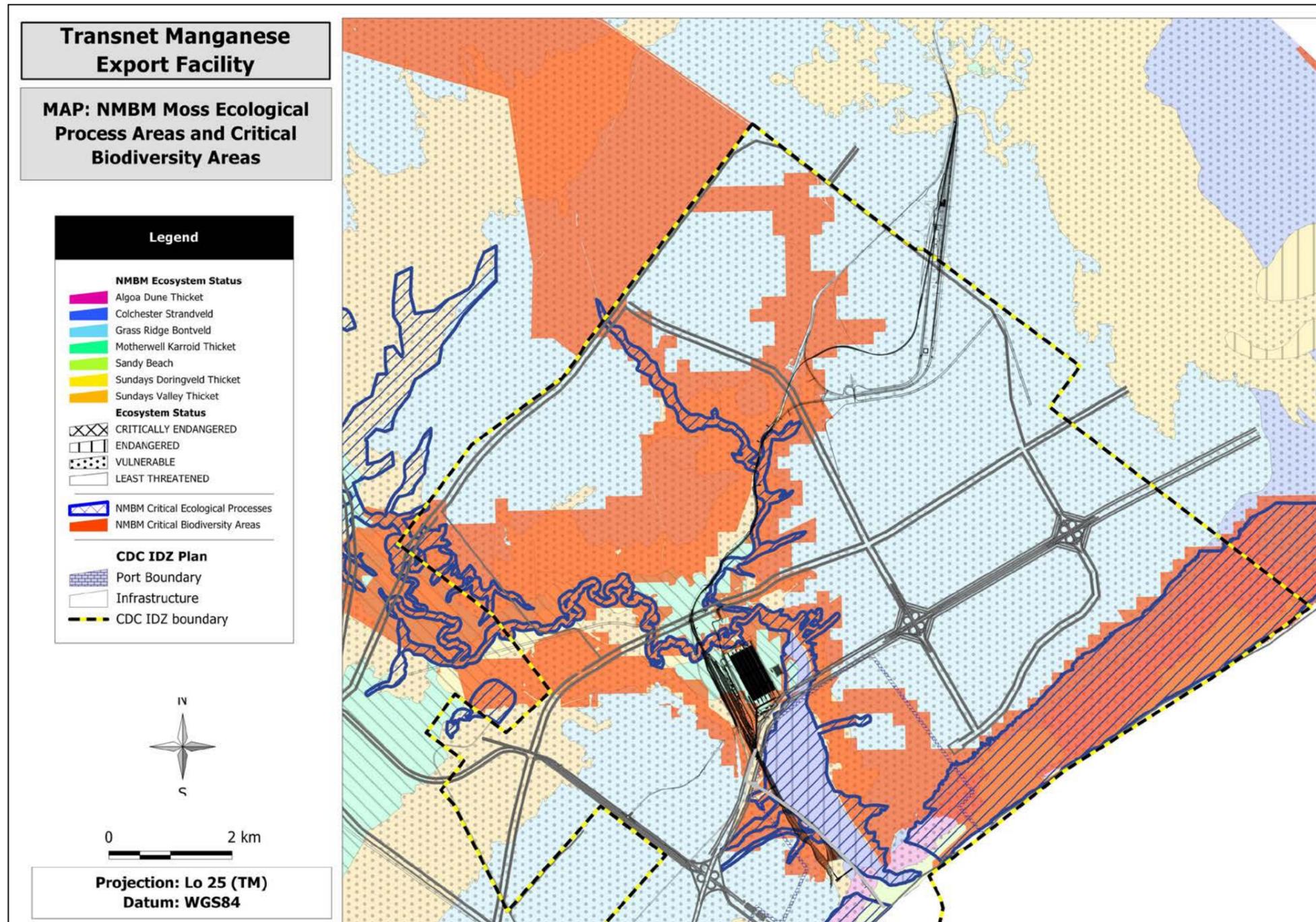


Figure 6.41: NMBM DBP Ecological processes showing Critical Biodiversity Areas (orange) and ecological process areas (dark blue) along the Coega River.

