

GOUKAMMA NATURE RESERVE COMPLEX

Western Cape
South Africa



Protected Area Management Plan 2016-2021

Prepared by
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The Goukamma Nature Reserve Complex (NRC) comprises the following:

Goukamma Provincial Nature Reserve was proclaimed as a Provincial Nature Reserve in Provincial Gazette 4854 dated 6 May 1994 by way of Proclamation 37/1994 in terms of Section 6(1) of the Nature Conservation Ordinance 1974, (Ordinance 19 of 1974).

The boundary of the nature reserve was amended by the addition of a portion of the farm Walkers Point No. 215, Buffalo Bay, in Provincial Gazette 5533 dated 9 June 2000 by way of Proclamation 45/2000.

Buffalo Valley will be established as a Nature Reserve in terms of Section 23 (1) of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003). The property is currently owned by the Buffalo Valley Trust. Negotiations have been concluded and CapeNature has taken over as the managing authority of the Buffalo Valley Contract Nature Reserve.

Goukamma Marine Protected Area (MPA) was proclaimed in Government Gazette 12667 dated 27 July 1990 by way of Government Notice R. 1810 of the same date in terms of the Sea Fishery Act 1988, (Act No. 12 of 1988). Regulations at this time stopped the removal of marine organisms or fishing of any kind within the MPA.

Subsequently an amendment of the above Government Notice took place in Government Gazette 12805 of 26 October 1990 by way of Government Notice R. 2497 of the same date wherein sub paragraph 6 of paragraph 2 of Government Notice R. 1810 was substituted to allow line fishing from the shore only.

Subsequently the above Act has been replaced by the Marine Living Resources Act, 1998 (Act No. 18 of 1998) and the Goukamma MPA, was re-proclaimed as a Marine Protected Area in terms of section 43 of this Act and published in Government Gazette No. 21948 dated 29 December 2000 by way of Government Notice R.1429 of the same date.

Goukamma Nature Reserve has been inscribed as part of the Garden Route Complex of the Cape Floral Region Protected Areas World Heritage Site (CFRPA WHS) approved by the World Heritage Committee of UNESCO (United Nations Educational, Scientific and Cultural Organisation) on 3 July 2015.

AUTHORISATION



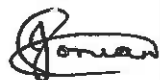



This management plan for the GNRC was drafted and recommended by the Reserve Management Committee (RMC), a multi-disciplinary team consisting of:

- Mr Ivan Donian - Manager: East Region
- Mr Mbulelo Jacobs - Protected Areas Manager: East Region
- Mr Keith Spencer - Conservation Manager
- Ms Natalie Baker - Ecological Coordinator: Garden Route
- Dr Annelise Schutte-Vlok - Regional Ecologist
- Ms Nokuthula Makeleni - Community Conservation Manager
- Mr Barend le Roux - Conservation Services Manager
- Ms Erika Swanepoel - Tourism Manager
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The RMC was supported by:

- Mr Patrick Meyer - Geographical Information System (GIS) Technician
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This management plan for Goukamma Nature Reserve Complex is recommended by:

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And approved by:

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- Dr Andrew Turner (CapeNature – Scientific Manager: Knowledge Manager) for herpetological information;
- Ms Coral Birss (CapeNature – Scientist: Mammologist) for mammalian information;
- Dr Antoinette Veldtman (CapeNature – Regional Ecologist) for arthropod information;
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EXECUTIVE SUMMARY

In compliance with the National Environmental Management: Protected Areas Act (NEM:PAA), 2003 (Act No. 57 of 2003), CapeNature is required to develop management plans for each of its protected areas. The object of a management plan is to ensure the protection, conservation and management of the protected area concerned in a manner which is consistent with the objectives of NEM:PAA and for the purpose for which it was declared. The approach to, and format of all CapeNature management plans is directed by the *Guidelines for the Development of a Management Plan for a Protected Area in terms of the National Environmental Management: Protected Areas Act* (Cowan & Mpongoma 2010). All CapeNature management plans must be read in conjunction with CapeNature's Co-ordinated Policy Framework (Cleaver-Christie *et al.* in prep.).

This management plan comprises seven sections.

Section 1 outlines the background, structure and authorisation processes of the management plan.

Management plans are strategic documents that provide the framework for the development and operation of protected areas. They inform management at all levels, from the Conservation Manager to support staff within CapeNature. The management plan indicates where reserve management intends to focus its efforts in the next five years (2016-2021). It focuses on strategic priorities rather than detailing all operational and potential reactive courses of action in the next five years. While planning for some emergencies is part of the management plan, it remains possible that unforeseen circumstances could disrupt the prioritisation established in this management plan. These should be addressed in the annual review and update of the management plan.

The management plan is drafted by the RMC, and then goes through an internal scientific and technical review. It is then sent for an independent external review before being recommended for stakeholder participation. The management plan is then reviewed by the CapeNature Executive and recommended by the Chief Executive Officer (CEO) to the CapeNature Conservation Committee. Once approved by the Conservation Committee, it is referred to the Western Cape Nature Conservation Board (WCNCB) for approval before being submitted by the Chairman of the WCNCB to the Department of Environmental Affairs and Development Planning (DEA&DP) for ministerial approval. The Western Cape Minister of Local Government, Environmental Affairs and Development Planning then sends the management plan out for public participation and only thereafter and based on the inputs received, can the plan be gazetted. The protected area management plan is reviewed annually to track progress on the Strategic Implementation Framework (SIF) discussed in section 6 and the document will be updated and reviewed every five years.

Section 2 outlines the strategic management framework of the GNRC, which is aimed at providing the basis for the protection, development and operation of the protected area over a five year period. It consists of the vision, purpose, values and objectives of the GNRC and summarises its opportunities, challenges, weaknesses and threats.

The vision describes the overall long-term goal for the operation, protection and development of GNRC. The vision of the GNRC as part of the protected area network in the Garden Route area is to conserve a system of sustainable living land- and seascapes that are representative of the region's biodiversity, ecosystem services and heritage features through integrated management, for the benefit of all.

The purpose is the foundation on which all future actions are based and is in line with the overall management philosophy of the organisation. For the GNRC the purpose is to protect: (1) a major element in the morphology of the dune cordons; (2) flora communities regarded as unique or endemic and that represent the Southern Cape lowland-coastal vegetation type, of which only a relatively small percentage still exists in an untransformed state; (3) an endorheic coastal lake in South Africa which is viewed as an ecologically sensitive aquatic system; (4) best remaining examples of marshland communities along Groenvlei Lake; (5) an "as near as naturally managed" temporary open/closed estuary (TOCE) that flows into a partially protected MPA; and (6) a sub-tidal reef structure which supports resident Sparidae that are vulnerable to offshore angling pressure and intertidal invertebrate species that provide a food source for heavily utilised recreational shore angling species.

Values for the GNRC are characteristics that deem the reserve complex unique in terms of its ecological, cultural and social aspects. The values of GNRC are characterised according to natural, ecosystem services, social, cultural and historic and eco-tourism values. Natural values include: the large untransformed landscape; the temperate climate; the rare and endangered species that are protected in the reserve; the threatened vegetation units that are protected in the nature reserve complex according to regional fine-scale vegetation map and conservation assessment, viz: Sedgefield Sandplain Fynbos (CR), Wilderness Forest-Thicket (VU), Groenvlei Coastal Forest (VU), Hartenbos Primary Dune (EN) and a small section of Groot Brak River and floodplain (EN); the Groenvlei Lake, which is one of only two closed freshwater endorheic coastal lakes in South Africa; the dune cordons and the highest vegetated dunes in Southern Africa; the fact that alien vegetation infestation is localized and being managed; the very high water quality in the estuary; the functional estuary where fish are partially protected from exploitation; the fact that it is now part of the Garden Route Complex of the inscribed Cape Flora Region Protected Area World Heritage Site (CFRPA WHS); the Goukamma MPA consisting of approx. 5.5 km of sandy shores, 5 km of rocky shores and 3.5 km of mixed rocky/sandy shore; and the important offshore reefs contained in the Goukamma MPA which offer protection to offshore linefish species. Ecosystem service values include: the functioning mountain to ocean system; the naturally functioning open-closed estuary; the fact that the estuary is an important fish nursery and that the river and estuary discharge into the MPA; the altitudinal and east-west gradients; the intact dune system within the reserve; the provision of ecosystem services (water, carbon, pollination, etc.); the importance of the nature reserve complex in controlling erosion, regulating water supply and mitigating storms and floods; and the fact that it falls within the proposed Garden Route Biosphere Reserve. Social values include: the strong partnerships with governmental and non-governmental stakeholders; the environmentally conscious and proactive community; the participatory management;

the environmental education facilities and opportunities; the opportunities for local economic development; the research opportunities for tertiary institutions; the high economic values; the good infrastructure and accessibility of the nature reserve complex, especially on the eastern side; falls within the greater paleo-landscape area; and the cultural and spiritual diversity. Eco-tourism values include: the scenic beauty of the area; the fact that it is a prime tourism destination; the seascapes and large areas of untransformed landscape; the proclaimed MPA; the recreational opportunities and events; the high economic values of the local area; and the good infrastructure and accessibility to the eastern part of the nature reserve complex in particular.

The objectives were derived from the vision and purpose and represent key performance areas in which achievement must be obtained in order to support the management intentions. Objectives, which are not measurable or testable, are then prioritised through the development of action plans and translated into strategic outcomes which are set out in the strategic implementation framework (SIF). The prioritised objectives are: (1) to conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems; (2) to improve the reach and quality of biodiversity management; (3) to create environmental awareness; (4) to expand and secure the conservation estate; (5) to provide appropriate opportunities and facilities for recreation; (6) to promote social and economic opportunities and sustainable utilisation; and (7) to effectively conserve our cultural heritage attributes.

Once these objectives were identified, a SWOT analyses was completed. A SWOT analysis is a strategic planning method used to evaluate the relevant strengths, weaknesses, opportunities, and threats. It involves specifying the objectives and identifying the internal and external factors that are favourable and adverse to achieving that objective. Strengths of the GNRC include: the dedicated staff; the close proximity of the reserve to communities; the existing support systems; the experienced staff; the integrated management style; the fact that the reserve is funded; the existing infrastructure on the reserve; the good internal and external communication; the fact that the MPA is adjacent to the terrestrial reserve; the variety of ecosystems in the nature reserve complex; the accessibility of the nature reserve complex, especially from the eastern side; the high level of knowledge regarding the biodiversity in the nature reserve complex; the corridor linkages and altitudinal gradients. Weaknesses include: the infestation by alien organisms (both faunal and floral); the limited budget; unfunded mandates; the lack of staff capacity; the challenges regarding access control; the close proximity of the reserve to urban areas; the configuration of the reserve and the resulting edge effects; the challenges around waste management, high energy use, quality of contractors, procurement procedures and recruitment procedures; and the lack of available and affordable facilities for staff. Opportunities include: research opportunities; partnerships with government institutions, involvement of Non-governmental Organisations (NGO) and Community Based Organisations (CBO); expansion opportunities towards the east and west; tourism concessionaire opportunities and partnerships; close proximity of reserve to communities; harvesting of alien products; external funding for projects; provision of a training facility and job opportunities. Threats identified include: land

disputes; periodic water shortages; inappropriate developments that are proposed and have occurred adjacent to the reserve; high number of seasonal visitors; flooding events (posing threats to roads and other infrastructure); habitat fragmentation and destruction that occur adjacent to the nature reserve complex; poaching; the high potential for hazardous spills; pressure to artificially breach the estuary; water abstraction; the proposed inter-basin transfer scheme from Homtini River to Karatara River; alien invasive organisms (plants and animals); limited options for expansion of the nature reserve towards the north; pollution as a result of desalination plants; upstream mismanagement of the river and adjacent areas; political pressure to allow fishing in the MPA; location of the N2 highway; coastal erosion protection through construction of hardwalls in Buffalo Bay; beach erosion at Buffalo Bay owing to fragmentation of dune by-pass corridor; lack of fires and climate change. These opportunities, threats, strengths and weaknesses are then addressed in the reserve objectives, and activities identified to deal with them in the SIF.

Section 3 provides a description of the GNRC and its ecological and operational context. The GNRC, comprising Goukamma Nature Reserve, Buffalo Valley Contract Nature Reserve and Goukamma MPA, is situated between the towns of Sedgfield and Knysna along the Southern Cape coast. It falls within the Knysna Municipal Area and the Eden District Municipality. The terrestrial part of the nature reserve complex covers an area of 2 679 ha and the MPA 3 201 ha.

The ecological context of the GNRC covers a number of aspects; including climate and weather, topography and the geology of the soils within the area. A description of the aquatic systems is also provided. Two major water bodies are found within the borders of the Goukamma Nature Reserve, namely, Groenvlei Lake and the Goukamma River and Estuary. Groenvlei Lake is one of only two closed freshwater lakes in South Africa. Its water body surface area is 2.34 km² while the surrounding vegetation in and peripheral to the water body covers 1.52 km². The total catchment area is about 13.8 km². There is no river that flows into the lake. Groenvlei is fed by direct rainfall and secondary groundwater discharges from the Table Mountain Group (TMG) aquifer via Van Kervelsvlei, a groundwater fed fen located northeast of the lake. There is however a different opinion that maintains that there is no hydraulic link between Groenvlei and Van Kervelsvlei, and that the latter is a disconnected system that is entirely fed by rainfall. According to him Groenvlei is fed by direct rainfall and groundwater, and the possibility that it is being fed by an underlying TMG Aquifer requires further research before it can be given credence.

The length of the Goukamma River is short (ca. 17.5 km, which includes the Homtini River) in relation to its catchment area (235 km²) and is subject to regular flooding. The river mouth opens naturally in the high freshwater flow periods (August - December), while the south-westerly winds close the mouth during low freshwater flow periods (late summer and early winter months).

Goukamma Estuary's maximum tidal reach is to about 9.2 km from the mouth, with only the lowest 3.3 km of the estuary falling within the protected area. At the coast, the estuary is diverted parallel to the shore by sand dunes and the mouth is situated behind a low sand barrier. The estuary mouth breaches naturally at 2.5–3.0 m above

mean sea level. A formal breaching policy does not exist and various reports, studies and discussions indicate the maintenance of an “as natural as possible” management programme. Farmers along the low-lying floodplain argue against the management approach not to induce breach. Goukamma Estuary serves as an important nursery for fish and habitat for birds. It closes naturally from time to time, with drought conditions prolonging the closed mouth conditions. During closed mouth periods brackish water is back-flooded into the surrounding floodplain, which drives the establishment of the more salt tolerant vegetation species that characterize an estuary. According to expert opinion premature artificial breaching leads to sedimentation in the lower reaches; an increase in the risk of flooding in the long run as the mouth becomes more constricted; shallowing of the lower reaches take place; and disruption of natural mouth regime cycles in the MPA occur. An estuary management plan is in the process of being developed; it is currently being reviewed and updated in preparation for the public participation process which will be taking place during 2016.

Goukamma MPA consists of approximately 5.5 km of sandy shores, 5 km of rocky shores and 3.5 km of mixed rocky/sandy shore. It has important offshore reefs which provide habitat to commercially important species, such as hake and endemic fish species, such as red steenbras. Furthermore, the offshore soft sediment areas close inshore between the offshore reefs are important areas for east coast sole. The MPA is also a critical breeding area for the African black oystercatcher (*Haematopus moquini*) along the Southern Cape coast.

Based on the national vegetation map, five vegetation types occur on the GNRC, of which none are classified as threatened. According to the regional fine-scale vegetation map, nine vegetation units occur on the GNRC, five of which are threatened, namely: Sedgefield Sandplain Fynbos (CR); Wilderness Forest-Thicket (VU); Groenvlei Coastal Forest (VU); Groot Brak River and Floodplain (EN) and Hartenbos Primary Dune (EN). At least seven plant species of conservation concern occur in the GNRC.

A block burning programme was re-initiated in 2002 when a block along the northern boundary was burnt, and subsequently controlled burns have taken place in 2004 and 2005. Reasons for the fires were to reduce fuel loads along boundaries, to prepare for ecological burns and for alien vegetation management.

The largest part of the terrestrial reserve has very low densities of invasive alien plants. Only a few sites along the coast have a scattered to medium density of invasive alien plants. Alien vegetation management is done according to the approved annual plan of operations (APO) with funds obtained through the Working for Water (WfW) programme as well as CapeNature’s Integrated Catchment Management (ICM) project.

To date 54 mammal species have been recorded within the GNRC ranging from the terrestrial pygmy mouse (*Mus minutoides*) to the humpback whale (*Megaptera novaeangliae*) in the ocean. Thirteen of the 243 bird species recorded in the GNRC are threatened, either at a regional or global scale. Of the 13 species, the Knysna

woodpecker (*Campethera notata*) has been found to be the most abundant, while the Cape cormorant (*Phalacrocorax capensis*), Knysna warbler (*Bradypterus sylvaticus*) and half-collared kingfisher (*Alcedo semitorquata*) have been recorded less frequently and the remaining threatened species seem to use the reserve on an *ad hoc* basis. Analysis of waterfowl data collected on Groenvlei Lake over a 30 year period shows a decline in the number of waterfowl over the period. The total number of birds declined by about 23%. The reasons for this decline are unknown and it is recommended that this should be investigated and appropriate management interventions implemented. In terms of reptiles, the marine turtles loggerhead (*Caretta caretta*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*), are of conservation concern, given that they are all threatened species.

Groenvlei is a noteworthy natural lake from both a conservation and recreational angling perspective. It harbours two small indigenous fish species, the estuarine round herring (*Gilchristella aestuaria*) and the Cape silverside (*Atherina breviceps*). Studies have shown that the Groenvlei populations of these two species have become morphologically and genetically unique through long-term isolation and vicariance. Unfortunately, the lake has also been stocked with several species of alien fishes, namely bluegill sunfish (*Lepomis machrochirus*), carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), mosquitofish (*Gambusia affinis*) and Mozambique tilapia (*Oreochromis mossambicus*). Reserve management tried to reduce carp numbers through monthly gill netting of shoreline weedbed areas from 2000-2007. This seemed to reduce carp numbers, but then netting stopped owing to other reserve management priorities and the theft of gill nets. A project to control carp has again been started by reserve management.

The Goukamma catchment as a whole is listed as a National Freshwater Ecosystem Priority Area (NFEPA) fish sanctuary and therefore important in terms of indigenous fish conservation. Three indigenous freshwater fish species, namely the Eastern Cape redfin (*Pseudobarbus afer*), the Cape Galaxias (*Galaxias zebratus*) and the Cape kurper (*Sandelia capensis*) occur in the Goukamma and Swartvlei catchments. Recent genetic research has indicated the existence of several unique lineages within all three these freshwater fish species associated with the rivers on the reserve. The fish abundance and distribution along the length of the estuary is typical of black water systems. A study on the diversity and abundance of fish species in the estuary found that estuarine-dependent marine species dominated the fish composition and that the Goukamma Estuary serves as a viable function for both marine migrant and estuarine resident fishes. Goukamma MPA supports a rich diversity of warm temperate species, including many species that are endemic to the south coast of South Africa. It has also been recognised as an invaluable area for resident, long lived reef species such as the roman (*Chrysoblephus laticeps*), galjoen (*Dichistius capensis*) and musselcracker (*Sparodon durbanensis*) with roman more abundant inside the MPA than outside.

The GNRC falls within the Knysna Municipal Area, which is made up of socially and racially diverse communities. Owing to in-migration, the area has experienced rapid growth of a predominantly poor population. Knysna and Sedgfield are the two primary urban settlements where the main retail and commercial activities are

concentrated. Karatara and Rheenendal are agricultural nodes located on the plateau above Knysna. In 2013 the total population of the Knysna Municipal Area was an estimated 71 200. The majority of the population can be considered youthful with 48% of the population below the age of 30. Sixty eight percent (68%) of the population are of an economically active age (15-65 years) and 9% of the population can be considered retired (over the age of 65). The proportion of the formally employed population is declining, while 16% of the economically active segment of the population is unemployed. The major land-uses in the area are: (a) forestry (pine plantations) with associated saw-mills; (b) farming consisting of dairy farms, vegetables and citrus and also game farms; and (c) urban development, specifically ribbon development has spread along the coast at a rapid rate over the past decade. Uneconomical agricultural land has been rezoned and urban settlements have spread in the form of holiday houses, bed and breakfast enterprises, hotels and golf courses.

The Garden Route is a major tourist and retirement area. Activities within the towns are based on tourism, where hotels and accommodation enterprises are predominant. Adventure companies specialising in outdoor sports are also active. A fleet of four commercial line angling boats (ski-boats) and a much larger fleet of recreational fishing boats operate from the Knysna lagoon.

Infrastructure on the GNRC has been developed and maintained for (a) operations, which consist of numerous stores, garages, workshops, offices, a vehicle ferry across the river, information kiosks and signage; (b) tourism, which consists of overnight facilities, picnic areas, entrance gates, laundry, ironing room, stores, trails, jetties and boardwalks; (c) staff accommodation; and (d) access and services, which consist of roads, fences and water reticulation.

Section 4 sets out the regional and local planning context of the protected area.

The GNRC falls within the Knysna Municipal Area, of which the greatest strength is its unique, natural resource base. This natural resource base sustains the economy through eco-tourism, agricultural activities, and forestry, which are the dominant sectors of the economy.

There has, however, been significant destruction of key natural resources. This is manifested in the loss of valuable unprotected indigenous vegetation, infestation by invasive alien plant species, urban sprawl, significant and ever increasing development pressure on environmentally sensitive areas, and controversial developments (e.g. marina development, golf courses, low density residential estates).

Key challenges in Knysna Municipality relate to stark contrasts in the socioeconomic and demographic profile - the most notable being a minority of very wealthy residents versus a majority of very poor residents living in the area. Some 46% of low-income households living in the municipal area are affected by poverty.

The Knysna Spatial Development Framework (SDF) is a spatial plan guiding development in the Knysna Municipal Area and also informs the Knysna Integrated Development Plan (IDP) for 2012-2017. The spatial development vision for Knysna is:

“Creating a community which co-exists within a unique natural, socioeconomic and cultural environment that is a model of sustainability”.

Goukamma Nature Reserve and all the areas proposed in the reserve’s expansion strategy are identified as Core 1 or Core 2 in the SDF. Core 1 areas include all areas with formal conservation status, and Critical Biodiversity Areas (CBA) identified through a systematic conservation planning process. Core 2 areas are those that are currently not yet exhibiting high levels of biodiversity loss, but which should be protected and restored in order to ensure that biodiversity pattern and ecological process targets can be met, as well as Ecological Support Areas (ESA), CBA aquatic buffer areas, coastline and coastal processes, river and ecological corridors and mountain catchment areas. This indicates that the reserve expansion strategy included in this plan is in line with the regional planning strategy.

The expansion of protected areas in South Africa is informed by the National Protected Area Expansion Strategy (NPAES) and CapeNature’s Protected Area Expansion Strategy and Implementation Plan has been developed in support of the NPAES. This CapeNature strategy addresses the formal proclamation of priority natural terrestrial habitats in the Western Cape Province as protected areas to secure biodiversity and ecosystem services for future generations.

Successful expansion has occurred to the north east of Goukamma in the past two years, with the inclusion of the Buffalo Valley Contract Nature Reserve in the GNRC. A management agreement has been signed with the landowner whereby CapeNature is appointed as the managing authority for a period of 30 years. The proclamation of the property as a nature reserve is in process and the property has been incorporated into this management plan. Other priority expansion opportunities have been identified towards the west and east of Goukamma Nature Reserve. These expansion areas have been highlighted as Critical Biodiversity Areas in recent conservation plans. For the MPA priority areas located immediately to the west have been identified. This area was highlighted as it could contribute significantly to some sub-tidal geology types and to the Groenvlei-Swartvlei coastal dune system. To enhance conservation through the existing MPA network, it has been proposed to extend the offshore boundary of the Goukamma MPA to include deeper reef areas and enhance protection of these habitats and linefish species; and to restrict shoreline fishing in some areas of the Goukamma MPA in order to enhance protection of coastal linefish species. GNRC falls within the proposed Garden Route Biosphere Reserve, for which an application to UNESCO is currently being compiled.

Section 5 outlines the conservation development framework (CDF) and the concept development plan for the protected area. Sensitivity mapping of reserve biodiversity and physical environment forms the main informant of spatial planning and decision-making in protected areas. It is intended to inform all planned and ad-hoc infrastructure development e.g. location of management and tourism buildings and precincts, roads, trails, firebreaks; inform whole reserve planning and formalisation of use and access as a reserve zonation scheme while also supporting conservation management decisions and prioritisation.

The sensitivity analysis for the GNRC included physical and biodiversity features. Although 47% of this reserve complex is underlain by gentle slopes and a large proportion (55%) of the reserve complex contains least threatened vegetation, these areas largely correspond to areas prone to flooding or currently underwater resulting in the overall sensitivity of the reserve being high with 90% of the reserve area having high to highest sensitivity. Thus even though the vulnerability status of the vegetation is largely low, the overall sensitivity of the nature reserve complex is high.

Protected area zonation provides a standard framework of formal guidelines for conservation, access and use for particular areas. Zonation goes beyond natural resource protection and must also provide for appropriate visitor experience; access and access control; environmental education; and commercial activities.

One of the key drivers of the GNRC's zonation is the fact that the section of the MPA around Buffalo Bay, the beach and the Goukamma Estuary are very popular with high visitor use, requiring nature based access.

The zonation of the GNRC is summarised as follows:

Primitive Zone: Areas beyond the existing heavily accessed portion of the reserve are zoned as primitive zone, with access permitted with a visitor permit. These areas provide opportunities for solitude and limit visitor impacts overall. This zone includes the greater part of the reserve. The three tourism facilities (River, Forest and Vlei lodge) on Buffalo Valley and the Mvubu Lodge next to Groenvlei also fall within this zone, as none of these facilities accommodate more than four to six people. **Nature Access Zone:** This zone includes the public road to Buffalo Bay and the access road to the Goukamma Station. It also includes the estuary, beach area and Groenvlei Lake as no permits are required to visit these sites. Licences for angling are however required, as well as a permit to launch a boat onto Groenvlei Lake. **Development – Management Zones:** This includes the existing staff housing, stores, workshop, etc. at the Goukamma Station, the existing staff house near the entrance to Buffalo Valley (which is ear-marked as the site for the new office complex of GNRC), and the inspection quarters and staff accommodation at the Groenvlei Station. Visitors to the estuary at the Goukamma Station require a day permit if picnicking or if they are booked in at the facilities. **Development – Low Intensity Zone:** The existing clustered tourism infrastructure (including the three rondawels, Otters Rest lodge and Fish Eagle Loft; Spotted Grunter and Galjoen units; picnic area) at the Goukamma Station as well as the proposed campsites fall within this zone. At the Groenvlei Station, the cluster of three converted bushcamp chalets and the proposed new lodge or two self-catering units fall within this zone. **MPA zoning** entails two proposed zones namely: (a) Controlled zone – (from the highwater mark, 100 m southwards) where shore angling with rod and line at any time of day is allowed, but bait collection, all net fishing and spearfishing are not allowed; and (b) Restricted zone – (the remainder of the MPA) a no take zone, where no shore angling, spearfishing, netting or bait collection are allowed.

Access to the GNRC and its facilities are provided to the public at various points. Along the western boundary open access to Groenvlei Lake and the MPA is provided to the public at two points. The point which provides access to the MPA on the western side

is not actively managed. This does cause enforcement difficulties, particularly with night fishing which is currently prohibited through management, but not legislated. On the eastern side the MPA access at Buffalo Bay is a high use area where the problem of night fishing is also evident. Revised regulations need to be drafted and accepted through the re-alignment and rezonation process of the MPA. Open access to the popular beach at Buffalo Bay (which is part of the Goukamma MPA) is provided and well sign posted.

In terms of developments the following changes or upgrades of existing infrastructure are proposed at the Goukamma Station: (a) to move the main entrance to the reserve northwards along the R346 to where the current entrance to Buffalo Valley Contract Nature Reserve is; (b) to move the office from the staff housing area to a suitable site closer to the entrance on Buffalo Valley Contract Nature Reserve; (c) to establish camp sites at the Goukamma Station as a new type of tourism facility; (d) to reduce the size of the current picnic area; and to improve the drinking water supply through installation of a rainwater reticulation system. Rerouting of the section of the R346 that falls within the floodplain of the Goukamma River is becoming a high priority that needs to be addressed by the Dept of Transport (in collaboration with the relevant role players). This section of the road remains a continuous problem because it falls apart each time there is a major flooding event.

At the Groenvlei Station the following changes to the existing layout are proposed: (a) to convert the existing single facility bushcamp into three separate self-catering units; (b) to demolish the two wooden frame and tin-clad staff houses and external ablution facility and replace with one staff house and an accommodation unit for two students with a common kitchen/living area and to develop a small office to accommodate two or three staff members and a small store; (c) to demolish the existing staff house, workshop and garage building and construct a tourism facility, consisting of two separate self-catering chalets or a lodge with 10-12 bedrooms and a parking area on the footprint; and (d) to improve the drinking water supply through a rainwater reticulation system. Planning is based on high tourism potential of the site, and the need to upgrade management infrastructure and provide more, and improved management access. Maintenance of the access road to the Groenvlei Station would need to be addressed in consultation with the landowners living along this road and the local authority.

Section 6 outlines the strategic implementation framework of the protected area and guides the implementation of the management plan over five years in order to ensure that it achieves its management objectives. The SIF translates the information described in Sections 3, 4 and 5 above into management activities and targets, which will be used to inform annual plans of operation as well as the resources required to implement them. The management targets will form the basis for monitoring of performance in implementing the plan and are thus measurable. The SIF contains the following sections: legal status and reserve expansion; regional integrated planning and cooperative governance; ecosystem and biodiversity management; wildlife management; fire management; invasive and non-invasive alien species management; cultural and heritage resources; law enforcement and compliance; infrastructure management; disaster management; socio-economic framework; management effectiveness; finance and administration management; human

resources management; occupational health and safety management; risk management; visitor management, ending with the tourism development framework.

Finally, **section 7** contains the references and glossary relevant to the text.

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ABBREVIATIONS

AEWA	African Eurasian Waterbird Agreement
APO	Annual Plan of Operations
BBBSNR	Brenton Blue Butterfly Special Nature Reserve
BCU	Biodiversity Crime Unit
BMS	Biodiversity Monitoring System
CBA	Critical Biodiversity Area
CBO	Community Based Organisations
CDF	Conservation Development Framework
CEO	Chief Executive Officer
CFR	Cape Floristic Region
CFRPA WHS	Cape Floral Region Protected Areas World Heritage Site
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CPUE	Catch Per Unit Effort
CR	Critically Endangered
CREW	Custodians of Rare and Endangered Wildflowers
DCA	Damage Causing Animals
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs and Development Planning
DEA: O&C	Department of Environmental Affairs: Oceans and Coast
Dept	Department
DPW	Department of Public Works
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EN	Endangered
EPWP	Expanded Public Works Programme
FMS	Fire Management Strategy
FPA	Fire Protection Association in terms of the National Veld and Forest Fire Act, 1998 (No.1 of 1998)
GIAMA	Government Immovable Asset Management Act
GIS	Geographical Information System
GRAP	Generally Recognised Accounting Practices
GNRC	Goukamma Nature Reserve Complex
HIRA	Hazard Identification and Risk Assessment
HRM	Human Resource Manager
ICM	Integrated Catchment Management
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
masl	metres above sea level
METT-SA	Management Effectiveness Tracking Tool for South Africa
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MUCP	Management Unit Clearing Plan
NBAL	Natural, Biological Alien
NEM: PAA	National Environmental Management: Protected Areas Act

NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGO	Non-governmental Organisation
NPAES	National Protected Area Expansion Strategy
NT	Near Threatened
OHSA	Occupational Health and Safety Act
PAAC	Protected Area Advisory Committee
PAMP	Protected Area Management Plan
PFMA	Public Finance Management Act
QEM	Quarterly Ecological Meeting
RMC	Reserve Management Committee
SAIAB	South African Institute for Aquatic Biodiversity
SANBI	South Africa National Biodiversity Institute
SANParks	South African National Parks
SAP	System Application and Products
SCM	Supply Chain Management
SDF	Spatial Development Framework
SIF	Strategic Implementation Framework
SOB	State of Biodiversity
SOP	Standard Operating Procedures
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
TOCE	Temporary Open/Closed Estuary
U-AMP	User Asset Management Plan
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VU	Vulnerable
WCNCB	Western Cape Nature Conservation Board
WCPAES	Western Cape Protected Area Expansion Strategy
WfW	Working for Water
WMA	Water Management Area
WWF	World Wildlife Fund
WWF-SA	World Wild Fund for Nature – South Africa

1) INTRODUCTION

1.1 Background to CapeNature Protected Area Management Plans

In compliance with the National Environmental Management: Protected Areas Act (NEM: PAA), 2003 (Act No. 57 of 2003), CapeNature is required to develop management plans for each of its protected areas. The object of a management plan is to ensure the protection, conservation and management of the protected area concerned in a manner which is consistent with the objectives of NEM:PAA and for the purpose for which it was declared. The approach to, and format of all CapeNature management plans is directed by the *Guidelines for the Development of a Management Plan for a Protected Area in terms of the National Environmental Management: Protected Area Act* (Cowan & Mpongoma 2010). All CapeNature management plans must be read in conjunction with CapeNature's Co-ordinated Policy Framework (Cleaver-Christie *et al.* in prep.).

Management plans are strategic documents that provide the framework for the development and operation of protected areas. They inform management at all levels, from the Conservation Manager to support staff within CapeNature. The purpose of the management plan is to:

- Provide the primary strategic tool for management of the protected area informing the need for specific programmes and operational procedures;
- Provide for capacity building, future thinking and continuity of management; and
- Enable the management of the protected area in such a way that its values and the purpose for which it has been established are protected.

When drafting management plans, CapeNature applies the adaptive management cycle, as shown in Figure 1.1.

Adaptive management enables CapeNature to:

- i) Learn through experience;
- ii) Take account of, and respond to, changing factors that affect the protected area;
- iii) Develop or refine management processes;
- iv) Adopt best practices and new innovations in biodiversity conservation management; and
- v) Demonstrate that management is appropriate and effective.

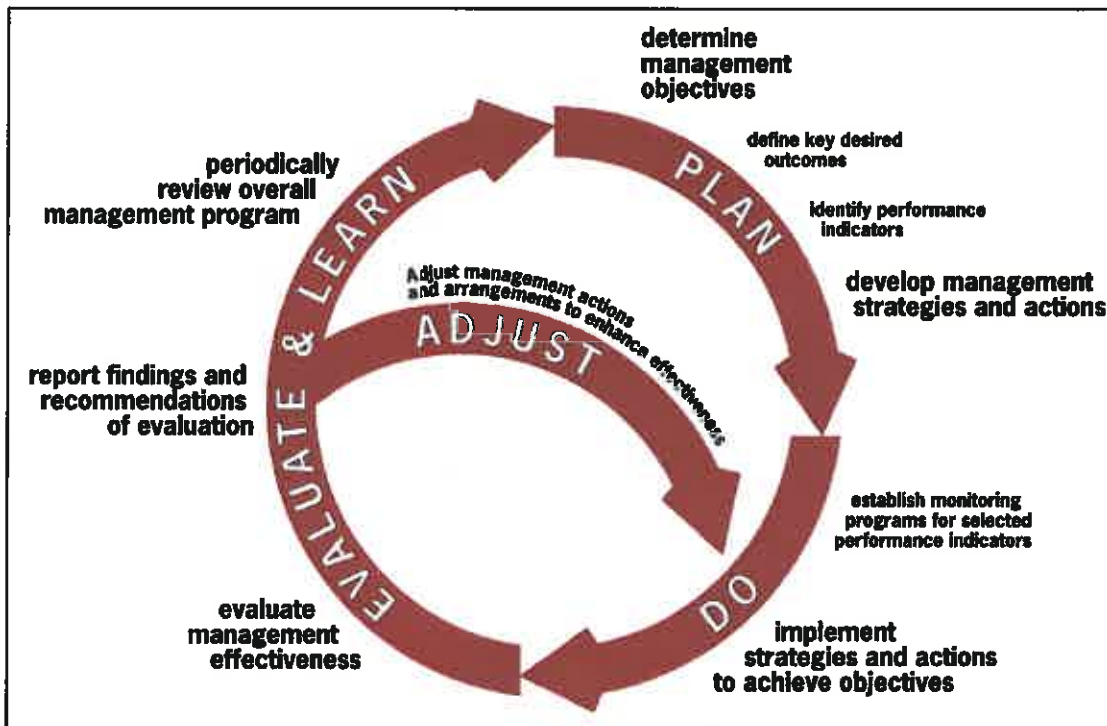


Figure 1.1: Adaptive management cycle (CSIRO 2012).

The management plan indicates where reserve management intends to focus its efforts in the next five years (2016-2021). The management plan thus provides the medium-term operational framework for the prioritised allocation of resources and capacity in the management, use and development of the reserve.

The management plan focuses on strategic priorities rather than detailing all operational and potential reactive courses of action in the next five years. The timeframe referenced in the Strategic Implementation Framework (SIF) follows financial years (1 April to 31 March), with Year 1 commencing from signing of the management plan by the Provincial Minister: Environmental Affairs and Development Planning. While planning for some emergencies is part of the management plan, it remains possible that unforeseen circumstances could disrupt the prioritisation established in this management plan. These should be addressed in the annual review and update of the management plan. The scope of the management plan for protected areas is constrained by a reserve’s actual or potential performance capability (such as available personnel, funding, and any other external factors) to ensure that the plan is achievable and sustainable.

1.2 Structure of the management plan

All CapeNature management plans are structured as follows (see Figure 1.2):

Section 1:	Outlines the background, structure and authorisation processes of the management plan.
Section 2:	Outlines the strategic management framework, which sets out the vision, purpose, values and objectives for the protected area and summarises its opportunities, challenges, and threats.
Section 3:	Provides a description of the protected area and its ecological and operational context.
Section 4:	Sets out the regional and local planning context of the protected area.
Section 5:	Outlines the conservation development framework and the concept development plan for the protected area.
Section 6:	Outlines the strategic implementation framework (SIF) of the protected area.
Section 7:	References and Glossary

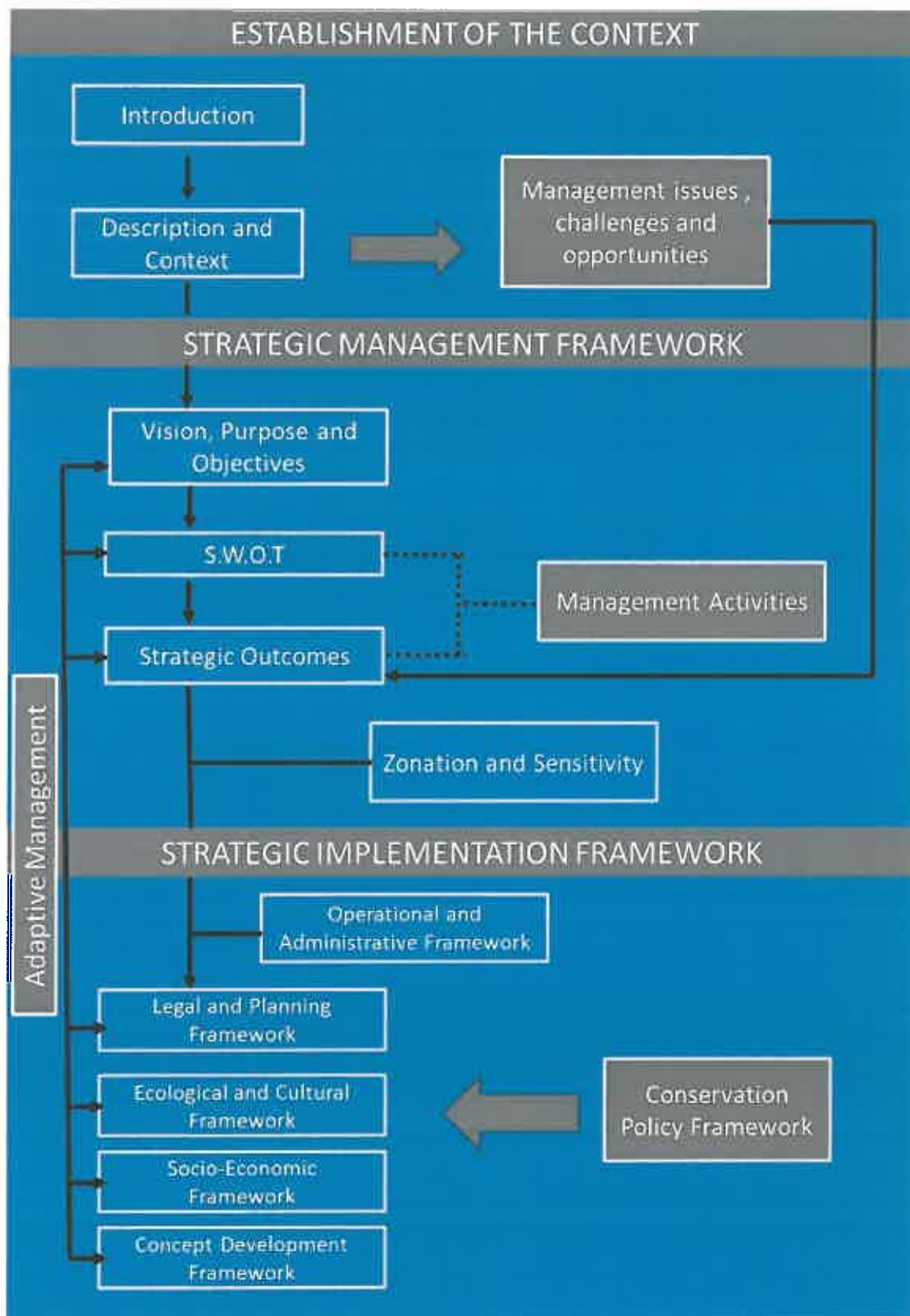


Figure 1.2: Structure of the management plan.

1.3 Approval and revision of the management plan

The management plan is drafted by the RMC. The scientific and technical content of the management plan is then internally reviewed according to Waller (2013). The edited management plan then undergoes an independent external review before being recommended for stakeholder participation where comments are considered and the management plan is once again edited where necessary. The management plan is then reviewed by the CapeNature Executive and recommended by the CEO to the CapeNature Conservation Committee. Once approved by the Conservation Committee, it is referred to the WCNCB for approval before being submitted by the Chairman of the WCNCB to the DEA&DP for ministerial approval. The Western Cape Minister of Local Government, Environmental Affairs and Development Planning then sends the management plan out for public participation and only thereafter and based on the inputs received, can the plan be gazetted. The approval process of the protected area management plan is outlined in Figure 1.3.

The protected area management plan is reviewed annually to track progress on the SIF discussed in Section 6 and the document will be updated and reviewed every five years.