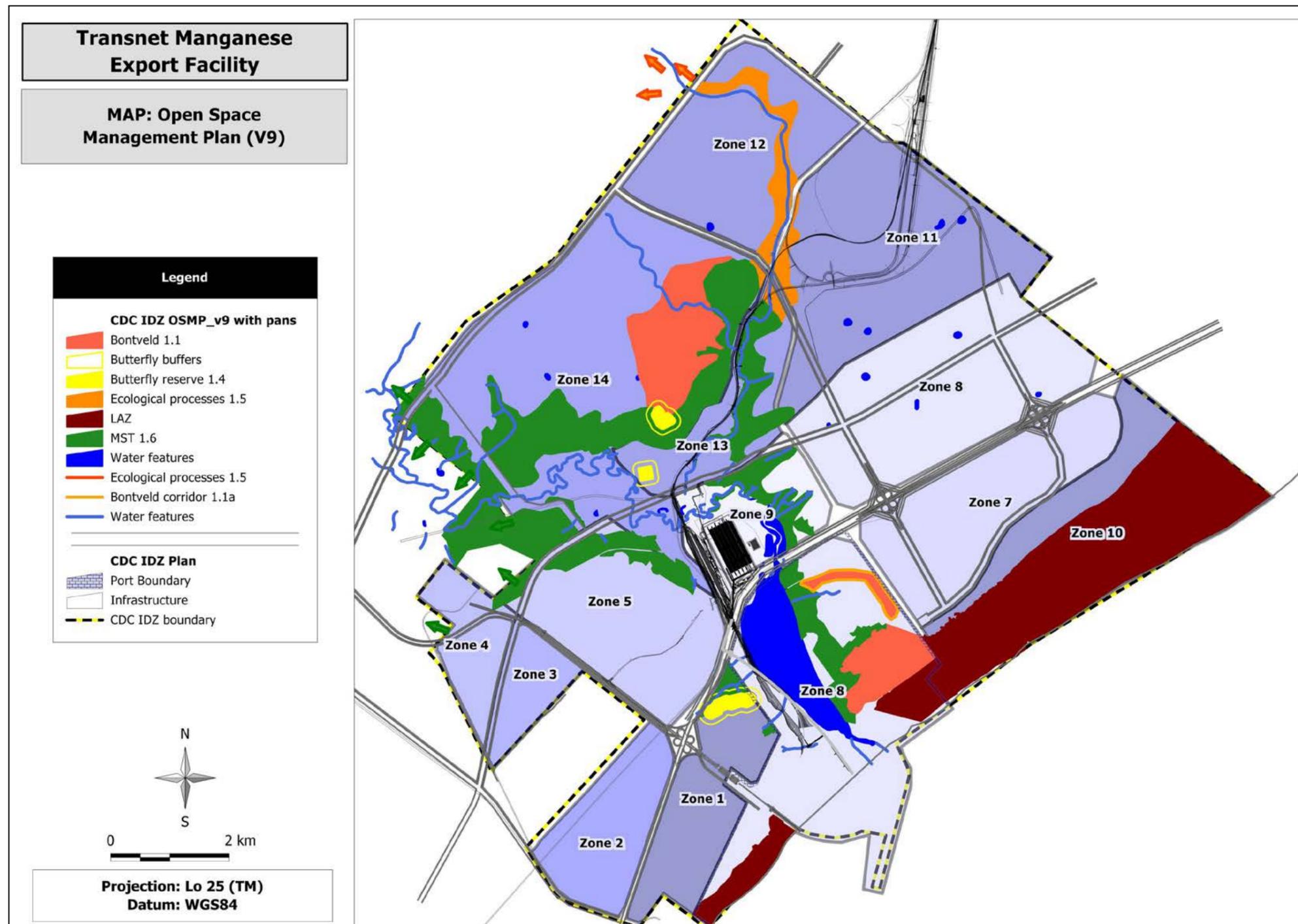


Figure 6.42: CDC IDZ Primary Network Open Space Management Plan (version 9)