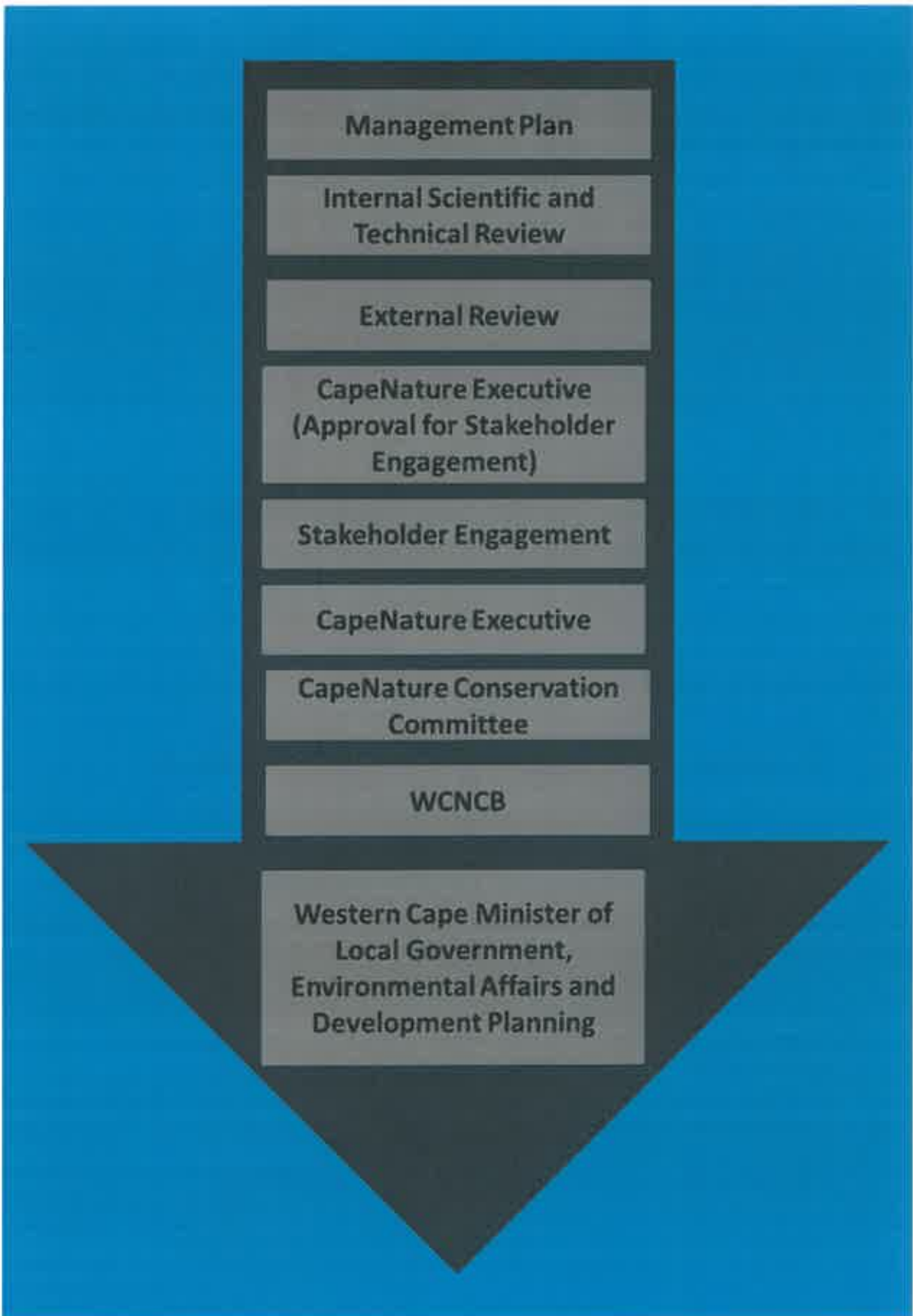


Figure 1.3: Approval and review of the management plan.

2) THE STRATEGIC MANAGEMENT FRAMEWORK OF GNRC

The strategic management framework is aimed at providing the basis for the protection, development and operation of the protected area over a five year period. It consists of the vision, purpose, values and objectives of the GNRC and summarises its opportunities, challenges, and threats.

A planning session, facilitated by the Regional Ecologist and guided by the Conservation Manager, defined the vision and purpose of the protected area. This umbrella statement indicates the management intent of the GNRC which in turn defines the management objectives. The management objectives were evaluated using the *Procedure for Defining Conservation Management Objectives and Goals* (Coombes & Mentis 1992) and categorised into objectives, action plans and tasks. The management objectives were prioritised through a pairwise comparison process and the results were used to populate the SIF (see Section 6). Actions plans were associated with objectives, and tasks (activities) were identified within each action plan.

2.1. The vision of the Goukamma Nature Reserve Complex

The vision describes the overall long-term goal for the operation, protection and development of the GNRC.

The vision of the GNRC as part of the protected area network in the Garden Route area is to conserve a system of sustainable living land- and seascapes that are representative of the region's biodiversity and ecosystem services through integrated management, for the benefit of all.

2.2 The purpose of the Goukamma Nature Reserve Complex

The purpose is the foundation on which all future actions are based and is in line with the overall management philosophy of the organisation.

According to Section 17 of NEM:PAA, the purpose of declaring an area as a protected area are: to protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in a system of protected areas;

- a) to protect ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes in a system of protected areas;
- b) to preserve the ecological integrity of those areas;
- c) to conserve biodiversity in those areas;
- d) to protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa;
- e) to protect South Africa's threatened or rare species;
- f) to protect an area which is vulnerable or ecologically sensitive;
- g) to assist in ensuring the sustained supply of environmental goods and services;
- h) to provide for the sustainable use of natural and biological resources;
- i) to create or augment destinations for nature-based tourism;
- j) to manage the interrelationship between natural environmental biodiversity, human settlement and economic development;
- k) generally, to contribute to human, social, cultural, spiritual and economic development; or
- l) to rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.

The GNRC was declared for a, b, c, d, e, f, g, h, i, k and l and its purpose is to protect:

- a major element in the morphology of the dune cordons;
- flora communities regarded as unique or endemic and that represent the Southern Cape lowland-coastal vegetation type, of which only a relatively small percentage still exists in an untransformed state;
- the only endorheic coastal lake in South Africa which is viewed as an ecologically sensitive aquatic system;
- best remaining examples of marshland communities along Groenvlei;
- an “as near as naturally managed” TOCE that flows into a partially protected MPA;
- sub-tidal reef structure which supports resident Sparidae that are vulnerable to offshore angling pressure and
- intertidal invertebrate species that provide a food source for heavily utilised recreational shore angling species.

2.3 The values of the Goukamma Nature Reserve Complex

Values are those characteristics that deem the protected area unique in terms of its ecological, cultural and social aspects. The values of the GNRC include:

<p>Natural values</p>	<ul style="list-style-type: none"> • large areas of untransformed landscape; • temperate climate; • contains rare and endangered species; • protects threatened vegetation units according to regional fine-scale vegetation map and conservation assessment (Vlok <i>et al.</i> 2008; Holness <i>et al.</i> 2010), namely: Sedgefield Sandplain Fynbos (CR), Wilderness Forest-Thicket (VU), Groenvlei Coastal Forest (VU), Hartenbos Primary Dune (EN) and a small section of Groot Brak River and Floodplain (EN); • Groenvlei Lake is one of two closed freshwater endorheic coastal lakes in South Africa; • contains dune cordons and the highest vegetated dunes in Southern Africa; • alien vegetation infestation is localized and being managed; • very high water quality in estuary; • functional estuary where fish are protected from exploitation; • part of Garden Route Complex of inscribed CFRPA WHS; • Goukamma MPA consists of approx. 5.5 km of sandy shores, 5 km of rocky shores and 3.5 km of mixed rocky/sandy shore; • Goukamma MPA contains important offshore reefs.
<p>Ecosystem service values</p>	<ul style="list-style-type: none"> • functioning mountain to ocean system; • naturally functioning open-closed estuary; • estuary is an important fish nursery; • river and estuary discharge into MPA; • altitudinal and east-west gradients; • intact dune system within reserve;

	<ul style="list-style-type: none"> • provision of ecosystem services (water, carbon, pollination, etc.); • the nature reserve complex plays an important role in erosion control, regulation of water supply and mitigation of storms and floods; • falls within the proposed Garden Route Biosphere Reserve area.
Social values	<ul style="list-style-type: none"> • strong partnerships with governmental and non-governmental stakeholders; • environmentally conscious and proactive community; • participatory management; • environmental education facilities and opportunities; • local economic development opportunities; • research opportunities for tertiary institutions; • good infrastructure and accessibility of the nature reserve complex, especially on the eastern side; • falls within the greater paleo-landscape area; • cultural and spiritual diversity.
Eco-tourism values	<ul style="list-style-type: none"> • scenic beauty; • prime tourism destination; • seascapes; • large areas of untransformed landscape; • proclaimed MPA; • recreational opportunities and events; • local economic development opportunities; • high economic values of the local area; • good infrastructure and accessibility, especially to the eastern side of the nature reserve complex.

2.4 The objectives of the Goukamma Nature Reserve Complex

The objectives were derived from the vision and purpose and represent Key Performance Areas in which achievement must be obtained in order to support the management intention. Objectives, which are not measurable or testable, are then prioritised through the development of action plans and translated into strategic outcomes which are set out in the SIF.

The prioritised objectives are:

1. To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems;
2. To improve the reach and quality of biodiversity management;
3. To create environmental awareness;
4. To expand and secure the conservation estate;
5. To provide appropriate opportunities and facilities for recreation;
6. To promote social and economic opportunities and sustainable utilisation; and
7. To effectively conserve our cultural heritage attributes.

2.5 Summary of management issues, challenges, opportunities and threats of the Goukamma Nature Reserve Complex

A SWOT analysis is a strategic planning method used to evaluate the relevant strengths, weaknesses, opportunities, and threats. It involves specifying the objectives and identifying the internal and external factors that are favourable and adverse to achieving that objective. The analysis identifies the GNRC's strengths, weaknesses, opportunities and threats (Table 2.1).

Table 2.1: Management strengths, weaknesses, opportunities and threats of the Goukamma Nature Reserve Complex.

Strengths	Obj 1	Obj 2	Obj 3	Obj 4	Obj 5	Obj 6	Obj 7
Dedicated staff							
Close proximity of the reserve to communities							
Existing support systems							
Experienced staff							
Integrated management style							
Funded reserve							
Existing infrastructure							
Good communication (internally and externally)							
MPA adjacent to terrestrial reserve							
Variety of ecosystems in nature reserve complex							
Accessibility of the nature reserve complex, especially from the eastern side							
High level of knowledge regarding biodiversity in the nature reserve complex							
Corridor linkages							
Altitudinal gradients							
Weaknesses							
Alien infestation (faunal and floral)							
Limited budget							
Some unfunded mandates							
Lack of staff capacity							
Access control challenges							
Close proximity of reserves to urban areas							
Reserve configuration (edge effects)							
Waste management challenges							
High energy use							
Quality of contractors							
Prolonged procurement and recruitment procedures							
Availability of affordable facilities for staff							
Opportunities							
Research opportunities							
Partnerships (government, NGOs, CBOs)							
Expansion opportunities (east and west)							
Tourism concessions and partnerships							
Close proximity of reserve to communities							
Harvesting of alien products							
External funding of projects							
Training facility available							
Job opportunities							

Threats							
Land disputes							
Periodic water shortages							
Inappropriate development adjacent to reserve							
High numbers of seasonal visitors							
Flooding events (posing threats to roads and other infrastructure)							
Adjacent habitat destruction and fragmentation							
Poaching							
High potential for hazardous spills							
Pressure to artificially breach estuary							
Water abstraction							
Proposed inter-basin transfer scheme (Homtini River to Karatara River)							
Alien invasive organisms (plants and animals)							
Limited options for expansion of nature reserve towards north							
Pollution as a result of desalination plants or oil spills							
Climate change							
Upstream mismanagement of river and adjacent areas							
Location of N2 highway							
Political pressure to allow fishing in MPA							
Coastal erosion protection through construction of hardwalls in Buffalo Bay							
Beach erosion at Buffalo Bay owing to fragmentation of dune by-pass corridor							
Lack of fires							

3) DESCRIPTION AND CONTEXT OF THE GOUKAMMA NATURE RESERVE COMPLEX

3.1 Location and extent of the Goukamma Nature Reserve Complex

The GNRC, comprising Goukamma Nature Reserve, Buffalo Valley Contract Nature Reserve and Goukamma MPA, is situated along the Southern Cape coast of the Western Cape Province of South Africa, approximately 40 km east of George, 20 km west of Knysna and south of the N2 highway. The GNRC falls within the Knysna Municipal Area.

Goukamma Provincial Nature Reserve and Buffalo Valley lie adjacent to the Goukamma MPA with which a common boundary is shared. These areas are managed as a unit by CapeNature.

The Brenton Blue Butterfly Special Nature Reserve (BBBSNR), which is located at Brenton on Sea, ca. 5 km east of the GNRC, is also managed from the GNRC office. Following a request from the BBBSNR management committee, a separate management plan will be drafted for this reserve. It will therefore not be covered in this plan.

The terrestrial reserve covers an area of 2 679 ha and the MPA 3 201 ha. The MPA includes 16.5 km of coastline (from Buffalo Bay to Platbank) and reaches 1 nautical mile (1.85 km) out into the Indian Ocean (Figure. 3.1). The highest point is at Trig. Beacon 221 and is 202.3 masl.

GNRC is situated between the following coordinates:

Northernmost limit of reserve:	34° 01' 17.1" S
Southernmost limit of reserve:	34° 06' 29.8" S
Westernmost limit of reserve:	22° 50' 00.1" E
Easternmost limit of reserve:	23° 01' 57.8" E

The reserve and surrounding area loci are covered by the 1: 50 000 map - 3422 BB SEDGFIELD.

Surrounding land use activities include:

- unmanaged natural veld between the western boundary and the Sedgefield urban edge;
- partially managed, residential small holdings along the south western shore of Groenvlei and north of the N2 highway;
- commercial accommodation operations (caravan park, chalets and time-share units) in the north western corner of Groenvlei;
- commercial pine plantations north and north east of the reserve;
- partially managed small scale farming operations and "lifestyle" farms along the banks of the Goukamma Estuary to just north of the N2;
- a small commercial hub of accommodation and restaurants at the N2 and Goukamma River junction;
- partially managed natural veld between the eastern boundary and the urban edge of Brenton-on-Sea;
- the holiday town of Buffalo Bay consisting of 200 erven, one restaurant, two caravan parks, a boat launch site and popular swimming beach to the south east of the reserve; and

- the Garden Route National Park, managed by South African National Parks, consists of numerous properties which are located in an arch shape around the GNRC (see Figure 3.1). The GNRC falls within the buffer zone of the Garden Route National Park.

The various land parcels constituting the terrestrial GNRC are listed in Table 3.1.

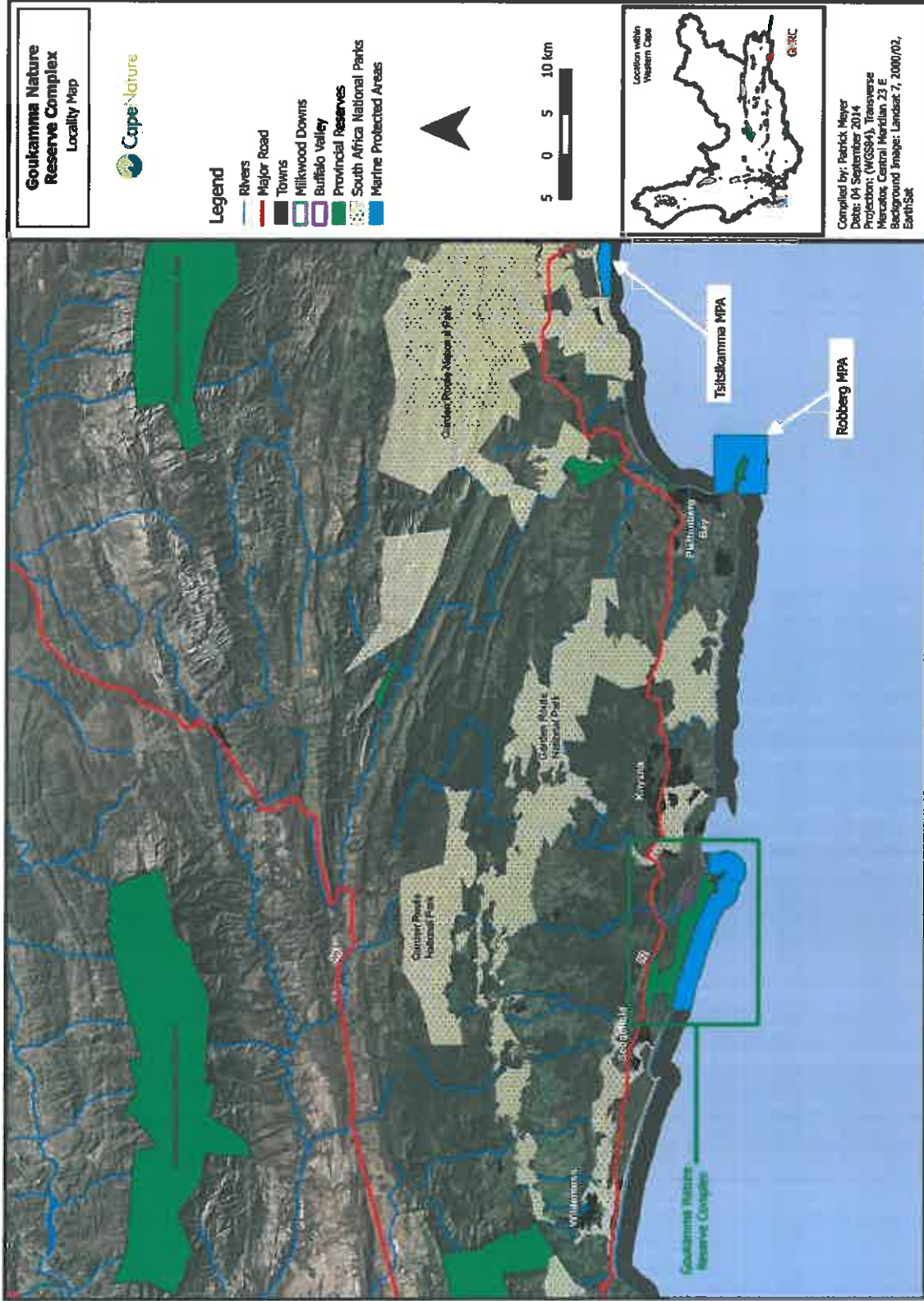


Figure 3.1: Location and extent of the Goukamma Nature Reserve Complex.

Table 3.1: Land parcels constituting the Goukamma Nature Reserve Complex.

Reserve component	Farm name and number	Portion #	Title deed number	Diagram number	Noting number	sheet	Conservation status
Goukamma Nature Reserve	MOERASFONTEIN 204	PORTION 7 (Portion of Portion 1)	T14585/1980	3499/78	AL-2BBA-6405 AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	MOERASFONTEIN 204	PORTION 8 (Portion of Portion 1)	T14585/1980	3500/78	AL-2BBA-6405		Provincial Nature Reserve
Goukamma Nature Reserve	MOERASFONTEIN 204	PORTION 9 (Portion of Portion 2)	T14585/1980	3501/78	AL-2BBA-6405		Provincial Nature Reserve
Goukamma Nature Reserve	MOERASFONTEIN 204	PORTION 10 (Portion of Portion 3)	T14585/1980	3502/78	AL-2BBA-6405		Provincial Nature Reserve
Milkwood Downs	RUYGTE VALLY 205	PORTION 38 (Portion of Portion 33)	T54400/1987	8811/48	AL-2BA-3596		World Wild Fund for Nature –South Africa (WWF-SA) property
Goukamma Nature Reserve	RUYGTE VALLY 205	PORTION 39 (Portion of Portion 33)	T23372/1964	8812/48	AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	RUYGTE VALLY 205	PORTION 81 (Portion of Portion 8)	T23201/1974	4265/50	AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	RUYGTE VALLY 205	PORTION 111	T19650/1967	1782/67	AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	RUYGTE VALLY 205	PORTION 112 (Portion of Portion 7)	T26351/1974	4268/50	AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	RUYGTE VALLY 205	PORTION 114 (Portion of Portion 95)	T9519/1976	3180/75	AL-2BA-3596		Provincial Nature Reserve
Goukamma Nature Reserve	GROEN VALLEI 207	REMAINING EXTENT	T10197/1991	1557/24	AL-2BB-3597 / AL-2BA-3596		Need to realign cadastral as per title deed
Goukamma Nature Reserve	GANZVLEI 208	PORTION 18 (Portion of Portion 7)	T6018/1963	5373/60	AL-2BB-3597		Provincial Nature Reserve
Goukamma Nature Reserve	GANZVLEI 208	PORTION 23 (Portion of Portion 13)	T45552/1984	935/63	AL-2BB-3597		Provincial Nature Reserve

Reserve component	Farm name and number	Portion #	Title deed number	Diagram number	Noting number	Conservation status
Goukamma Nature Reserve	GANZVLEI 208	PORTION 26 (Portion of Portion 24)	T14585/1980	3503/78	AL-2BA-3596 AL-2BBA-6405 AL-2BBC-6407	Provincial Nature Reserve
Goukamma Nature Reserve	GANZVLEI 208	PORTION 27 (Portion of Portion 2)	T2637/1980	3504/78	AL-2BBA-6405	Provincial Nature Reserve
Goukamma Nature Reserve	BUFFALO BAY FOREST RESERVE 211	REMAINING EXTENT	DUMDUM - UNREGISTERED STATE LAND		AL-2BBC-6407	Provincial Nature Reserve
Goukamma Nature Reserve	WALKER'S POINT 215	REMAINING EXTENT	G11/1947	4693/46	AL-2BD-3598	Provincial Nature Reserve
Goukamma Nature Reserve	ADMIRALITY RESERVE	0/1				Provincial Nature Reserve
Buffalo Valley Contract Nature Reserve	WELTEVREDE 214	PORTION 1 (Remainder)	T93237/1995			Contract Nature Reserve being managed by CapeNature
Buffalo Valley Contract Nature Reserve	WELTEVREDE 214	PORTION 2 (Portion of Portion 1)	T93237/1995			Contract Nature Reserve being managed by CapeNature

3.2 History of the Goukamma Nature Reserve Complex

In the early 1900s the Buffalo Bay area and coastal strip westwards were reserved as a Forest Reserve. This land was known as the Buffalo Bay Forest Reserve which was reserved to control and reclaim drift sands in the area. Several fishermen were allowed to reside at Rowwehoek (Walker's Point) under permits from the Dept of Forestry in the early 1900s. It is likely that they utilised the intertidal zone at this time. Hunting licences were also issued from time to time in the area (Heinecken 1970).

The removal of wild oysters on a commercial basis had been carried out for approximately 100 years. Oyster harvesting was not controlled on a quota and no accurate figures were kept. This was stopped when the coast was declared a MPA in 1990.

Parts of the reserve had reasonable grazing potential especially after fires, and were grazed by cattle, while other parts were planted with pines. The area around Groenvlei was used mainly for pasturage before the proclamation of the reserve. Between 1968 and 1970 large areas of the fynbos were cut on a rotational basis using a "bossieslaner" probably to promote grazing (Van der Merwe 1976). The area is not clearly defined but seems to have been within the dune slacks in the more level areas of the western section.

During the early 1940s *Acacia cyclops* (Rooikrans), *Acacia saligna* (Port Jackson) and *Ammophila anenaria* (Marram grass) were used in conjunction with indigenous seeds and plants to stabilise the mobile dunes in the area of the Goukamma Estuary. This natural drift sand area, forming a headland bypass system, was viewed by the Agricultural Department as a threat. This was due to upriver farming practices being compromised when floodplains "back flooded". The drift sands were stabilized from 1918 to 1939 by the Forestry Department. Since the reserves inception in 1960, management efforts have concentrated on the removal of these alien plant species. During the 1970s, 1980s and early 1990s teams of chainsaw operators removed dense infestations of Rooikrans and Port Jackson in substantial areas. Biological control of Port Jackson was started in 1988 when the gall-forming fungus (*Uromycladium tepperianum*) was introduced to trees in the areas around the estuary. The fungus did very well on the Port Jackson. In 1994 the seed-feeding weevil (*Melanterius servulus*) was introduced on the Rooikrans but this biological control took a long time to reproduce and was not successful. When clearing re-started in 2004, 27 ha of dense adult Port Jackson was felled and burned in April 2005. Although many trees felled were infected, reserves of infected plants were left on the seaward side of the management road which runs parallel to the coast approximately 1 km from the pont crossing. Between the mid-1990s to 2004 low levels of alien clearing took place. Aliens, primarily Rooikrans and Port Jackson, continue to be removed today and good progress at eradicating these species is being made through the WfW project. As eradication takes place, the area is colonised and vegetated by indigenous plants. Unfortunately, as a result of a substantial root base having been established, the drift sands will never function naturally again.

3.3 Ecological context of the Goukamma Nature Reserve Complex

3.3.1 Climate and weather

The climate is generally mild and temperate with relatively little variation in means. The hottest month on average is January with a mean maximum air temperature of 31.2°C, while the coldest month is July, with an average minimum temperature of 4.2°C (Figure 3.2; CapeNature, Unpublished data, Goukamma Nature Reserve Complex).

The area is characterised by a so-called bimodal rainfall pattern (two peaks per year in October and May) with a strong orographic influence (rise and cooling of moisture laden air) against the Outeniqua Mountains. However, on the GNRC the average rainfall over a 37 year period indicates that the highest average rainfall (74 mm) has been recorded in August (Figure 3.2). Rain occurs mostly at night and in the early morning. Thunderstorms occur rarely and contribute little to the annual rainfall. The average humidity is high at 88%, caused by the close proximity of the warm ocean current (Agulhas Current). Frost and hail do occur, and dew is a common occurrence during autumn, winter and spring (Schultz 1965).

The wind patterns in the south Atlantic and south Indian oceans are influenced by a number of dominant meteorological features. Warm air, which rises in the tropics near the equator, moves southwards and descends in the vicinity of 30° to form the so-called Hadley cells. This descending air causes two semi-permanent anti-cyclonic high-pressure systems to form, which are centred over the South Atlantic and Indian Oceans, with air moving in an anti-clockwise rotation around the centre of the high-pressure system. South of the Hadley cell, cyclonic low-pressure systems are found off the polar circle margin of the “Roaring Forties”. These low-pressure systems move in an anti-clockwise rotation from west to east. This whole system shifts seasonally between 5 and 10 degrees latitude; southwards in summer and northwards in winter. The significance of the interactions between the cyclonic and anti-cyclonic systems and the sub-tropical warm Agulhas Current however, is that neither system predominates to the exclusion of the other. The Agulhas Current generally enhances the convective processes and encourages rainfall development (Schultz 1965).

In the Southern Cape, the cyclonic coastal lows are confined to areas below the escarpment of the Outeniqua Mountains. They show sharp changes in the wind direction, temperatures and humidity as they move eastward along the coast, typically bringing high intermittent rains. The wind change is generally to the south west. Due to the northward shift of the “Roaring Forties” belt there is an increase in coastal lows and associated cold fronts in winter. During summer, the Southern Indian Ocean Anti-cyclone ridging in south of the sub-continent, causes a predominance of easterly winds along the coast. These south easterly (SE) winds cause upwelling and bring cold water into the coastal areas (8°C). This sudden drop in water temperature often stuns fish which are subsequently washed onto the beaches. Precipitation is caused by advection of cool moist air by this anti-cyclone and by the influence of the mountains. The prevailing winds are south-easterly during summer and south-westerly during winter, while very strong winds are uncommon. Dry bergwinds from the north cause a severe lowering in humidity and an increased fire hazard, especially during winter (Schultz 1965).

The Goukamma Nature Reserve area receives more sunlight in the afternoon than the morning, due to coastal fog and mist. The average yearly sunlight period varies between 50% and 60% and seldom drops below 40%. The average number of days that receive 10% or less sunshine is between 40 - 50 days, while the number of days where 90% or more sunshine is received is between 50 – 100 days (Schultz 1965).

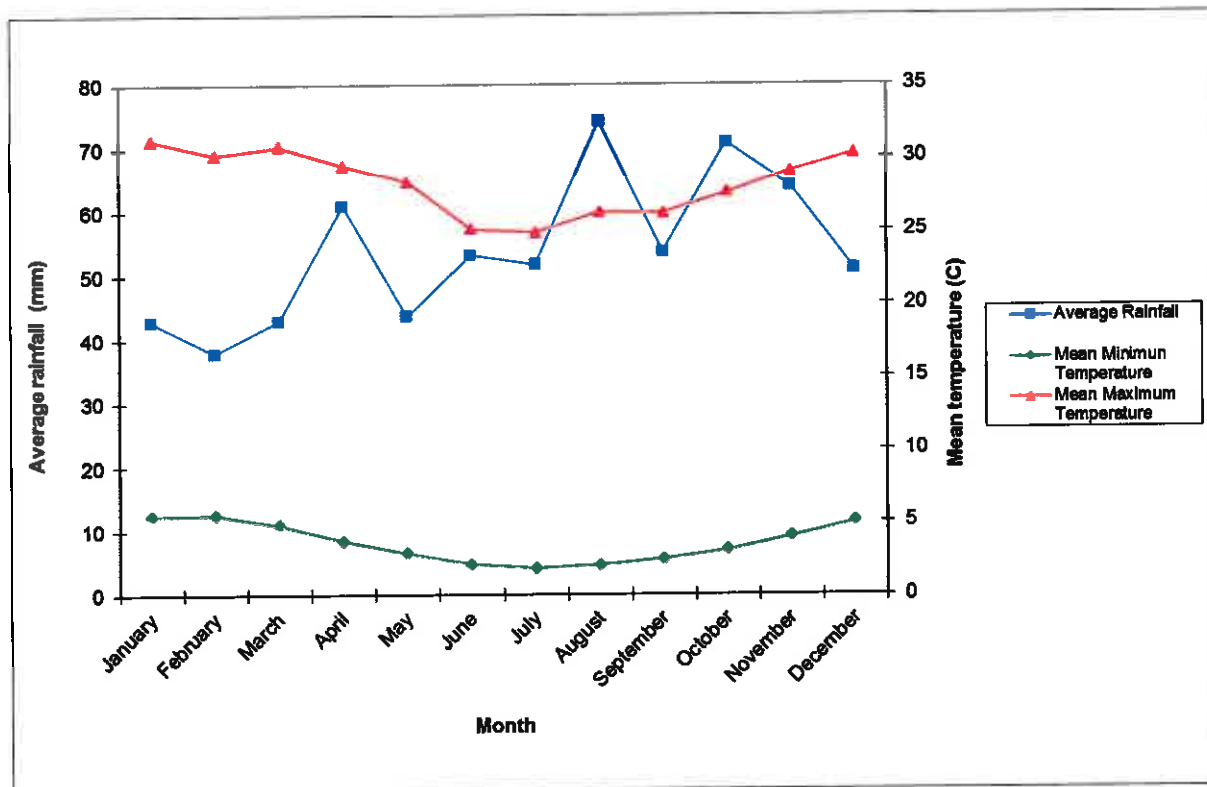


Figure 3.2: Average rainfall and mean minimum and maximum temperature per month recorded for Goukamma Nature Reserve Complex over a 37 year period (1979-2015).

3.3.2 Topography

During the complex sea-level history there have been numerous phases of dune-building followed by coastal erosion that formed sea cliffs. These fossil sea cliffs form large, steep seaward-facing slopes parallel to the present coastline and form a major element in the morphology of the cordons. Trailing arms of parabolic dunes form another major topographic element, oriented at 15-30° to the shoreline.

Within the GNRC, there are quaternary sand dunes running in an east-west direction increasing in height as one moves inland from the coast. Some connect with one another forming a lattice or dune mosaic. These dune cordons consist of steep-sided ridges, and the highest point in the reserve is one of these cordons measuring 202.3 m in height. They probably formed during the sea-level rises of the Pleistocene inter-glacial period. Three major dune cordons exist in the area. The dunes form ridges which are cemented together by calcium carbonate to form dune rock or aeolionite. There is an additional coalesced mass of older fossil dunes inland of these cordons that form hills up to 340 m high. In places, the dune sand can reach thicknesses in excess of 300 m (Tinley 1985).

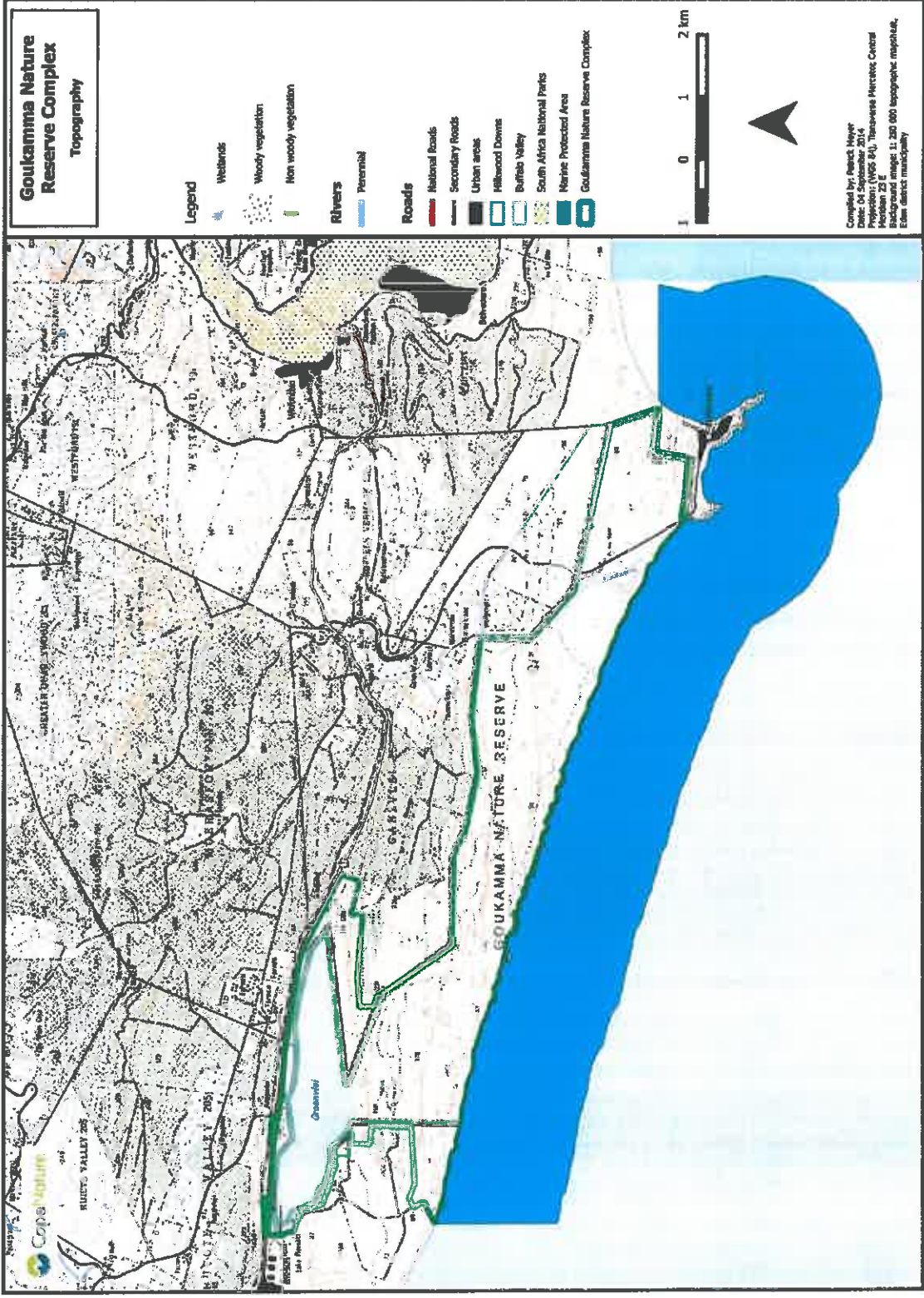


Figure 3.3: Topography of the Goukamma Nature Reserve Complex.

3.3.3 Geology and soils

The area covered by the GNRC is entirely underlain by Late Pliocene (~3.6 – 2.6 Ma) rocks of the Wankoe Formation. The Wankoe Formation, the member which forms the bulk of the Tertiary (~66 – 2.5 Ma) aged Bredasdorp Group, generally unconformably overlays the De Hoopvlei Formation of the same group (Malan 1989). However, at Goukamma it unconformably overlays the Skurweberg Formation of the Table Mountain Group which outcrops just outside the reserve at the headlands Rowwehoek and Walker Point (Malan 1989).

The Wankoe Formation generally outcrops as prominent ridges of calcified dune sand and consists of grey-weathered, massive or large-scale cross-bedded calcarenite and calcareous sandstone (Council for Geological Science 2004). At Goukamma, the Wankoe Formation represents amongst the most easterly outcrops of the formation and group which extends from Hermanus in the west to Plettenberg Bay in the east (Malan 1989).

The Garden Route Lakes complex extends from the Kaaimans River mouth at Wilderness in the west, to Rowwehoek and Brenton in the east and 8 km inland to Homtini. This coastal sand forms the foothills of the Outeniqua Mountains that proceeds inland over the escarpment of Table Mountain Sandstone. Alluvial sedimentation occurs in the river valleys whilst the coastal areas consist of recent sand beaches (Malan 1989; Harris *et al.* 2010).

The intertidal zone is composed of wave cut limestone platforms, exposed reefs and sandy beach to the west of the Goukamma Estuary (see Figure 3.4). To the east, from Rowwehoek to Walker point, sand-stone headlands and intertidal areas of rounded boulders and deep rock pools predominate. The offshore zone includes sub-tidal rocky reefs of aeolianite or sandstone origin (Flemming *et al.* 1983), and sub-tidal sandy and muddy substrates.

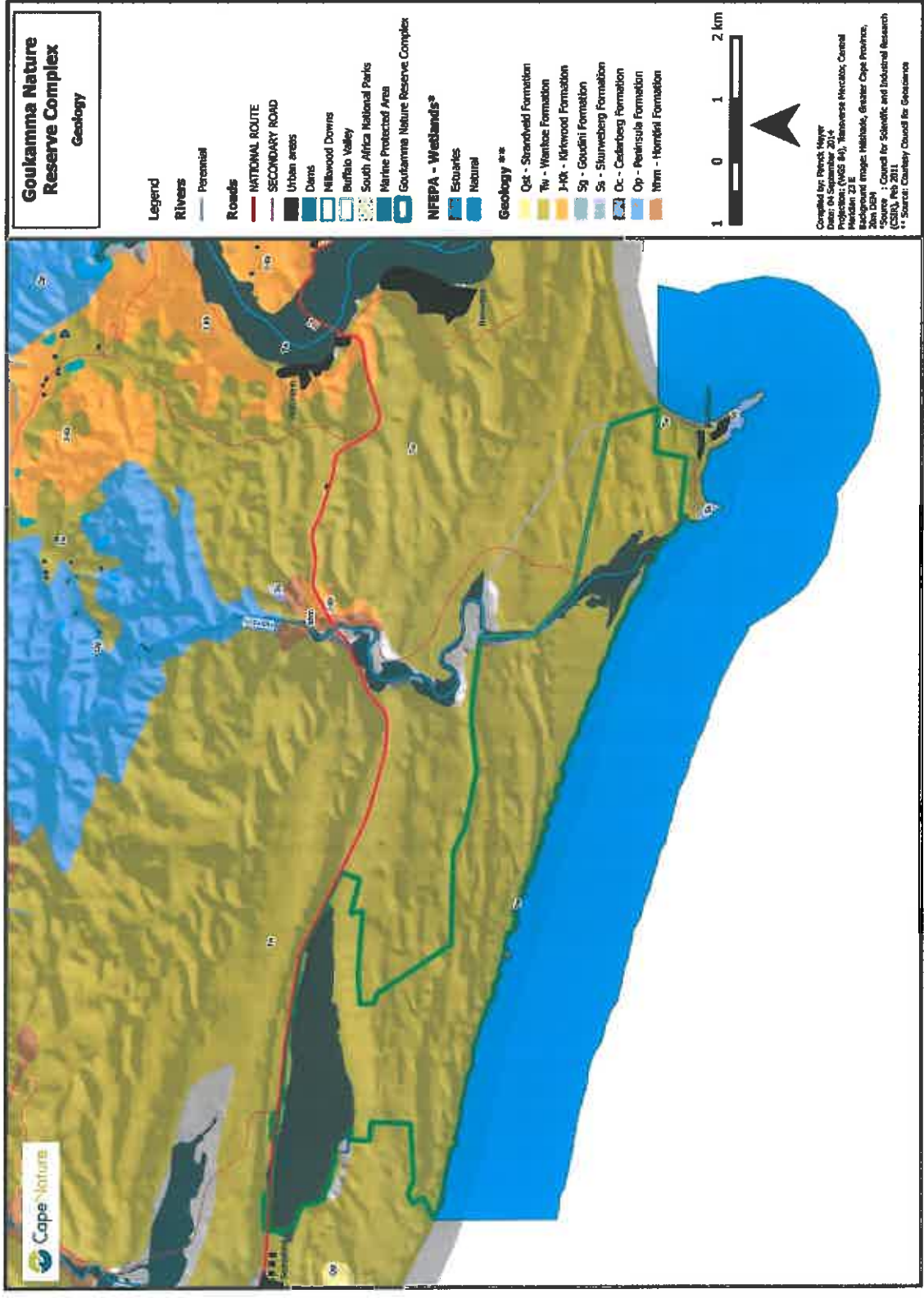


Figure 3.4: The geology of the Goukamma Nature Reserve Complex (Council for Geoscience 2004).

3.3.4 Aquatic systems

The reserve complex falls within the Gouritz Water Management Area (WMA), in the Garden Route catchment (River Health Programme 2007). This catchment area drains the Karatara and Goudveld State Forest sections of the Outeniqua Mountains.

Two major water bodies are found within the borders of the Goukamma Nature Reserve, namely, Groenvlei and the Goukamma River and Estuary. Both of these systems fall within a Freshwater Ecosystem Priority Areas (NFEPA) sub-catchment, although the wetlands systems themselves (Groenvlei Lake and Goukamma Estuary) have not been marked as FEPA wetlands (Nel *et al.* 2011b).

3.3.4.1 Groundwater

The Wankoe Formation forms part of the intergranular Bredasdorp Group Aquifer. An intergranular aquifer refers to water being stored within openings between the grains of weathered rock or unconsolidated material. At Goukamma, the aquifer yield is low at 0.1–0.5 l/s (DWAF 2000), in contrast to westerly occurrences of the aquifer where yields of around 2 l/s are recorded. The groundwater quality is good with an electrical conductivity of 70–300 mS/m (DWAF 2000) and water tends to be of a sodium-chloride-calcium-alkaline nature.

According to the Department of Water Affairs (DWA) Aquifer Vulnerability Map, the nature reserve complex falls within a major (high yielding system of good quality water) groundwater/aquifer system that is highly susceptible to contamination by anthropogenic activities in the catchment (see <http://www.dwaf.gov.za/Groundwater/documents/Aquifer%20Susceptibility%20Map.pdf>).

During a drought, which reached its zenith in 2010, an application by the Knysna Municipality was made to install and use a borehole in the eastern section of GNRC in order to supplement water supply to the larger Knysna area. This application was declined.

3.3.4.2 Rivers

The Goukamma River is the only permanent river in the GNRC. The river has a relatively large catchment area of 235 km² (Van Niekerk *et al.* 2009) that includes the Homtini River, which was found to be in a good condition in its upper reaches during the 2005-2006 sampling period of the Gouritz WMA of the River Health Programme (River Health Programme 2007). The Goukamma River's length is short (ca. 17.5 km, which includes the Homtini River) in relation to its catchment area and is subject to regular flooding. The river mouth opens naturally in the high freshwater flow periods (August - December) with south-easterly winds maintaining the mouth open. In the low freshwater flow period (late summer and early winter months) the south-westerly winds close the mouth.