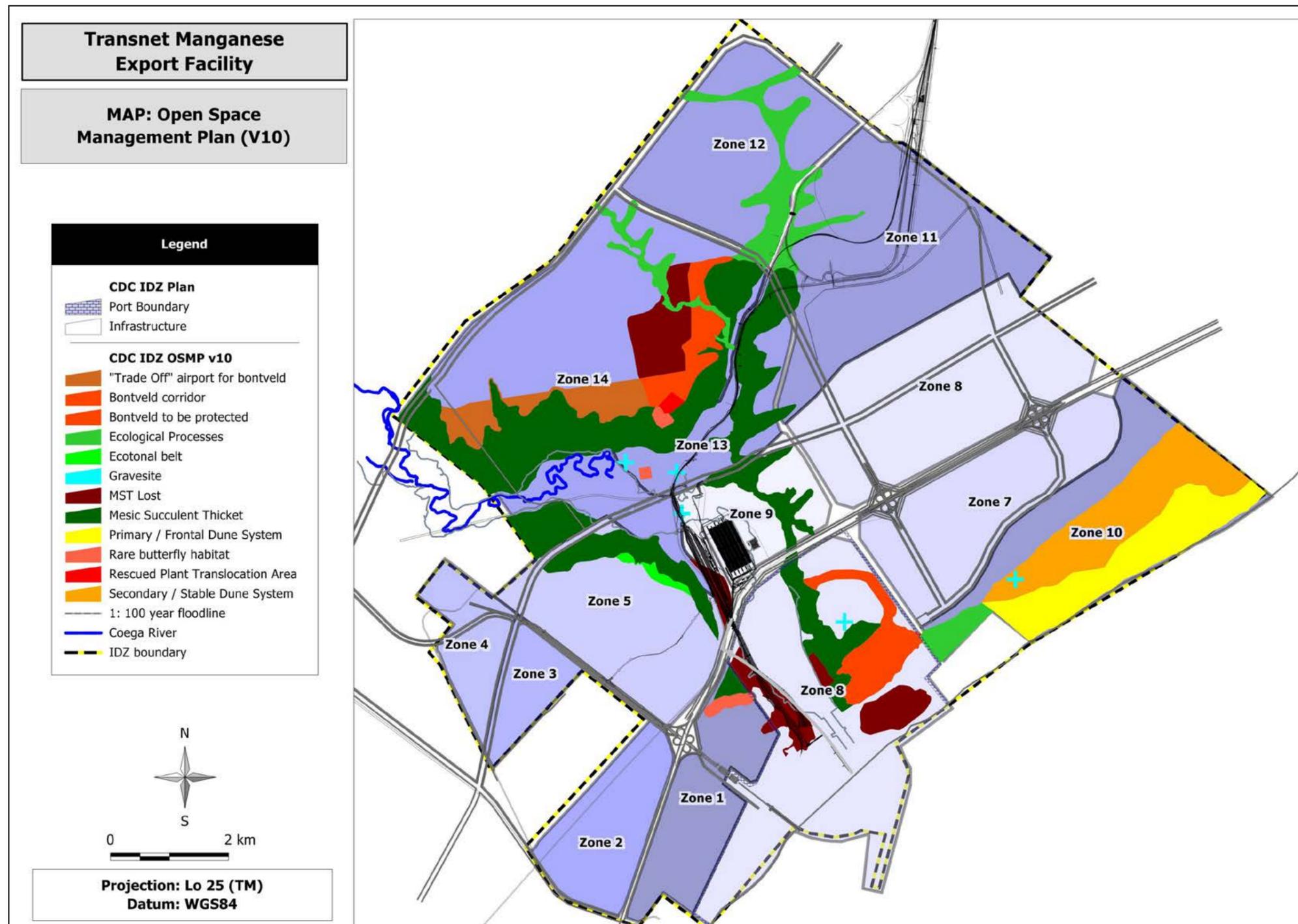


Figure 6.43: CDC IDZ OSMP (version 10)