Figure 3.5: Aquatic systems of the Goukamma Nature Reserve Complex (Nel et al. 2011a, 2011b). Note that the flood risk areas are also indicated.

3.3.4.3 Lakes

Groenvlei Lake is the only standing water body in GNRC and is approximately 2.34 km² in size while the total catchment area is about 13.8 km². The lake has a length of about 3.7 km and a width of 0.9 km. The lake has no river inflow. According to Roets *et al.* (2008) Groenvlei is fed by rainfall and secondary groundwater discharges from the Table Mountain Group (TMG) aquifer via Van Kervelsvlei, located northeast of the lake. Parsons (2009) however, argues that Groenvlei is fed by both direct rainfall and groundwater, but that there is no hydraulic link between Groenvlei and Van Kervelsvlei, the latter being a disconnected system that is entirely fed by rainfall. In contrast with Wilderness and Swartvlei Lakes, Groenvlei Lake has no connection with the sea. It is slightly saline (about 3.0 parts salt per thousand) with an average surface level of about 3 m amsl. The maximum depth is 5.6 m but mostly it is not more than 3.7 m deep. As its name indicates, Groenvlei's water has a slightly greenish hue.

3.3.4.4 Other freshwater aquatic systems (wetlands, springs, pans)

There is a wetland on the Buffalo Valley Contract Nature Reserve and a series of small temporary flooded wetlands are evident inland of the primary dune to the west of the Goukamma River mouth. It is believed these wetlands are remnants of the meandering nature of the river through the floodplains. These wetlands are wetter during winter rainfall periods and when the river mouth is closed and the estuary back floods.

3.3.4.5 Estuaries

The estuary's maximum tidal reach is to about 9.2 km from the mouth (coordinates 34°01'42"S; 22°56'22"E). Only the lowest 3.3 km of the estuary lies within the protected area. The estuary has an average depth of 1–2 m with localised deeper channels present in the middle and upper reaches. At the coast the estuary is diverted parallel to the shore by sand dunes and the mouth is situated behind a low sand barrier (James & Harrison 2008). The estuary mouth breaches naturally at 2.5–3.0 m above sea level (Kaselowski 2012).

The Goukamma Estuary mouth used to be artificially breached when salt water which overtopped the closed mouth during spring tides pushed up river to near the N2 road. Freshwater is extracted from this point for use in the Buffalo Bay village. Artificial breaching was stopped in 1995.

While a formal breaching policy does not exist, various reports, studies and discussions indicate the maintenance of an "as natural as possible" management programme. Mechanical manipulation is used as a last resort in emergency situations. Farmers along the low-lying floodplain argue against the management approach not to induce breach. However, according to Van Niekerk (L van Niekerk, pers. comm. 13/11/2015) the Goukamma Estuary is one of the few near natural condition estuaries along this coastline and serves as an important nursery for fish and habitat for birds. It closes naturally from time to time, with drought conditions prolonging the closed mouth conditions. During closed mouth periods brackish water is back-flooded into the surrounding floodplain, which drives the establishment of the more salt tolerant vegetation species that characterize an estuary. Premature artificial breaching leads to sedimentation in the lower reaches; an increase in the risk of flooding in the long run as the mouth becomes more constricted; shallowing of the lower reaches take

place; and disruption of natural mouth regime cycles in the MPA occur. Van Niekerk therefore urges that the Goukamma Estuary should not be artificially breached.

An important factor for the Goukamma Estuary is the fact that it has a large catchment area which is utilised for forestry purposes and has large sections of indigenous forest which have not been utilised. Water is therefore of a very high quality. Water extraction is limited in the upper catchment to supply the settlement of Keurhoek with a few small-holdings along the river extracting mainly for domestic use. In the lower reaches of the Goukamma River, water extraction is limited to supplying approximately 200 holiday houses and two caravan parks at Buffalo Bay. This extraction is very seasonal with high extraction during the Christmas holidays. Fortunately there is no further room for development at Buffalo Bay and future water requirements should be limited. Very little irrigation farming is carried out in the catchment area. Moving upstream from the mouth, an old partially broken cement weir crosses the river at approximately 8.5 km followed shortly by a (currently) disused railway bridge and a further 200 m above this bridge, the bridge that carries the national road dual carriageway, crosses the system.

The physico-chemical parameters (temperature, salinity, dissolved oxygen, pH, conductivity and turbidity) are highly variable in TOCE. There are three dominant hydrodynamic states in which TOCE's can exist (Snow & Taljaard 2007). These are mouth open, mouth semi-closed and mouth closed. The factor most commonly influenced by mouth state is the salinity profile of the estuary. When the estuary mouth is open, the river flow to the estuary is sufficiently high to keep the mouth open to the sea. This allows continued sea water intrusion during high tides and with river inflow introducing fresh water into the upper reaches, this provide a salinity gradient in the estuary (Snow & Taljaard 2007). A longitudinal salinity gradient exists in the estuary where the position of the haloclines depends on the rate of river inflow. The longitudinal gradient shifts according to the tides on a daily basis with the more saline water being found at the mouth and more freshwater at the head of the estuary (Snow & Taljaard 2007).

During periods of mouth closure, there is extremely low or no river inflow and a further increase in the height of the berm (sand bar at the mouth of an estuary) prevents seawater from entering the estuary or water from draining from the estuary into the sea. During these times a strong stratification of the salinity is characteristic which effectively limits oxygenation of the bottom water which resulted in frequent occurrence of bottom water hypoxia. This stratification is dominant in the deeper channelled upper reaches while good mixing and homogenous salinity can be found in the shallower lower reaches (Kaselowski 2012). The changes in the remainder of the water quality parameters are largely seasonally and weather dependent with lesser influence by tidal changes.

Van Niekerk and Turpie (2012) did a desktop National Health Assessment of all estuaries in South Africa and Goukamma Estuary was classified as 'good' based on its habitat state, biological state and estuary health state. They recommend that the Goukamma Estuary requires '*full protection*' status with '*full no-take*' areas.

Due to the steep-sided and narrow, channel-like nature of the estuary, very little intertidal habitat is present, most of which is dominated by marine sediment in the lower reaches. No salt marsh vegetation has been recorded but it may have been present in the past. No information on invertebrates has been published to date.

The Goukamma Estuary serves as a viable function for both marine migrant and estuarine resident fishes (James & Harrison 2008). An important aspect of temporary open/closed estuaries is the period and timing of mouth openings. The recruitment of estuarine dependent fishes into estuaries is largely defined by the ability to move into estuaries which are open at those crucial periods. This needs to be taken into consideration when developing mouth management plans. The Goukamma Estuary is one of the very few estuaries out of the 247 functional estuaries on the South African coastline where fish are protected from exploitation (limited fishing with a rod is allowed, but no cast-nets, trek-nets or any bait removal is allowed).

Non-consumptive utilisation is actively encouraged by commercial operators in the area and canoeing, birding and swimming are practiced at low levels. The occasional event such as stand-up paddle races and minor interest group activities (scouts, outdoor clubs) do happen irregularly.

Incidence of flooding (historical): Prior to 1921 transverse mobile sand dunes transferred sand into the headland by-pass dune system into the Buffalo Bay half-heart bay beaches. This sand movement into the Goukamma River was negatively perceived – as it would close the mouth causing flood damage to forests and farms in the catchment area. Alien vegetation (*Acacia cyclops*, *Acacia saligna* and *Ammophila arenaria*) was propagated on these mobile dunes from 1921 until Cape Nature Conservation took over management in 1956. This stabilized dune system has stopped the Goukamma River mouth from "tail wagging" and caused it to permanently migrate to the east (Helström 1996).

Three recent flood events have occurred on:

- 24 September 1993 with an average stream discharge, measured at 1 km upstream of the mouth, at 380 m³/sec resulted in approximately 50 linear metres of frontal dune being eroded at the mouth. Lateral erosion of the stream bank by 10 metres also occurred.
- 2-3 August 2006 (1:50 year size category) resulted in extensive damage in excess of 40 m to the eastern bank, destruction of a permanent gatehouse, picnic area and substantial undercutting of the main access road to Buffalo Bay.
- 27-29 October 2007 (1:50 year size category) resulted in the complete destruction and removal of approximately 200 m of the main access road to Buffalo Bay.

These high intensity, short duration storm events increase the potential for the recreational facilities and provincial road from being undermined by erosion and thereby posing major management decisions by CapeNature and the Department (Dept) of Transport. A survey of the river's flow pattern and bank erosion rates has also been conducted (Dept of Agriculture 2004) in an attempt to determine the best possible locations for groin construction, which would curb erosion at the critical points mentioned. The flood of August 2006 resulted in damage and before any remedial action could be implemented to protect the road the flood of October 2007 created further damage. Initial recommended repairs, entailing the recovery of the washed away bank and substantial cement groins and retaining walls within the river, was approved through a formal Environmental Impact Assessment (EIA) process. However, an appeal was lodged against the approval granted by the DEA&DP, who subsequently amended their decision in order to allow for road repairs inland of the proposed site, effectively ensuring a "retreat from the river" principle. It must be noted that the preferred alternative generated by the EIA was to establish an alternative route for the Buffalo Bay access road within the raised dunes to the north of the river's floodplain. A recommendation was made to begin investigations into this alternative as the existing repair was considered a medium term solution.

An informal advisory body (Estuary Forum), well represented by authorities and members of the public, was convened in early 2014 in order to develop a Situation Analysis Report as part of the Scoping Phase of the Estuary Management Plan according to the National Estuarine Management Protocol of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008). A draft estuary management plan has been compiled (De Villiers 2014) and is currently being reviewed and updated in preparation for the public participation process which will be taking place during 2016.

3.3.4.6 Marine systems

South Africa has three major bio-geographic zones: (a) the cool temperate West Coast; (b) the warm temperate South Coast; and (c) the sub-tropical East Coast. Goukamma MPA is located roughly in the middle of the warm temperate South Coast zone which covers the area from Cape Point to East London. Goukamma is representative of a larger inshore zone which is complex with warm water intrusions from the Agulhas current and wind-induced upwelling of cold South Indian/Atlantic Central water (Harris 1978; Götz 2005).

South Africa has various marine ecotypes:

- **Rocky and sandy shores**
Goukamma MPA consists of approximately 5.5 km of sandy shores, 5 km of rocky shores and 3.5 km of mixed rocky/sandy shore.
- **Offshore reefs (including rocky reefs and coral reefs of Zululand)**
Goukamma MPA has important offshore reefs (see Figure 4.2) extending to 37 m deep. The reef accounts for only 25% of the MPA and it occurs mostly in the eastern end of the MPA, where the Walkers Point headland extends into the sea (Götz 2005). These reefs are important habitat for commercially important species such as hake and endemic fish species such as red steenbras. The seaward boundary of the MPA is only one nautical mile offshore and does not adequately protect these reefs from utilisation by recreational as well as commercial fishers. The need to increase reef protection adjacent to Goukamma MPA has been highlighted in various reports and studies (Götz 2005; Sink *et al.* 2012).
- **Offshore soft sediment**
Goukamma MPA has offshore soft sediment areas close inshore between the offshore reefs. Although these areas are low in species diversity they are important areas for east coast sole.
- **Breeding sites of sea birds are important habitats for conservation.**
The Goukamma MPA is an important breeding area for the African black oystercatcher (*Haematopus moquini*) along the Cape south coast with adult bird densities of 2.95 birds per km. The presence of the MPA (and regular field ranger patrols) has ensured that the highest breeding success rates occur within this area. Many other seabirds are known to frequent the area.

Attwood *et al.* (1997) assessed the MPAs in South Africa in conjunction with the reserve managers. The results from this can be seen in Table 3.2 where populations were ranked as either in pristine condition, healthy, critical or unknown. The majority of marine species were in a healthy condition, 12 were listed as pristine and six critical condition.

Table 3.2: The status of species or species groups in the Goukamma MPA (Atwood *et al.* 1997).

Species	Scientific name/Family	Pristine	Healthy	Critical	Unknown
Southern right whale	<i>Eubalaena australis</i>		X		
Humpback whale	<i>Megaptera novaeangliae</i>		X		
Humpback dolphin	<i>Sousa chinensis</i>		X		
Common dolphin	<i>Delphinus delphis</i>	X			
Bottlenose dolphin	<i>Tursiops truncatus</i>	X			
Cape clawless otter	<i>Aonyx capensis</i>	X			
Cape fur seal	<i>Arctocephalus pusillus</i>	X			
Whitebreasted cormorant	<i>Whitebreasted cormorant</i>		X		
African black oystercatcher	<i>Haematopus moquini</i>		X		
Belman	<i>Umbrina robinsoni</i>			X	
Bronze bream	<i>Pachymetopon grande</i>		X		
Elf/shad	<i>Pomatomus saltatrix</i>		X		
Galjoen	<i>Dischistius capensis</i>		X		
Kob	<i>Argyrosomus inodorus</i>		X		
Musselcracker	<i>Sparodon durbanensis</i>		X		
Poenskop	<i>Cymatoceps nasutus</i>			X	
Red steenbras	<i>Petrus rupestris</i>			X	
Seventyfour	<i>Polysteganus undulosus</i>			X	
Stumpnoses	<i>Sparidae</i>				X
White steenbras	<i>Lithognathus lithognathus</i>			X	
Serranidae	<i>Serranidae</i>		X		
Carangidae	<i>Carangidae</i>		X		
Shallow reef sparids			X		
Deep reef sparids			X		
Bronze whaler	<i>Carcharhinus brachyurus</i>		X		
Great white shark	<i>Carcharodon carcharias</i>		X		
Hammerhead shark	<i>Sphyrna zygaena</i>		X		
Mako shark	<i>Isurus spp.</i>				X
Ragged tooth shark	<i>Carcharias taurus</i>		X		
Sand/guitar sharks	<i>Rhinobatos spp.</i>		X		
Skates	<i>Rajidae</i>				X
Smooth hounds	<i>Mustelus mustelus</i>				X
Southern spiny shark	<i>Galeorhinus galeus</i>				X
Spotted gulley shark	<i>Triakis megalopterus</i>		X		
Black/brown mussels	<i>Choromytilus meridionalis</i> <i>/ Perna perna</i>	X			
Chitons		X			
Cowrie	<i>Cypraea spp.</i>		X		
Cuttlefish	<i>Sepia sp.</i>		X		
Alikreukel	<i>Turbo sarmaticus</i>		X		
Limpets			X		
Octopus	<i>Octopus spp.</i>		X		
Periwinkles	<i>Littorinids</i>	X			
Plough shells	<i>Bullia spp.</i>	X			
Rock oysters	<i>Striostrea margaritacea</i>		X		
Scallop	<i>Pecten sulcicostatus</i>				X
Siffie	<i>Haliotis spadicea</i>		X		
Squid	<i>Loligo vulgaris reynaudii</i>				X
White mussel	<i>Donax serra</i>		X		

Species	Scientific name/Family	Pristine	Healthy	Critical	Unknown
Swimming crabs		X			
Rock crabs	<i>Plagusia</i> sp.	X			
Musselworm	<i>Pseudonereis variegata</i>			X	
Cape reef worm	<i>Gunnarea capensis</i>		X		
Sea urchin		X			
Sea cucumbers		X			
Red bait	<i>Pyura stolonifera</i>		X		

One of the greatest threats to the MPA is political pressure to open the area to coastal fishing. South Africa's reef fish are under severe threat and the no-take component of the MPA needs to remain no-take. It has been recommended by scientists and management that shore angling in parts of the MPA needs to be stopped, as this would ensure full protection of fish species within the MPA. A re-alignment and rezonation proposal to improve protection in the MPA is currently underway. The details of this proposal encourage equitable access to resources while vastly improving protection. There is a strong need for a socio-economic study to demonstrate the value and benefits of the MPA to maintaining habitat for threatened fish species, improving existing livelihoods and the alternative options available to people (such as alternative subsistence programmes).

3.3.5 Vegetation

Goukamma Nature Reserve is located in the Cape Floristic Region (CFR), one of the world's six floral kingdoms. This Floral Kingdom is globally renowned for its exceptionally rich flora containing an estimated 9 383 species of vascular plants of which almost 69% are endemic (restricted to the region) (Goldblatt & Manning 2000; Manning & Goldblatt 2012). This makes it one of the richest regions in the world in terms of botanical diversity.

The vegetation of the area has been mapped nationally at a 1: 1 000 000 scale (Mucina & Rutherford 2006) and regionally at a 1: 50 000 scale (Vlok *et al.* 2008).

3.3.5.1 National vegetation map

According to the South African Vegetation Map (Mucina & Rutherford 2006) there are five different vegetation types on the GNRC. These are listed in Table 3.3 and illustrated in Figure 3.6.

The nature reserve complex comprises mainly of Southern Cape Dune Fynbos and Freshwater Lakes, with Southern Coastal Forest restricted to the western section and Cape Coastal Lagoons and Cape Seashore Vegetation limited to the area adjacent to the mouth. All these vegetation types are classified as Least Threatened (LT) according to Mucina and Rutherford (2006). Full descriptions of vegetation types are given in Mucina and Rutherford (2006) and are not repeated here.

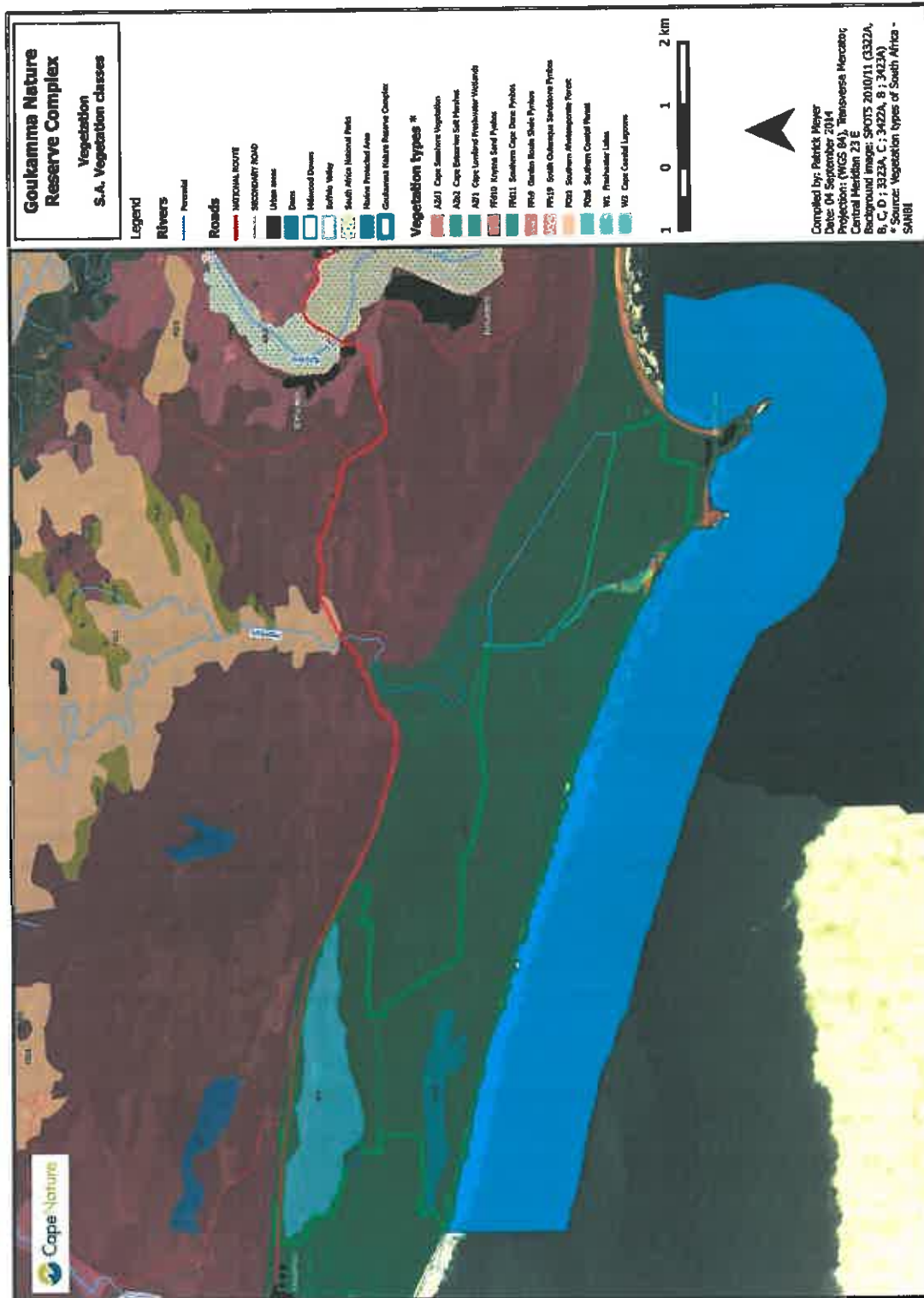


Figure 3.6: Vegetation types of the Goukamma Nature Reserve Complex based on the SA Vegetation Map (Mucina & Rutherford 2006).

Table 3.3: Vegetation types occurring on the GNRC according to the South African Vegetation Map (Mucina & Rutherford 2006). The biome, size and conservation status of each vegetation type are also given.

Vegetation Type	Biome	Ha captured	Conservation Status
Southern Cape Dune Fynbos	Fynbos	1 796.6	LT
Freshwater Lakes	Waterbodies	338.3	N/A
Southern Coastal Forest	Forest	116.6	LT
Cape Coastal Lagoons	Waterbodies	20.5	N/A
Cape Seashore Vegetation	Azonal Vegetation	6.2	LT

3.3.5.2 Regional fine-scale vegetation map

A detailed, fine-scale vegetation map was compiled at a 1:50 000 scale for the Garden Route Initiative by Vlok *et al.* (2008). This map illustrates the complexity in the landscape resulting from the merging of the biomes and the effect of key environmental factors, such as the variation in geology, annual rainfall, temperature regimes and the dependence on fire (Vlok *et al.* 2008). A total of 86 different vegetation units are identified and described in the report.