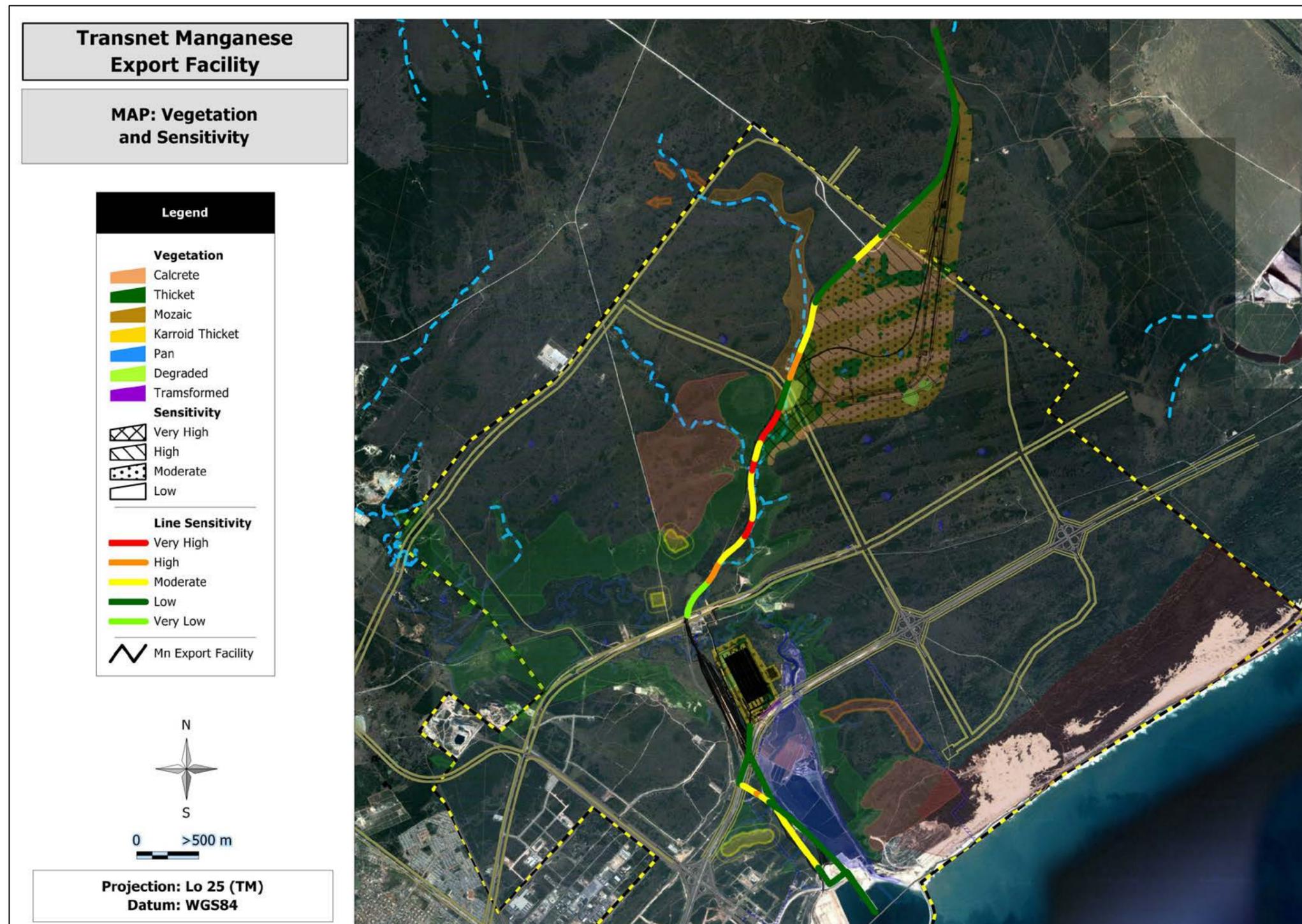


Figure 6.44: Overall terrestrial vegetation habitat and vulnerabilities for the Site.

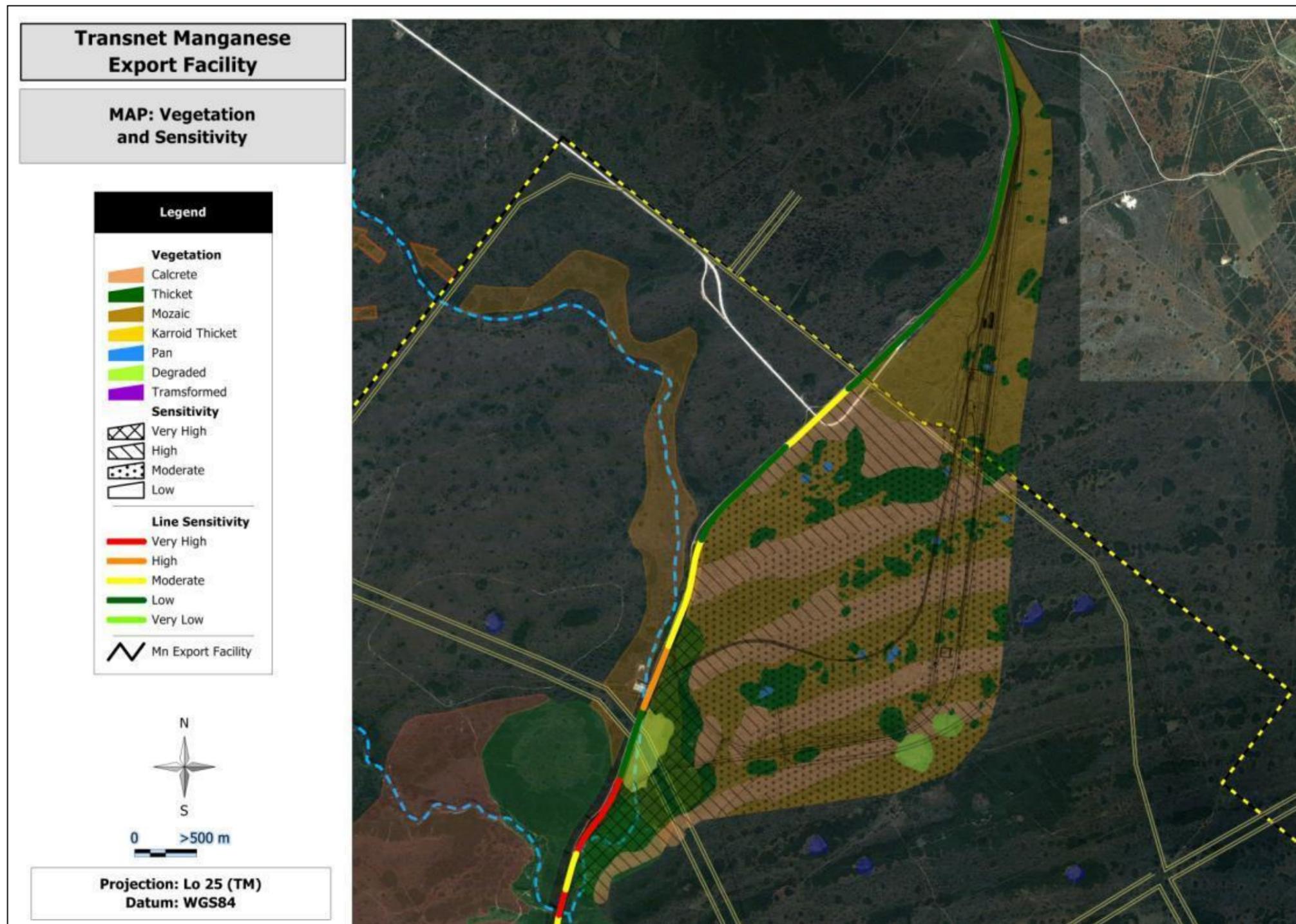


Figure 6.45: Overall terrestrial vegetation habitat and vulnerabilities for the compilation yard area. Note Compilation Yard infrastructure indicated in black.