From a management point of view, this fine-scale map is more practical and useful to inform management actions. According to the map, nine vegetation units occur on the GNRC, four of which are terrestrial, three aquatic and two marine (Figure 3.7).

A brief description (taken from Vlok *et al.* 2008) as well as the conservation status (Holness *et al.* 2010) and a note on the current ecological condition of each are given below. Name changes of species documented in Manning and Goldblatt (2012) are included.

Terrestrial vegetation units

Fynbos Biome

- **Sedgefield Thicket-Fynbos (LT)** – This is the largest vegetation unit occurring on GNRC (total 1010 ha). It is a mosaic of Dune Sandplain Fynbos and Subtropical Thicket. The bush-clumps currently present in this unit are probably much more abundant and larger than they used to be as most of this habitat has been protected against fires for many years. In the past browsers probably also contained the extent of these bush-clumps, which consists mostly of dune thicket species such as *Azima tetraacantha*, *Carissa bispinosa*, *Cussonia thyrsiflora*, *Euclea racemosa*, *Olea exasperata*, *Searsia glauca*, *Sideroxylon inerme* and *Tarchonanthus littoralis*, which all can grow rapidly in the absence of fire. These bush-clumps easily overgrow the adjacent matrix Fynbos vegetation in the absence of fire. This results in the loss of the rich biodiversity of the matrix Sandplain Fynbos. Geophyte species endemic to the Sandplain Fynbos, such as *Gladiolus vaginatus* and *Satyrium princeps* will first go extinct without the correct fire regimes, but they will soon be followed by endemic shrubs such as *Erica glandulosa* ssp. *fourcadei*. Within the GNRC most of this unit is currently in a moribund state and in need of a fire.

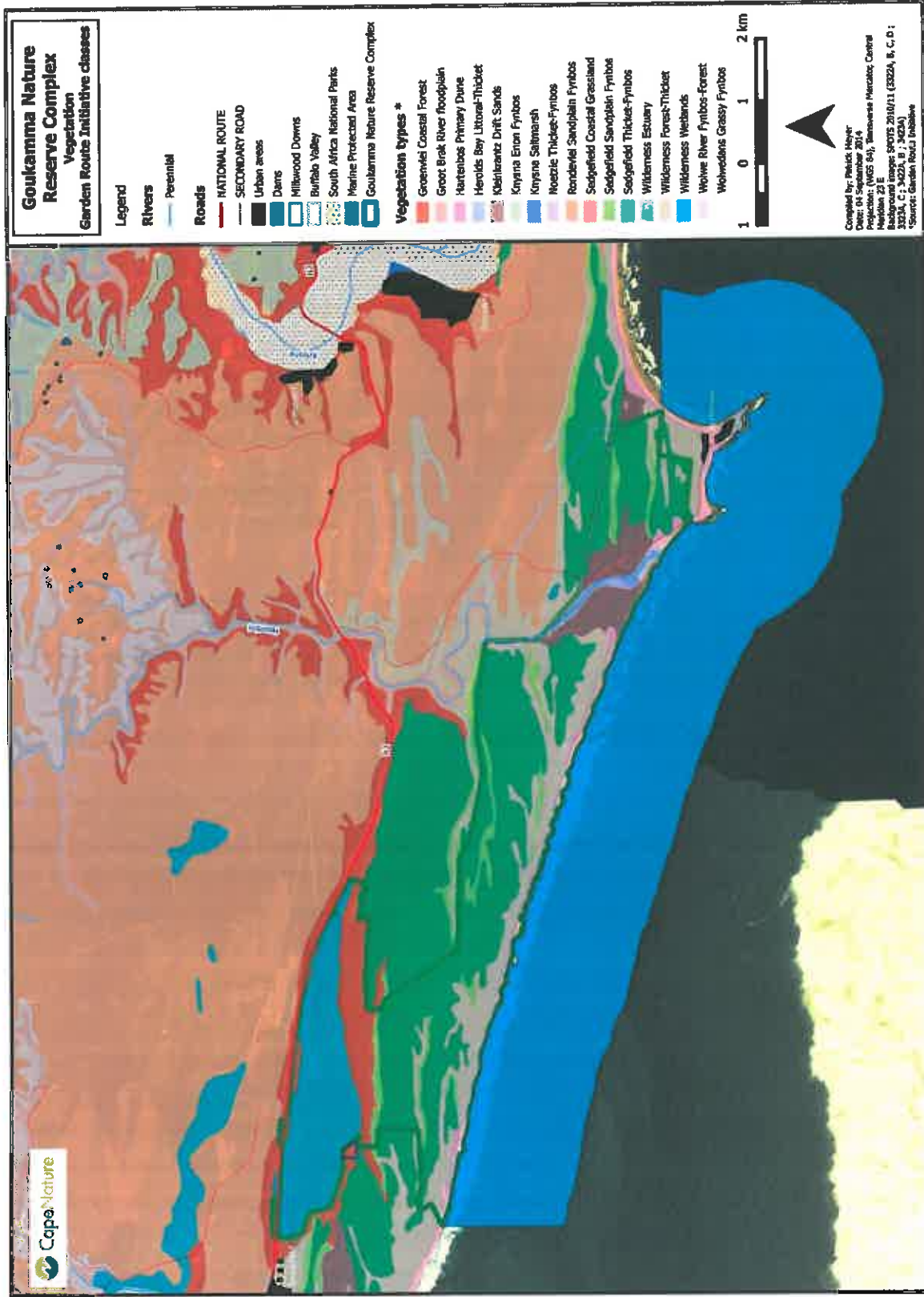


Figure 3.7: Vegetation of the Goukamma Nature Reserve Complex based on the Garden Route fine-scale map (Vlok et al. 2008).

- **Sedgefield Sandplain Fynbos (CR)** -- This unit occurs in small pockets in the GNRC, totalling 252 ha. It is an arid unit restricted to north-facing slopes of the secondary dune systems. It is a very arid and vulnerable habitat that is very sensitive to physical disturbance. It is poor in species, with the bulk of its dry sands held together by *Agathosma apiculata*, *Restio eleocharis* (previously *Ischyrolepis eleocharis*), *Olea exasperata*, *Searsia crenata* and a few graminoids such as *Stipagrostis zeyheri*. No rare species are known from this unit, but the local variant of the uncommon *Centella calcarea* may prove to be a distinct endemic taxon.

Subtropical Thicket Biome

- **Wilderness Forest-Thicket (VU)** – A total of 472 ha of this unit occur in the GNRC. This habitat is restricted to the secondary dune systems, just inland of the mobile dune systems. The matrix vegetation consists of Dune Thicket with typical species such *Azima tetracantha*, *Carissa bispinosa*, *Cassine peragua*, *Euclea racemosa*, *Lycium cinereum*, *Searsia crenata*, *Searsia pterota*, *Mystroxydon aethiopicum*, *Muraltia spinosa* (previously *Nylandtia spinosa*), *Putterlickia pyracantha* often forming impenetrable stands as these shrubs are usually woven together with creepers such as *Asparagus aethiopicus*, *Cynanchum ellipticum*, *Rhoicissus digitata*, *Sarcostemma viminalis* and *Solanum quadrangulare*. A forest like community of trees such as *Olinia ventosa*, *Pterocelastrus tricuspidatus*, *Sideroxylon inerme* and *Tarchonanthus littoralis* (previously *T. camphoratus*) occur in the protected dune slack areas. Where these dune slack areas are deep these trees form a dense closed canopy that is well lifted above ground level, thus qualifying to be called a “Milkwood forest”. These forests are never very wide, although they can be quite long. This unit is in a pristine condition.

Forest Biome

- **Groenvlei Coastal Forest (VU)** - This habitat is restricted to deep sandy soils in the lowlands with 180 ha occurring in the GNRC. It is best developed next to extensive water bodies, where fires originate and burn upslope. The tall closed canopy consists of tall *Afrocarpus falcatus* often emerging above the canopy. It also has deciduous trees such as *Celtis africana* often locally abundant. It is most easily recognized as it has trees with a subtropical affiliation such as *Calodendrum capense*, *Ekebergia capensis*, *Strychnos decussata* and even sometimes *Olea europaea* spp. *africana* present. The population of *Celtis africana* on the nature reserve may be of particular interest, as it may be the southern-most population of a species which occurs as far north as the equator. Such peripheral populations often contain unusual genetic material within the species. No rare plant species are known from this unit, but it is the habitat of the rare Knysna Woodpecker (*Campethera notata*). These forests were probably more extensive in the past as they were initially not afforded much protection. This unit is in a near pristine condition on the southern side of Groenvlei, but the section east of the vlei has been transformed in the past and is currently in a very slow state of recovery.

Aquatic vegetation units

- **Wilderness Wetlands (LT)** – Groenvlei Lake falls entirely in this unit, as well as a small wetland on the Buffalo Valley property, and covers an area of 385 ha. Species such as *Phragmites australis* and *Typha capensis* are abundant and sound indicators of this unit. It is not particularly rich in species and no endemic plant species are known from it. It is, however, an important habitat for a range of aquatic wildlife. Not much is known about the ecological role of fire in this habitat, but it may well be required periodically to control the growth of tall species (such as *Phragmites*) in the absence of large herbivores, which probably curbed their growth in the past. The unit is in a very good condition.
- **Wilderness Estuary (LT)** – This unit is 37 ha in size on GNRC. According to Vlok *et al.* (2008), every estuary in the Garden Route domain should probably be recognized as a distinctive unit as they vary much in ecological processes and the fauna present. However, all the estuaries in the Western Cape have been lumped into the Wilderness Estuary unit, as the plant species present in this habitat do not vary much. Differentiating the Estuary habitat from the upland River and floodplain habitat is not easy. The boundary between these two units changes as freshwater input from the inland competes with saltwater penetration from the sea. Useful indicators to determine this boundary is the presences of submerged aquatic species (e.g. *Potamogeton pectinatus*, *Ruppia maritima*, *Zostera capensis*) and plant species such as *Cotula coronopifolia*, *Juncus kraussii*, *Limonium scabrum*, *Scirpus maritimus*, *Suaeda caespitosa* and *Tinopyrum distichum* along the outer edge. The Goukamma Estuary falls within this unit.
- **Groot Brak River and Floodplain (EN)** – Only 10 ha of this unit occur in the GNRC. *Prionium serratum* is a distinctive species of this habitat type, but within the Garden Route domain it does not form extensive stands, as it does in the more western Breede - and Goukou River systems. This species does not occur within the boundaries of the GNRC, as the part of the river flowing through the reserve is salt because of the penetration from the sea. The vegetation present varies much, from Fynbos-Forest ecotone dominated communities in the upper areas where large shrubs such as *Brachylaena neriifolia*, *Laurophyllus capensis*, *Psoralea affinis* and *Virgilia divaricata* are abundant, to true forest communities - with species such as *Afrocarpus falcatus*, *Calodendrum capense*, *Cunonia capensis*, *Nuxia floribunda*, *Platylophus trifolius* and *Searsia chirindensis* abundant within the floodplain zone. Also rather typical of this habitat is *Cliffortia odorata* that often develops extensive mats along the embankments of the river systems, but this may be an artefact of altered flow regimes.

Marine Biome

- **Hartenbos Primary Dune (EN)** – About 107 ha of this unit occur in the GNRC. The Hartenbos Primary Dune unit is by far the most extensive and it extends westwards to the Breede River. It has few species present, mostly *Ammophila arenaria* (alien), *Arctotheca populifolia*, *Gazania rigens*, *Hebenstreitia cordata*, *Ipomoea pes-caprae*, *Senecio elegans*, *Scaevola plumieri*, *Tetragonia decumbens* and *Thinopyrum distichum* are present. The plants tend to be sparse, but just inland (secondary dunes) the vegetation becomes rapidly more dense and taller, with shrubs such as *Metalasia muricata*, *Morella cordifolia*,

Passerina rigida, *Searsia crenata* and often somewhat stunted *Sideroxylon inerme* present. The latter constitutes the transition to Dune Thicket vegetation and the cut-off point between these two units is often difficult to determine. The absence of species such as *Scaevola plumieri*, *Tetragonia decumbens* and *Thinopyrum distichum* is useful to indicate the transition from Primary Dune to Dune Thicket units. The Primary Dune units act as a precursor to the Dune Thicket units. Wherever they are absent, often due to stabilization of the supporting Drift Sands habitat, wave action starts eating into the secondary dunes, undermining the sands of the Dune Thicket. *Gladiolus gueinzii* is the only uncommon plants species present in this unit.

- **Kleinkrantz Driftsands (LT)** – This unit belongs to the marine component. It is 142 ha in extent within the GNRC. Being a natural area where windswept sand from the sea is deposited and periodically released back to the sea, this is not a habitat in which many plant species flourish. After good rain some annuals such as *Senecio elegans* may be locally abundant in spring, but not for long. In its natural state this habitat is largely devoid of vegetation. Its natural sand movement did not allow for development of many coastal areas and this habitat was therefore stabilized, mostly by alien species *Acacia cyclops* and *Acacia saligna* in the previous century.

During a survey conducted in October 2000, 180 species of marine algae were collected from the GNRC coastline (Unpublished data, Scientific Report on the SANPAD Phycology-expedition to the Goukamma coastal Reserve, 12-15 October 2000). No further surveys as comprehensive as this have been conducted.

Based on specimens collected and observations recorded on the reserve and adjacent areas, the current plant species list for the GNRC stands at 263 (and a marine count of 180) plant species (including subspecies and varieties). This list is by no means complete and is constantly being updated through baseline data collection. Full species lists are not provided here. If required, species lists are available on request from Scientific Services, Assegaaibosch Nature Reserve, Jonkershoek, Stellenbosch.

There are seven threatened plant species known to occur within the GNRC (Table 3.4; Raimondo *et al.* 2009; www.sanbi.org.za). These include species listed as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) and Declining. The species are being monitored with the assistance of the Custodians of Rare and Endangered Wildflowers (CREW) groups.

Table 3.4: Plant species of conservation concern recorded from the Goukamma Nature Reserve Complex and adjacent areas.

Scientific Name	Family	Threatened Status according to Raimondo <i>et al.</i> (2009)	Distribution and threats description (Information obtained from the Red Data List on the South African National Biodiversity Institute's (SANBI) website (www.sanbi.org.za)).
<i>Satyrium princeps</i>	Orchidaceae	VU C2a(i)	Wilderness to Port Alfred. This species was once quite common, but the population has been much reduced by habitat loss. Remaining subpopulations tend to be small and confined to small fragments of natural vegetation. The largest subpopulation occurs in the Goukamma Nature Reserve, where there are about 450 plants in scattered clumps. There are currently seven known remaining subpopulations, but it is suspected that a number of other subpopulations remain, and continued surveys are needed. Population decline due to ongoing habitat loss is continuing.
<i>Eulophia speciosa</i>	Orchidaceae	Declining	Western Cape to tropical East Africa and Sudan. Declines in wild subpopulations have been observed as a result of harvesting for the medicinal trade. It is common in muthi markets and an overall, continuing decline is suspected. It is still too common to list as NT.
<i>Pentameris barbata</i> subsp. <i>orientalis</i> (previously <i>Pentaschistis barbata</i> subsp. <i>orientalis</i>)	Poaceae	CR B1ab(i,ii,iii,iv,v)+ 2ab(i,ii,iii,iv,v); D	A highly range-restricted subspecies, known from two subpopulations in the Knysna area. The subpopulation inside the Goukamma Nature Reserve was rediscovered following a fire in the western sector of the reserve. The second subpopulation (outside the reserve) is severely threatened by invasive alien plants and urban development. There are fewer than 100 mature individuals of this subspecies extant.
<i>Erica chloroloma</i>	Ericaceae	VU B1ab(ii,iii,iv,v)+ 2ab(ii,iii,iv,v)	Wilderness to the Fish River Mouth. Between 10 and 15 severely fragmented subpopulations continue to decline due to ongoing habitat loss and fragmentation, as well as competition from unmanaged alien invasive plants. Populations of the species around Knysna have disappeared, mostly due to fragmentation by coastal developments, invasive alien plant infestations and lack of fire. There is a large subpopulation still surviving in the Goukamma Nature Reserve, but ongoing clearing of alien invasive plants is critical.
<i>Erica glandulosa</i> subsp. <i>fourcadei</i>	Ericaceae	VU B1ab (ii,iii,iv,v)	Mossel Bay to Cape St Francis. This taxon is restricted to highly transformed and fragmented coastal lowlands. Many recent records indicate that this species is more common than previously estimated; however, except for the area between Sedgefield and Knysna, where this species is still quite common, particularly in the Goukamma Nature Reserve, all other subpopulations are isolated due to habitat loss and fragmentation.
<i>Erica glumiflora</i>	Ericaceae	VU B1ab(i,ii,iii,iv,v)	Wilderness to East London, and extending inland around Grahamstown. The major threat to this species is ongoing habitat loss to urban, coastal and industrial development. Much

Scientific Name	Family	Threatened Status according to Raimondo <i>et al.</i> (2009)	Distribution and threats description (Information obtained from the Red Data List on the South African National Biodiversity Institute's (SANBI) website (www.sanbi.org.za)).
			of its habitat is also infested by unmanaged invasive alien plants, particularly <i>Acacia cyclops</i> . In Goukamma Nature Reserve, it occurs at two sites on a dune ridge in the western sector.
<i>Gladiolus vaginatus</i>	Iridaceae	VU B1ab(iii)	Cape Peninsula to Knysna. Formerly a very common species, now remaining mostly as small isolated subpopulations on fragments of natural vegetation within its lowland distribution range. Severely fragmented and declining due to crop cultivation, coastal development and alien invasive plants.

3.3.6 Fire regime

Various historical accounts of wild fire as well as managed fire depict the area as being part of a fire zone. The accounts date back to the 15th century seafarers who noted large smoke clouds in the vicinity of the Outeniqua Mountains. In more recent centuries the practice of annual burning of lands to protect surrounding forest from fire and to improve grazing were noted.

In February 1869, the "Great Fire" raged through the Knysna district burning out large areas of the indigenous forest and bush. Accounts of this fire have, over the years, grown out of proportion and have led to the belief that the whole of the Knysna district was once covered by indigenous forest. This is not true as there are large areas in the district that are not suitable for forest generation, one in particular being the sand-dune area, which makes up most of the reserve.

The only reference to true indigenous forest that might have existed in the Goukamma Reserve area is taken from Phillips (1960). In describing the "Great Fire" of 1869 he says "With the exceptions of the forests at Kwaaibrand, portions of Koopmansbosch and Robbehoek, the forests escaped lightly". The "Robbehoek" referred to is probably found at the mouth of the Goukamma River.

It is therefore possible that true forests did exist in the Goukamma River area and that they were destroyed by fire in 1869, this in turn could have resulted in the formation of drift sands, which were later reclaimed by the Forestry Department from 1921 to 1956.

The 'Buffelsbaai Bosreservaat' was burnt artificially as far back as 1907. A block-burning programme was implemented from 1962 – 1968 (Van der Merwe 1976). This was however stopped due to financial constraints, but internal and boundary firebreaks were maintained.

Natural fires have since occurred but were extinguished by management. Lightning has accounted for these fires which occurred from November – March. Other historical records state:

- According to Martin (1960) the eastern and south eastern shores of Groenvlei were burnt on a regular basis to remove the sedge.

- Accidental fires have burnt considerable portions of the northern shore of Groenvlei such as in December 1951 (Martin 1960).
- Schwarz (1905) noted that the forest on the southern side of Groenvlei was burnt on a yearly basis which reduced the forest while the grass-covered hills were reduced to sand dunes because of regular burning.
- According to Van der Merwe (1976) he started a fire and slashing programme in 1969 to ascertain the management requirements for veld management. These test plots were placed on the southern slope of the main Groenvlei dune.
- Groenvlei experiences regular fires along the northern shoreline as a result of negligence by members of the public or ignitions by the steam train that runs along the N2 highway adjacent to the vlei.

A block burning programme was re-initiated in 2002 when a block along the northern boundary was burnt, and subsequently controlled burns have taken place in 2004 and 2005. Reasons for the fires were to reduce fuel loads along boundaries, to prepare for ecological burns and for alien vegetation management.

No controlled burns have been conducted since 2005, but a fire occurred east of the main road to Buffalo Bay during December 2011 following a vehicle accident. Figure 3.8 shows the fire history map for the GNRC. Internal and boundary firebreaks have been well maintained. The fire management blocks have been modified to take into account natural forest areas and additional properties which have been included in operational management.

An up to date Fire Management Plan is available which details fire management actions, plans, and responses.

The GNRC is a member of two Fire Management Units, Ruigtevlei and Western Heads, which fall within the Southern Cape Fire Protection Association (SCFPA) and actively assists with management of fire in these areas.