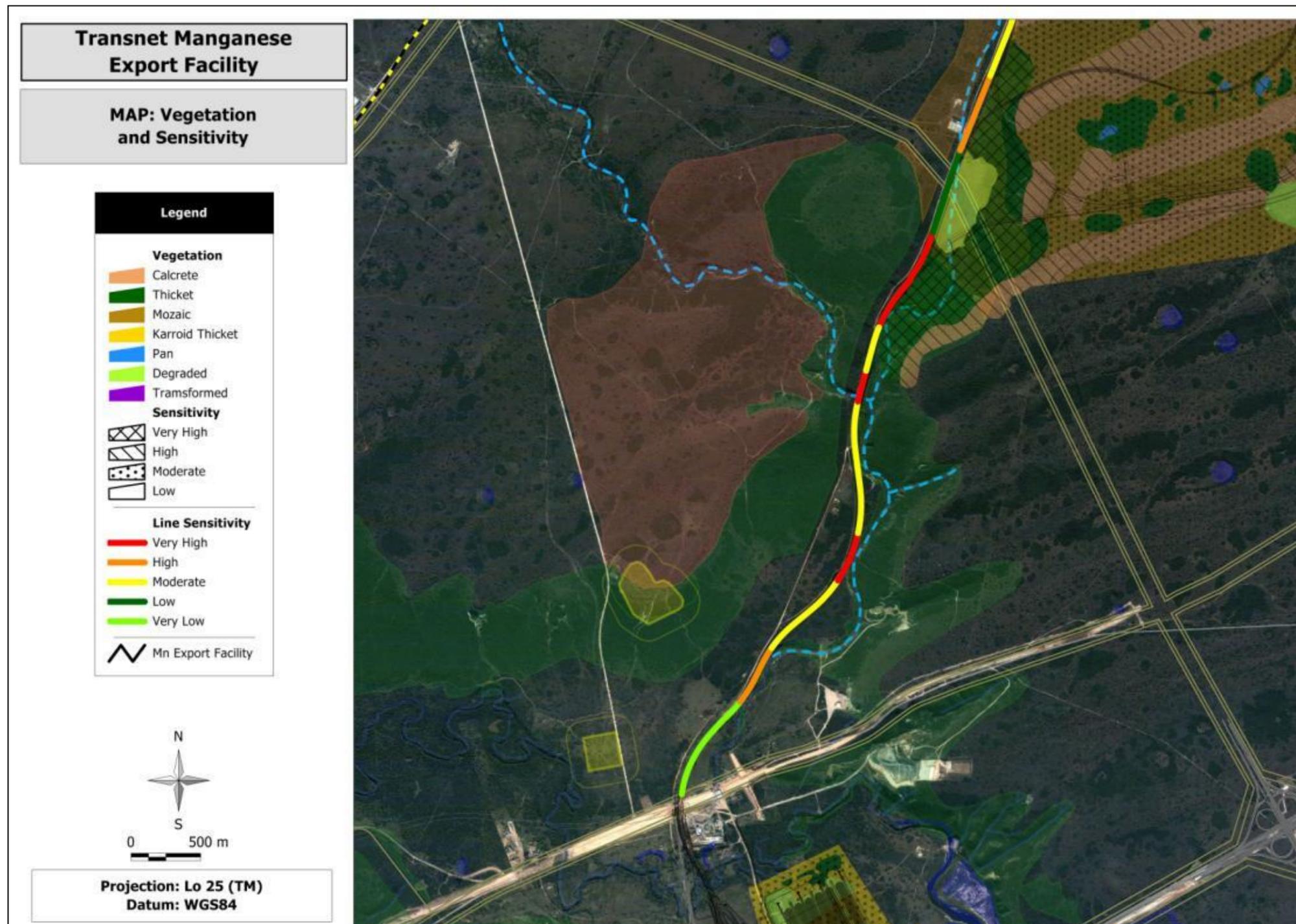


Figure 6.46: Overall terrestrial vegetation habitat and vulnerabilities for the Line doubling.