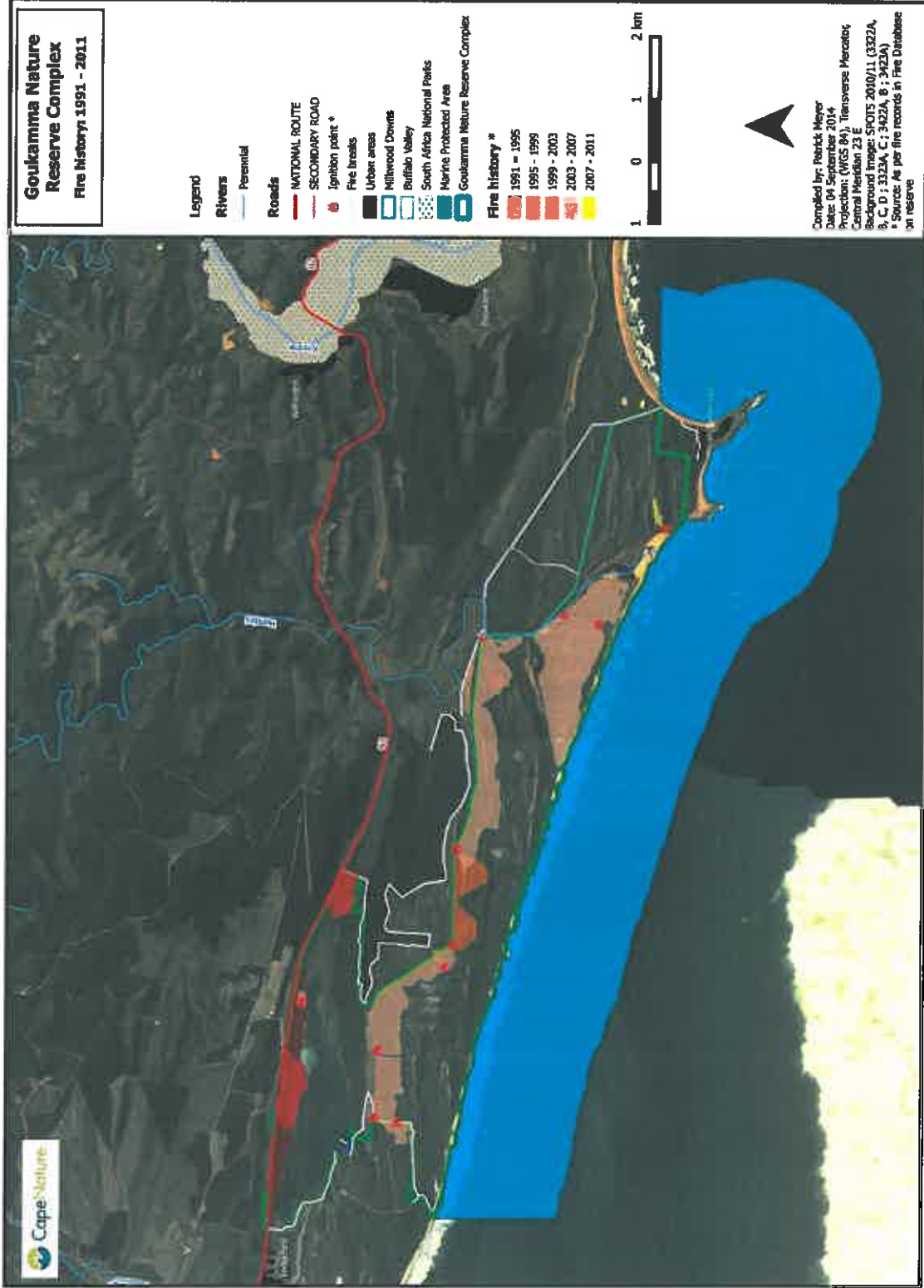


Figure 3.8: Fire history map of the Goukamma Nature Reserve Complex.

3.3.7 Invasive species

3.3.9.1 Invasive alien plant species

Recent focussed efforts to map alien species have revealed approximately 34 alien species occurring on GNRC of which *Acacia cyclops* and *Acacia saligna* are the most threatening in terms of spread and numbers (Table 3.5). The major alien plant threats to the GNRC are due to infestations from neighbouring properties in the west and north and include various ornamental species.

Table 3.5: Invasive alien plant species on the Goukamma Nature Reserve Complex and adjacent areas.

Scientific name	Vernacular name	Family	Status
<i>Acacia cyclops</i>	Red eye/Rooikrans	Fabaceae	Declared invader
<i>Acacia mearnsii</i>	Black wattle/Swartwattel	Fabaceae	Declared invader
<i>Acacia melanoxylon</i>	Blackwood	Fabaceae	Declared invader
<i>Acacia saligna</i>	Port Jackson/Goudwilger	Fabaceae	Declared invader
<i>Acacia longifolia</i>	Long-leaved wattle	Fabaceae	Declared weed
<i>Ammophila arenaria</i>	Marramgrass	Poaceae	Declared
<i>Anredera cordifolia</i>	Madiera vine	Basellaceae	Declared weed
<i>Arundo donax</i>	Giant reed (Spaansriet)	Poaceae	Declared weed
<i>Briza major</i>	Love grass	Poaceae	Declared weed
<i>Cestrum laevigatum</i>	Inkberry	Solanaceae	Declared weed
<i>Cortaderia selloana</i>	Pampas grass	Poaceae	Declared weed
<i>Datura stramonium</i>	Common thorn apple	Solanaceae	Declared weed
<i>Eucalyptus</i> spp.	Bluegums/Bloekom	Myrtaceae	Declared invader
<i>Hakea sericea</i>	Silky Hakea/Syerige hakea	Proteaceae	Declared weed
<i>Lagurus ovatus</i>	Hare's Tail	Poaceae	Declared weed
<i>Leptospermum laevigatum</i>	Australian myrtle	Myrtaceae	Declared weed
<i>Lantana camara</i>	Lantana	Verbenaceae	Declared invader
<i>Lolium perenne</i>	Perennial ryegrass	Poaceae	Declared weed
<i>Myoporum tenuifolium</i>	Manatoka	Myoporaceae	Declared invader
<i>Opuntia ficus-indica</i>	Sweet prickly pear	Cactaceae	Declared weed
<i>Opuntia monacantha</i>	Drooping prickly pear	Cactaceae	Declared weed
<i>Paraserianthes lophantha</i>	Stink bean	Fabaceae	Declared weed
<i>Pennisetum clandestinum</i>	Kikuyu grass/Kikoejoegrass	Poaceae	Proposed Declared invader
<i>Pinus pinaster</i>	Cluster pine/Trosden	Pinaceae	Declared invader
<i>Pinus radiata</i>	Radiata pine/Radiataden	Pinaceae	Declared invader
<i>Plantago lanceolata</i>	English plantain	Plantaginaceae	Declared weed
<i>Raphanus raphanistrum</i>	Wild mustard	Brassicaceae	Proposed Declared weed
<i>Rubus cuneifolius</i>	American bramble	Rosaceae	Declared weed
<i>Salvinia molesta</i>	Kariba weed/Watervaring	Salviniaceae	Declared weed
<i>Sesbania punicea</i>	Red sesbania	Fabaceae	Declared weed
<i>Solanum elaeagnifolium</i>	Silver-leaf bitter apple	Solanaceae	Declared weed
<i>Solanum mauritianum</i>	Bugweed	Solanaceae	Declared weed
<i>Solanum sisymbriifolium</i>	Dense-thorned bitter apple	Solanaceae	Declared weed
<i>Tagetes minuta</i>	Khaki weed	Asteraceae	Declared weed

The GNRC has been subdivided into management units (or mini-compartments), using the mapping methodology developed for WfW (Figure 3.9). These management units have been drawn using natural features (e.g. crest of mountains; ridges; rivers) or infrastructure (e.g.

roads, boundary fences, etc.) as boundaries, and a limit of 20 person days per contractor team required to clear the area. They are known as NBAL's (Natural, Biological Alien). All this information has been captured in GIS.

A database has been compiled for the area in MS Excel format. For each NBAL, the different species occurring within the area, their densities, age classes and method of clearing are captured (Sp.1 to Sp.10); with a calculation of the total density at the end, as well as the clearing date, costing, contract number and clearing stage (e.g. initial, 1st follow-up, 2nd follow-up, etc.).

This database is compatible with the GIS spatial layer and has been populated with information obtained from reserve field rangers and managers as well as from the WIMS system. This system is used for alien vegetation management analysis and planning (e.g. to determine the extent, density and age class of invasive alien plant species on the reserve, for comparison with previous years). It is however, essential to continuously update this database with new/recently verified information on a monthly basis during reserve monthly planning sessions.

Alien vegetation is eradicated by reserve management according to a management clearing unit plan which is captured in the Annual Plan of Operations (APO). Funding is obtained through the WfW programme as well as the CapeNature Integrated Catchment Management project.

An active WfW project is registered and annual follow-ups and initial clearings ensure that the density of alien species remains low. The majority of the reserve, comprising the area north of Buffalo Bay and east of the estuary is clear of alien species. The old drift sands west of the Goukamma station, which were stabilised by alien species and have been the focus of intense clearing efforts using fire and mechanical means, have largely been cleared save for the primary dunes. The successes of the WfW project within the reserve boundaries, has allowed the project to expand to neighbouring properties to address alien infestation threats.

Biological control of Port Jackson was started in 1988 when *Uromycladium tepperianum* the gall forming fungus, was introduced to trees in the areas around the estuary. It did not appear to do very well and due to a communications problem most infected trees were cut down. The area was re-infected in 1994. Today the fungus is present but appears to have largely failed in function, possibly due to the absence of severe stress situations such as drought. During the mid-1990s to 2004 low levels of alien vegetation clearing took place. When initial clearing re-started in 2004, 27 ha of dense adult Port Jackson was felled and burned in April 2005. Follow-up clearing in areas that have been felled and burnt takes place on an annual basis and good progress at eradicating these species is being made through the WfW project. As eradication takes place, the area is colonised and vegetated by indigenous plants.

Salvinia molesta (Kariba weed) occurs within the Goukamma River. *Cryptobagous salviniae* (leaf-feeding weevil) was introduced during 1988. Infestation is low at present, but annual assessment of the population should be undertaken.

Melanterius maculatus, a natural enemy of *Acacia mearnsii* (blackwattle) has been released in the lower reaches of the Goukamma River, but upstream from the GNRC. Two release sites have been populated on different release dates, one year apart.

Pinus spp. plantations surround the GNRC but a good buffer of fynbos and forest patches of varying widths exist between them and most boundaries. Plantations are largely well managed, but escapee seeds do pose a problem in terms of potential infestation.

Recent work outside of the WfW project has focussed on mapping emerging alien species and the removal of two species, namely *Cestrum laevigatum* (inkberry), and *Yucca* sp.

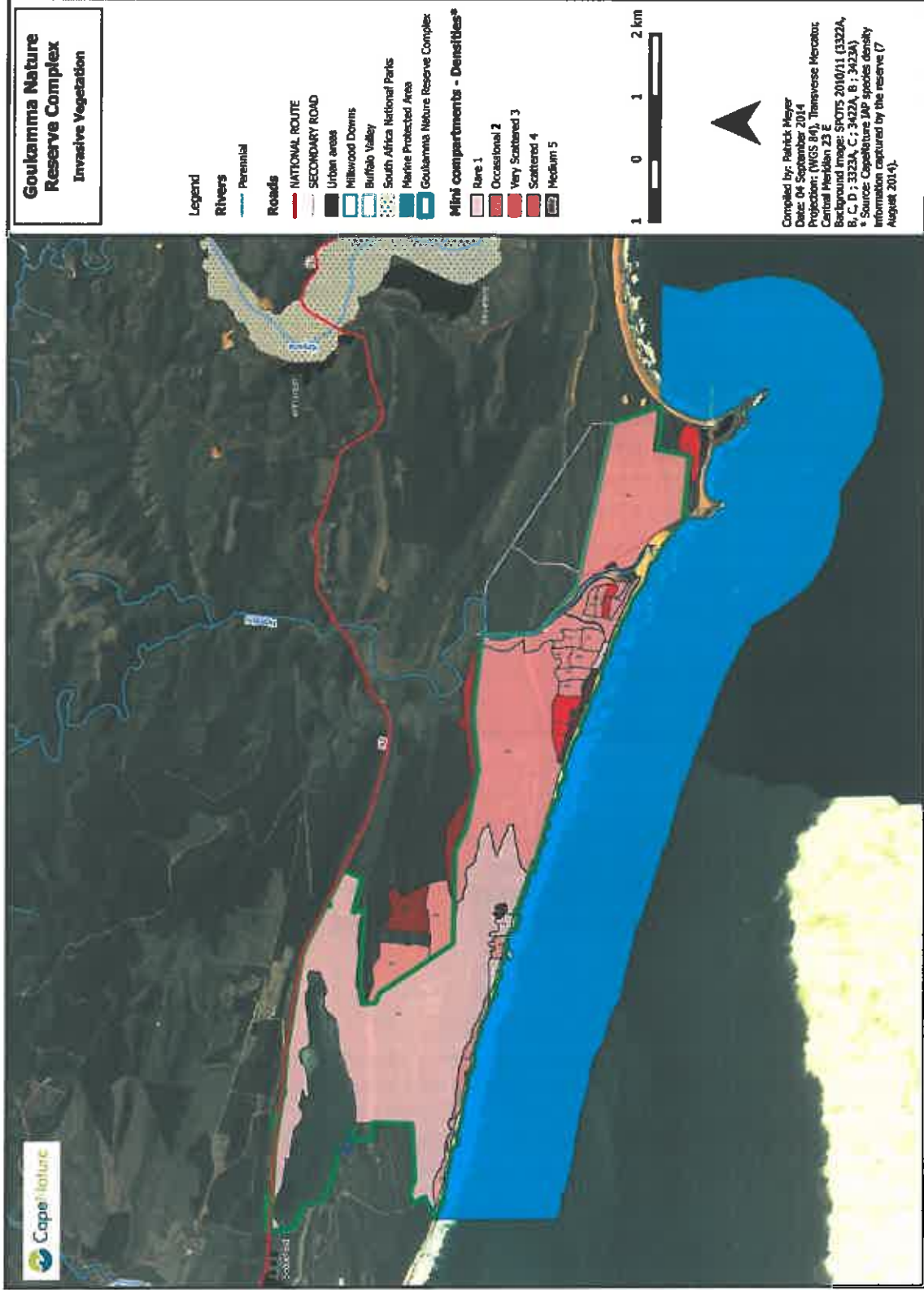


Figure 3.9: Invasive vegetation map and management compartments of the Goukamma Nature Reserve Complex.

3.3.9.2 Invasive alien animal species

Five alien fish species are present in the Groenvlei Lake. Four of these species were introduced legally. The large-mouth black bass (*Micropterus salmoides*) was introduced from America in 1934 (Harrison 1936) for angling purposes and were followed by bluegill sunfish (*Lepomis machrochirus*), which were introduced as a source of food for the bass. Many years later (February 1976), Mozambique tilapia (*Oreochromis mossambicus*) was introduced to combat the excessive algal growth in the lake. Later mosquito fish (*Gambusia affinis*) was also introduced as a mosquito control agent and forage for bass. These were all legal stockings by the Inland Fisheries section of firstly the Cape Provincial Administration, and from 1952, the Cape Nature Conservation Department, with all species subsequently establishing reproducing populations in the vlei. Large-mouth bass have thrived in Groenvlei, and support regional bass angling tournaments. The Groenvlei fish community was stable for many years, with co-existence of the indigenous and alien fish species. Both indigenous fish species are open water species and school in great numbers and are adept at coping with fish predators, factors which have allowed their co-existence with predatory species such as largemouth bass and bluegill sunfish. Unfortunately, in about 1997, an unknown person illegally released carp (*Cyprinus carpio*) into the lake. The illegal introduction of carp in the 1990s, and their recent increase in numbers based on anecdotal reports is of concern, because of the capacity of this species to proliferate and cause habitat degradation (reduction in aquatic plants, increases in turbidity) through their feeding habits (Roberts & Tilzey 1997). In addition, carp degrade the natural habitat of other fish by disturbing the lake bottom, clouding the water and thereby reducing visibility which hinders other fish from finding food; they prey on the eggs of other fish and carp have introduced harmful fish parasites into local waters.

Reserve management from 2000-2007 tried to reduce carp numbers through monthly gill netting of shoreline weedbed areas. This seemed to reduce carp numbers, but then netting stopped due to other reserve management priorities and the theft of gill nets. A project to control carp has again been started by reserve management. Large numbers of predatory bass and bluegill likely provide the most effective options for carp control, but targeted spearfishing and netting of carp adults prior to spawning time (September) would also be of value. A large-scale piscicide operation to kill all carp, will kill all fishes too, including the conservation worthy populations of *Gilchristella aestuaria* and *Antherina breviceps*. It is not recommended due to the scale and cost of the project and the environmental risk. A research project which measures Catch Per Unit Effort (CPUE) and incorporates a mark recapture aspect (spaghetti tagging) has been initiated with local carp angling enthusiasts. This project, coupled with netting data from reserve management control efforts, should quantify the carp numbers in Groenvlei. A research project is urgently required to quantify the impact of carp on the ecology of the vlei, with recommendations for future management.

The alien Mediterranean mussel (*Mytilus galloprovincialis*) occurs in the intertidal zone of the rocky shoreline. Occurrences of red tide do occur in the MPA. As more and more knowledge is gained around micro-organisms in the marine environment so do records of alien species. A recent red tide bloom was caused by an alien species.

Low numbers of alien mammals have been recorded and include feral pigs, domestic cats, dogs and mules. These animals have been removed as soon as possible.

3.3.8 Mammalian fauna

According to the State of Biodiversity Report (Birss & Palmer 2012) CapeNature focuses its monitoring efforts on endemic, threatened, keystone and alien invasive species which are collectively termed “Priority Species”. Priority species are monitored in three ways namely to attain levels of diversity, distribution and abundance. The remaining indigenous species are not excluded and distribution data is collected for all indigenous species that are not listed as priority species. The GNRC mammalian species list is updated regularly through baseline data collection.

The GNRC comprises of terrestrial, fresh water and salt water environments and therefore supports a diverse range of mammal species. A total of 54 mammal species have been recorded for the GNRC ranging from the terrestrial pygmy mouse (*Mus minutoides*) to the humpback whale (*Megaptera novaeangliae*) of the ocean. Antelope species such as the Cape grysbok (*Raphicerus melanotis*) and bushbuck (*Tragelaphus scriptus sylvaticus*) are frequently observed on the reserve and surrounding area while the elusive and vulnerable blue duiker (*Philantomba monticola*) was last recorded in 1998. Various predators including the Cape clawless otter (*Aonyx capensis*), caracal (*Caracal caracal*), honey badger (*Mellivora capensis*), water mongoose (*Atilax paludinosus*), small spotted genet (*Genetta genetta*), large-spotted genet (*Genetta tigrina*) and leopard (*Panthera pardus*) are also present on the reserve and surrounding area.

Bat observations and/or specimens collected over time on GNRC reveal three species namely the Cape serotine bat (*Neoromicia capensis*), Wahlberg’s epauletted fruit bat (*Epomophorus wahlbergi*) and the Egyptian free-tailed bat (*Tadarida aegyptiaca*).

In terms of the other small mammals, species of conservation concern are the white-tailed mouse (*Mystromys albicaudatus*) which is listed as an Endangered species according to the South African Red data book as well as the Knysna long-tailed forest shrew (*Myosorex longicaudatus longicaudatus*) that is listed as Near Threatened (NT) for which there are no known observation/specimen records for both species. There is a deficiency of distribution data in terms of the smaller mammals (bats, shrews and mice) that are likely to occur on the reserve and confirming the presence of these species through appropriate surveys should be carried out in order to gain an insight into their specific habitat requirements and ecological role.

Indigenous large mammal species known to have occurred historically in the GNRC and surrounding area the African elephant (*Loxodonta africana*), African buffalo (*Syncerus caffer caffer*) and hippopotamus (*Hippopotamus amphibius capensis*) (Skead 1982). Bones of hippopotamus have been found in close proximity to Groenvlei Lake (Rhett Hiseman, pers. comm.).

A total of 17 confirmed records of Cetaceans (whales and dolphins) occur within the MPA. From time to time carcasses of both whale and dolphins wash up on the shores of the MPA.

In terms of human wildlife conflict, species that require monitoring and, in some cases, management, are:

- the endemic Cape dune mole rat (*Bathyergus suillus*) as this species’ burrowing nature does cause some disturbance to reserve infrastructure and therefore control methods should be implemented in order to prevent further damage.

- the vervet monkey (*Cercopithecus pygerythrus*) and bush pig (*Potamochoerus larvatus koiropotamus*) could potentially become a nuisance specifically around tourism infrastructure
- genets (*Genetta* spp.), which frequent tourism facilities and are easily befriended, should be monitored for human interactions at specific sites.

It is imperative that management identifies the cause or potential cause, of human wildlife conflict before a problem arises or exacerbates, and implement effective management measures to reduce or eliminate the conflict.

Table 3.6: Mammal species of conservation concern that occur, are likely to occur or which may have occurred on the Goukamma Nature Reserve Complex.