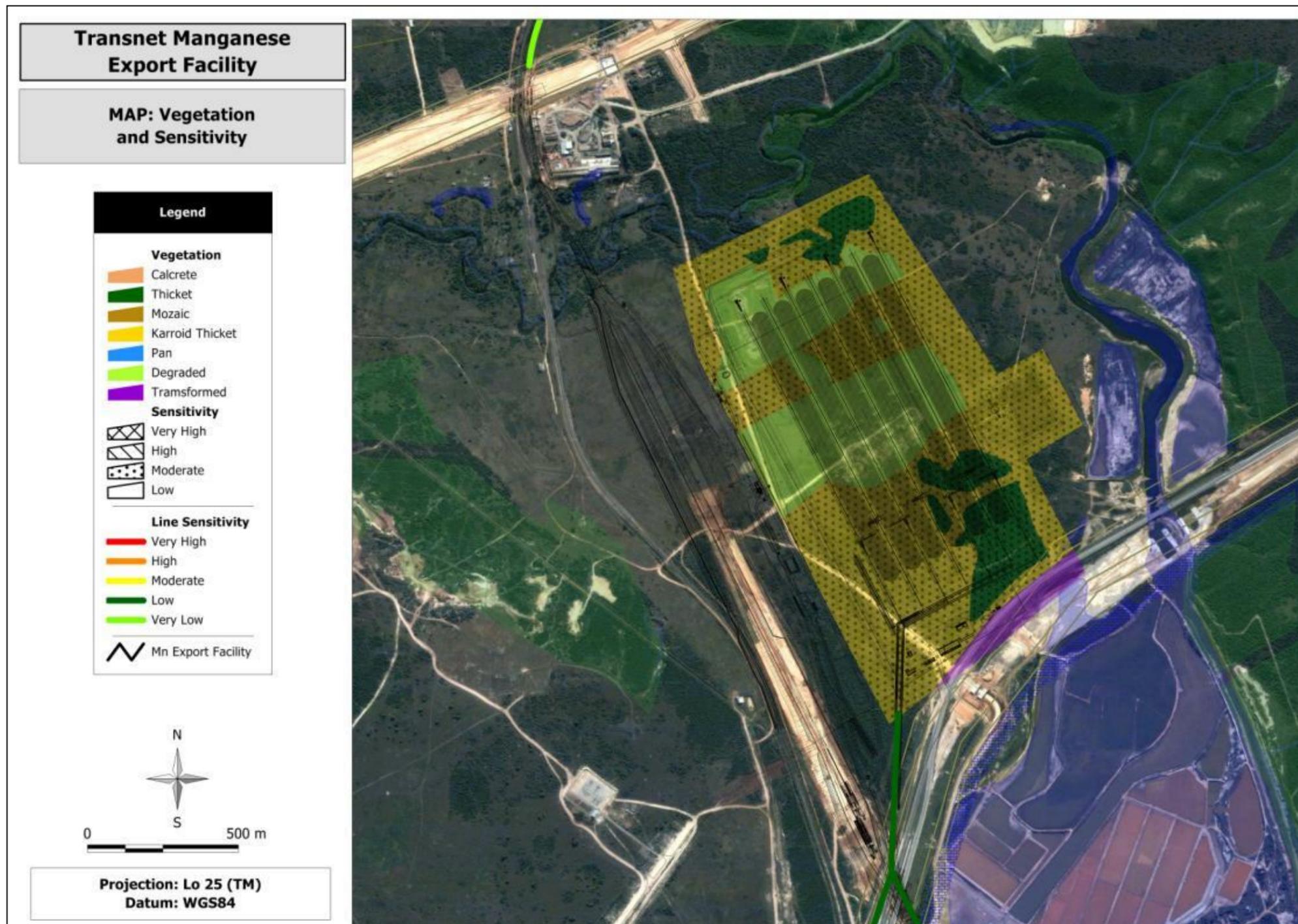


Figure 6.47: Overall terrestrial vegetation habitat and vulnerabilities for the Stockyard.

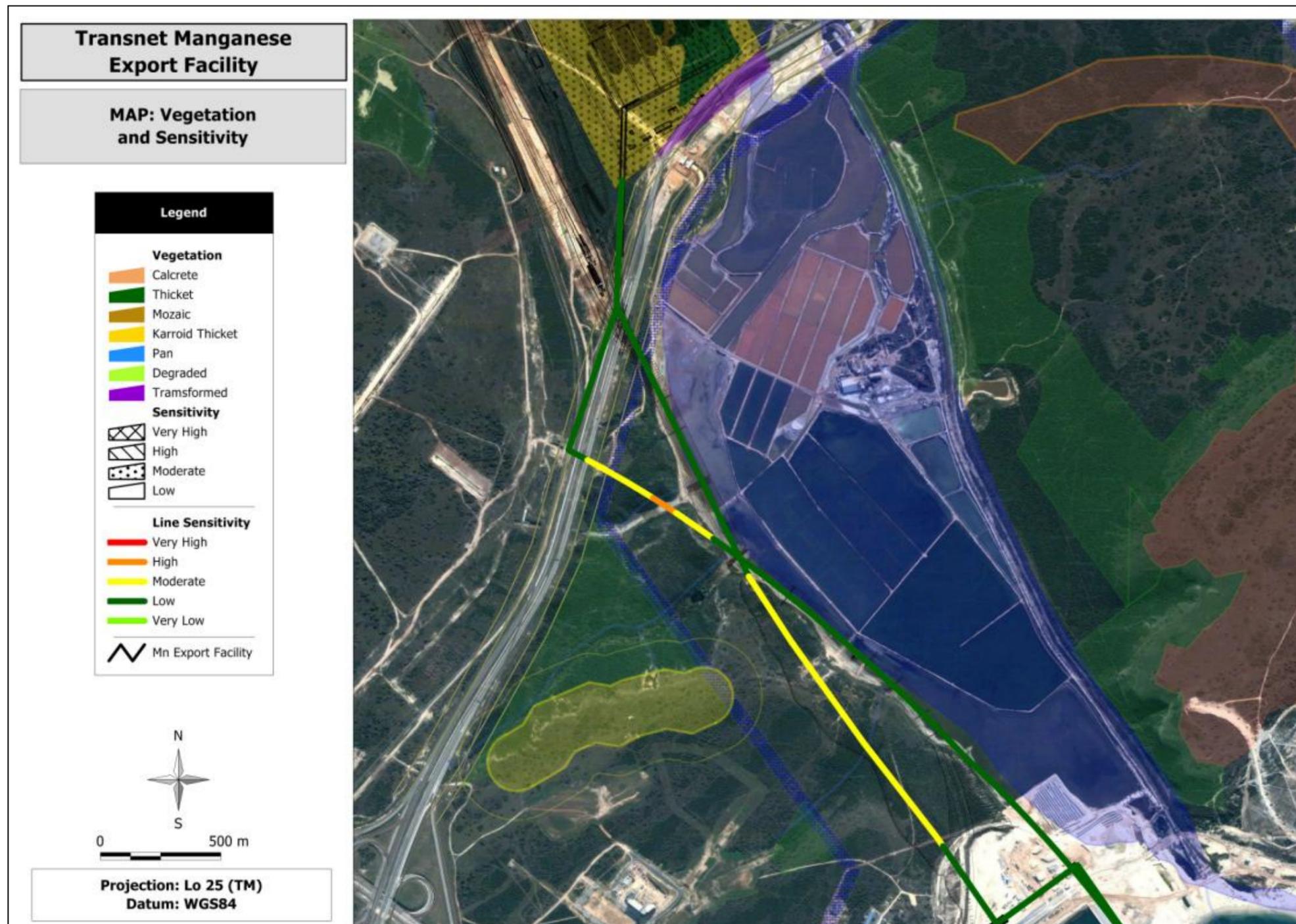


Figure 6.48: Overall terrestrial vegetation habitat and vulnerabilities for the preferred and alternative Conveyor route.