Species	Common name	International Union for Conservation of Nature (IUCN) Category (IUCN 2011)	South African Red Data Book Category (Friedman & Daly 2004)
<i>Amblysomus corriae corriae</i>	Fynbos golden mole (East)	Near Threatened (NT)	Near Threatened (NT)
<i>Dasymus incomtus</i>	Water rat	Not Evaluated (NE)	Not Evaluated (NE)
<i>Mystromys albicaudatus</i>	White-tailed mouse	Endangered (EN)	Endangered (EN)
<i>Panthera pardus</i>	Leopard	Near Threatened (NT)	Least Concern (LC)
<i>Mellivora capensis</i>	Honey badger	Least Concern (LC)	Near Threatened (NT)
<i>Cephalophus monticola</i>	Blue duiker	Least Concern (LC)	Vulnerable (V)
<i>Raphicerus melanotis</i>	Cape grysbok	Least Concern (LC)	Least Concern (LC)
<i>Poecilogale albinucha</i>	African striped weasel	Least Concern (LC)	Data Deficient (DD)
<i>Aonyx capensis</i>	African clawless otter	Least Concern (LC)	Least Concern (LC)
<i>Atilax paludinosus</i>	Marsh mongoose	Least Concern (LC)	Least Concern (LC)
<i>Myosorex longicaudatus longicaudatus</i>	Knysna long-tailed forest shrew	Vulnerable (V)	Near Threatened (NT)
<i>Myosorex varius</i>	Forest shrew	Least Concern (LC)	Data Deficient (DD)
<i>Suncus infinitesimus</i>	Least dwarf shrew	Least Concern (LC)	Data Deficient (DD)
<i>Rhinolophus capensis</i>	Cape horseshoe bat	Least Concern (LC)	Near Threatened (NT)
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	Least Concern (LC)	Near Threatened (NT)
<i>Miniopterus schreibersii</i>	Schreiber's long-fingered bat	Near Threatened (NT)	Near Threatened (NT)
<i>Myotis tricolor</i>	Temminck's hairy bat	Least Concern (LC)	Near Threatened (NT)
<i>Mirounga leonine</i>	Southern elephant seal	Least Concern (LC)	Endangered (EN)
<i>Megaptera novaeangliae</i>	Humpback whale	Least Concern (LC)	Near Threatened (NT)
<i>Tursiops aduncus</i>	Indian Ocean bottlenose dolphin	Data deficient (DD)	Vulnerable (V)
<i>Sousa chinensis</i>	Indo-Pacific humpbacked dolphin	Near Threatened (NT)	Vulnerable (V)
<i>Balaenoptera edeni</i>	Bryde's whale	Data deficient (DD)	Vulnerable (V)

3.3.9 Avifauna

The GNRC has six broad avifauna habitats namely, freshwater lake, coastal lagoon and estuary, sandy/rocky shores, open sea, dune fynbos, and coastal forest. Two hundred and forty-three species of birds have been recorded for the reserve, constituting just more than 40% of the 599 species of birds recorded for the Western Cape Province (Shaw & Waller 2012). Thirteen of the listed species are threatened (Table 3.7) either on a regional or global scale. Using South African Bird Atlas reporting rates as a proxy for abundance the reserve is only important for the Knysna woodpecker (*Campethera notata*). Cape cormorant (*Phalacrocorax capensis*), Knysna warbler (*Bradypterus sylvaticus*) and half-collared kingfisher (*Alcedo semitorquata*) were recorded less frequently while the remaining threatened species used the reserve on an ad hoc basis and could be described as vagrants to the reserve (SABAP2 2014).

Table 3.7: Avifaunal species of national and/or international conservation concern that occur on the Goukamma Nature Reserve Complex.

English name	Scientific name	IUCN Conservation Status (IUCN 2013)	South African Conservation Status (Taylor 2014)
Cape cormorant	<i>Phalacrocorax capensis</i>	Endangered	Endangered
Black harrier	<i>Circus maurus</i>	Vulnerable	Endangered
Martial eagle	<i>Polemaetus bellicosus</i>	Vulnerable	Endangered
African marsh harrier	<i>Circus ranivorus</i>	Least Concern	Endangered
Cape gannet	<i>Morus capensis</i>	Vulnerable	Vulnerable
Knysna warbler	<i>Bradypterus sylvaticus</i>	Vulnerable	Vulnerable
Greater painted snipe	<i>Rostratula benghalensis</i>	Least Concern	Vulnerable
Lanner falcon	<i>Falco biarmicus</i>	Least Concern	Vulnerable
Verreaux's eagle	<i>Aquila verreauxii</i>	Least Concern	Vulnerable
Eurasian curlew	<i>Numenius arquata</i>	Near Threatened	Near Threatened
European roller	<i>Coracias garrulus</i>	Near Threatened	Near Threatened
Knysna woodpecker	<i>Campethera notata</i>	Near Threatened	Near Threatened
Half-collared kingfisher	<i>Alcedo semitorquata</i>	Least Concern	Near Threatened

Three surveys of waterbirds are/have been undertaken on various sections of the reserve. The longest running survey is of the waterbirds on Groenvlei Lake situated in the northern section of the reserve. This survey was initiated in 1979 and still continues. Unfortunately counting methodologies and frequencies of counts have not been consistent over the monitoring period, only allowing analysis of subsets of data and complicating analysis. The following problems were encountered with the data:

1. Between 1979 and 1989 monthly counts (some months – very few were skipped) were done for only a subset of species.
2. During 1990 monthly counts of all species were carried out for the first six months.
3. From July 1990 to December 1995 no counts were done.
4. From January 1996 to July 2014 counts of all species were done at least biannually (one in January/February and one in June/July).

The other two bird surveys include the section of coast between the Goukamma River mouth to the reserve boundary which was initiated in 1998 and the coastal survey that was initiated

in 2013. The latter survey covers the area between the high-water mark and the top of the primary dune for the entire coastal section of the reserve.

Over the past 20 years, a total of 40 water bird species have been recorded for the Goukamma Estuary. Dominant bird species comprise gulls that are primarily found in the lower reaches and mouth area while terns occasionally venture up the estuary. Water fowl are dominated by little grebe and yellow-billed ducks. Dominant waders comprise resident species typical of sandy habitats, e.g. African black oystercatcher, while grassy areas and bushy banks are primarily inhabited by blacksmith lapwings and water thickknees respectively. Migrant waders are scarce due to the limited suitable intertidal habitat.

In order to determine trends over the entire survey period of Groenvlei Lake only those species that were counted for the entire period (1979 till present) were used. This subset of 14 species represents 27% of the 52 species that have been recorded and counted on the waterbody. Although this percentage is low the subset does however include red-knobbed coot (*Fulica cristata*), which on average over the entire monitoring period represented 75% of the birds counted during a particular survey. Dominance of this species on Groenvlei Lake is illustrated in Figure 3.10. Only the three major species in terms of numbers have been included in the graph (Figure 3.10). Analysis of the data shows a decline in the number of waterfowl over the three decades of monitoring. Total number of birds declined about 23% while red-knobbed coot numbers declined by 20%. It is clear that the decline in the red-knobbed coot is responsible for the decline in total numbers. The reasons for this decline are unknown and it is recommended that this should be investigated and appropriate management interventions implemented. The continual monitoring of the waterbirds at Groenvlei Lake according to the monitoring protocol is required. This is to ensure consistency in data collection to measure success of any management interventions and/or to monitor waterbird numbers as part of South Africa's contribution to the Convention on the Conservation of Migratory Species of Wild Animals (CMS Secretariat 1979) and the Agreement on the conservation of African-Eurasian Migratory Waterbirds (UNEP/AEWA Secretariat 2012).

The GNRC does not have any critical habitat that any of the 21 species of conservation concern are dependent on. However, there are three important roost sites for marine bird species (Cape cormorant, African black oystercatcher, Caspian tern) along the coast of the MPA. The estuary and the MPA are most likely important feeding sites for some of these listed species (half-collared kingfisher, Caspian tern, African penguin) and Groenvlei has good habitat for others (half-collared kingfisher, African marsh harrier, Knysna warbler).

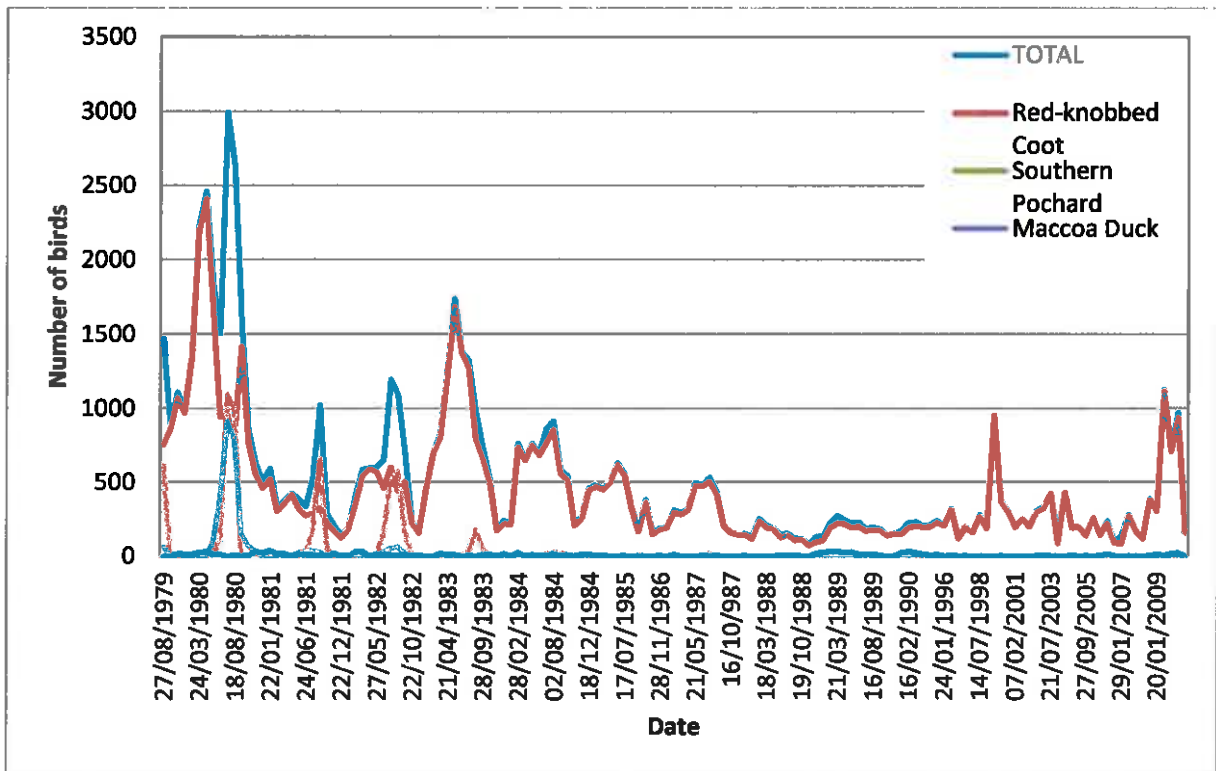


Figure 3.10: Total number of birds and the number of the three most abundant species on Groenvlei Lake (1979-2013).

3.3.10 Reptiles

There are 37 reptile species recorded in GNRC. Of particular conservation concern are the marine turtles (leatherback, loggerhead, hawksbill and green) which are all threatened species (Table 3.8). Management actions here are limited to keeping fishing vessels (especially long-liners) out of the MPA and recording all sightings and stranding of these turtles.

Table 3.8: Reptile species of conservation concern that occur on the Goukamma Nature Reserve Complex.

Species	Common Name	IUCN Category (IUCN 2011)	South African Red Data Book Category (Branch 1988)
<i>Caretta caretta</i>	loggerhead turtle	Endangered A1abd	Vulnerable
<i>Chelonia mydas</i>	green turtle	Endangered A2bd	Vulnerable
<i>Eretmochelys imbricata</i>	hawksbill sea turtle	Critically Endangered A2bd	Vulnerable
<i>Dermochelys coriacea</i>	leatherback sea turtle	Vulnerable A2bd	Vulnerable

3.3.11 Amphibians

Thirteen species of frogs have been recorded in the GNRC. The only species of conservation concern is the Knysna leaf-folding frog (*Afrixalus knysnae*), which is listed as Endangered

(Minter *et al.* 2004). The continued presence (and breeding) of this frog on the reserve needs to be confirmed as there have been no recent records of this frog from the nature reserve.

3.3.12 Fish

Groenvlei is a noteworthy natural lake from both a conservation and recreational angling perspective. It is one of only two closed freshwater lakes in South Africa. Prior to the stockings of several species of alien fishes several decades ago, the lake had two small indigenous species of fishes, the estuarine round herring (*Gilchristella aestuaria*) and the Cape silverside (*Atherina breviceps*). Both species are widely distributed in South African estuaries on both the east and west coasts (Whitfield 1998), but what is interesting about the Groenvlei populations is that they have been isolated there for a considerable period and a detailed study by Ratte (1989) noted significant morphological and genetic differences between the Groenvlei and Swartvlei populations of the two species. He concluded that the Groenvlei populations warranted special conservation attention, which is further emphasized in a recent study by Phair *et al.* (2015) that Groenvlei harbours genetically unique and sufficiently divergent populations of round herring and Cape silverside to suggest they should be considered distinct management units.

The South African Institute for Aquatic Biodiversity (SAIAB) undertook a fish survey of Groenvlei in 2013 and 2014 for CapeNature. Fyke and seine netting confirmed the presence of the two indigenous fish species as well as bluegill, carp, largemouth bass, mosquitofish and Mozambique tilapia (B. Dredge pers. comm.). Bluegill and Mozambique tilapia dominated the net catches.

The Goukamma Nature Reserve boundary includes the coastal sections of both the Goukamma and Swartvlei catchments. The freshwater reaches of the Goukamma and Homtini Rivers are outside the boundary of the reserve but are important in terms of indigenous fish conservation. The upper reaches of these rivers should be considered for inclusion into suitable protected area expansion initiatives such as stewardship agreements, especially as the Goukamma catchment as a whole is listed as a NFEPA fish sanctuary. While the western section of the reserve is in the Swartvlei catchment, there are no rivers of conservation concern within this catchment associated with the reserve. It must however be noted that the Hoogekraal River in the Swartvlei catchment is also listed as a NFEPA fish sanctuary. The Goukamma and Swartvlei catchments are home to three indigenous freshwater fish species, namely the Eastern Cape redbfin (*Pseudobarbus afer*), the Cape Galaxias (*Galaxias zebratus*) and the Cape kurper (*Sandelia capensis*).

Recent genetic research has elucidated the existence of several unique lineages within all three freshwater fish species associated with the rivers on the reserve. Swartz (2005), in a study on the phylogenetics and evolution of the *Pseudobarbus* redbfins, illustrated the existence of four distinct lineages within the species currently described as *P. afer*. One of these lineages, currently referred to as *Pseudobarbus* sp. “*afer* Forest” or Forest lineage, is the most widespread lineage and is associated with several coastal river systems in the southern Afrotropical Forest area of the CFR (Swartz *et al.* 2008). The *P. afer* population in the Goukamma River, while not genetically analysed, is believed to form part of this lineage (Swartz 2005). The most recent conservation status assessment of freshwater fishes of Southern Africa lists the Forest redbfin as Near Threatened (Tweddle *et al.* 2009). The four major lineages described for *P. afer* can be considered as Evolutionarily Significant Units

(Moritz 1994) and should thus be conserved in the same way as separate species. Translocations should not be allowed between populations that are currently isolated in different river systems, especially not where divergence exist between the minor lineages within the Forest lineage, i.e. Klein Brak River, Wilderness Lakes Region, Plettenberg Bay and Tsitsikamma (Swartz 2005).

As is the case for *P. afer*, there has also been significant genetic research conducted recently on the currently described *G. zebratus* and *S. capensis*. Each of these species are considered a species complex with as many as 14 known historically isolated lineages within *G. zebratus* and three within *S. capensis* (Skelton & Swartz 2011). Subsequent research by Chakona *et al.* (2013a) presented evidence for more than three distinct *S. capensis* lineages. The work of Chakona *et al.* (2013b) illustrated the existence of a wide-spread *Galaxias* lineage, *Galaxias* sp. 'nebula' and this lineage is believed to be present in most coastal river systems of the Southern Cape, including the Goukamma and Swartvlei systems. These lineages are awaiting comprehensive morphological descriptions as many likely represent new species. As a result of the major taxonomic revisions that are due for *G. zebratus* and *S. capensis*, the conservation status of both is currently listed as Data Deficient (Tweddle *et al.* 2009).

Regular fish monitoring (every 3-5 years) of Groenvlei Lake and the Goukamma River is required which should be a joint operation between Scientific Services and reserve management. Fish monitoring involving other accredited role players should be encouraged by local management for training purposes.

The fish abundance and distribution along the length of the estuary is typical of black water systems (Kaselowski 2012). In a study by James and Harrison (2008), a total of five seine net hauls and five gill net sets sampled a total of 1313 fish from 16 species and nine families. The highest proportion of these were from the Mugilidae family (four species) followed by Gobiidae (three species), Sparidae and Soleidae (two species respectively). The estuarine resident, *Gilchristella aestuaria* dominated the catch numerically at 44.7% followed by *Rhabdosargus holubi* (18.1%), *Lithognathus lithognathus* (17.5%), *Liza richardsonii* (8.7%), *Mugil cephalus* (3.9%), *Psammogobius knysnaensis* (3.7%) and *Caffrogobius gilchristi* (1.7%). *Liza richardsonii* dominated the catch gravimetrically with 52.9% followed by *Argyrosomus japonicus* (17.0%), *Pomadasys commersonii* (12.8%), *Lithognathus lithognathus* (12.5%) and *Myxus capensis* (2.6%). This study found that the majority of *R. holubi* and *L. lithognathus* sampled were 0+ recruits. The estuarine-dependent marine species dominated the fish composition with 11 species comprising 49.9% of the catch numerically and 99.0% by mass. Five estuarine dependent species comprised 50.3% of the catch numerically but only 1.0% by mass. From this, it would appear that the Goukamma Estuary serves as a viable function for both marine migrant and estuarine resident fishes (James & Harrison 2008).

Goukamma MPA has been recognised as an invaluable area for resident, long lived reef species such as the roman (*Chrysolephus laticeps*), galjoen (*Dichistius capensis*) and musselcracker (*Sparodon durbanensis*) with roman being found to be more abundant inside the MPA than outside (Götz 2005; Götz *et al.* 2009b).

There have been numerous research projects and publications relating to the rich fish diversity in Goukamma MPA. These research projects have focussed on the linefish species and the reef associated fishes. Goukamma supports a rich mixture of warm temperate species, including many species that are endemic to the south coast of South Africa.

The studies that focussed on the shore based line fishery sampled 23 species (Van Zyl 2011) and 35 species (Pradevand & Hiseman 2006) with the most abundant species being blacktail (*Diplodus sargus capensis*) and galjoen with smaller proportions of cape stumpnose (*Rhabdosargus holubi*), strepie (*Sarpa salpa*), shad (*Pomatomus saltatrix*), zebra (*Diplodus cervinus hottentotus*), dusky kob (*Argyrosomus japonicus*) and white musselcracker.

The reef based assessment recorded 37 species with the most abundant species being fransmadam (*Boobsoidea inornata*), roman, steentjie (*Spondyliosoma emarginatum*), blue hottentot (*Pachymetopon aeneum*), strepie (*Sarpa salpa*) and santer (*Cheimerius nufar*) (Götz *et al.* 2009b). In a follow-up paper Götz *et al.* (2009c) reported that the principle food source (crinoidea) of roman was scarce in the MPA where the latter was most abundant. There was a higher abundance of algae and crinoidea at sites that were being fished. Götz (2005) found that hake (*Merluccius capensis*), various resident reef fish (notably santer (*Cheimerius nufar*) and dageraad (*Chrysolephus cristiceps*)) and kob (*Argyrosomus japonicus*) were most frequently targeted by the local boat based linefishery. Fishing effort was found to be highest around the border of the MPA (2.7 boats/km²) and lowest in the core of the MPA (0.2 boats/km²). Goukamma MPA has been shown to be effective in maintaining a spawning stock of roman and the latter had a higher density and mean size inside the protected area than outside (Götz *et al.* 2008; 2009b). The larval ecology and the oceanographic conditions in the area suggest a good potential for the enhancement of roman stocks outside the reserve through larval dispersal (Götz *et al.* 2008). Based on CPUE data collected over a 15-year period on the catching of roman in the vicinity of the MPA, Kerwath *et al.* (2013) found that catch rates increased rapidly after the implementation of the Goukamma MPA without measurable disadvantages for fishers.

Gotz *et al.* (2007) investigated the effects of hook size, bait type, water depth and fishing effort on the selectivity and capture mortality of reef fish. The results of this study are useful for developing rules for catch-and-release competitions and planning catch-per-unit-effort surveys.

Marine fish species that are of conservation concern are listed in Table 3.9. There are two species of fish known to be present in the MPA which are listed as "Protected" under the *List of Threatened and Protected Species* issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007. These species are the great white shark (*Carcharodon carcharias*) and white steenbras (*Lithognathus lithognathus*). "Protected" is defined under NEMA as indigenous species of high conservation value or national importance that require national protection. It is believed that the *List of Threatened and Protected Species* as referenced has omitted the red steenbras (*Petrus rupestris*) which is now closed to all fisheries (23/11/2012) and is found in the GNRC. The great white shark is the only known species to be present in the MPA which is listed as "Vulnerable" under the *Draft List of Threatened and Protected Species* issued in terms of NEM: Biodiversity Act.

Table 3.9: Fish species of conservation concern that occur in the Goukamma Nature Reserve Complex.

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linefish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths <i>et al.</i> 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Carcharodon carcharias</i>	Great white shark	Vulnerable A2cd+3cd	Protected	Prohibited species	Unknown	Not assessed
<i>Lithognathus lithognathus</i>	White steenbras	Lower risk / conservation dependant	Protected	No-sale recreational species	>25% collapsed	32
<i>Epinephelus andersonii</i>	Catface rockcod	Near threatened	Vulnerable	Commercially exploitable species	40-50% optimally exploited	Not assessed
<i>Pomatomus saltatrix</i>	Elf/Shad/Bluefish/Tailor	Not assessed	None	Commercially exploitable species	25-40% overexploited	100
<i>Dichistius capensis</i>	Galjoen/Damba	Not assessed	None	No-sale recreational species	>25% collapsed	95
<i>Seriola lalandi</i>	Yellowtail/Geelstert	Not assessed	None	Commercially exploitable species	40-50% optimally exploited	54
<i>Atractoscion aequidens</i>	Geelbek/Cape salmon	Awaiting publication	None	Commercially exploitable species	>25% collapsed	52
<i>Argyrosomus inodorus</i>	Silver kob	Awaiting publication	None	Commercially exploitable species	>25% collapsed	50
<i>Thysites atun</i>	Snoek	Not assessed	None	Commercially exploitable species	40-50% optimally exploited	26
<i>Argyrosoma argyrosoma</i>	Carpenter/Silverfish	Awaiting publication	None	Commercially exploitable species	25-40% overexploited	16
<i>Diplodus sargus</i>	Blacktail	Awaiting publication	None	No-sale recreational species	Not assessed	14

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linefish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths <i>et al.</i> 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Chrysoblephus laticeps</i>	Red Roman	Awaiting publication	None	Commercially exploitable species	40-50% optimally exploited	12
<i>Pachymetopon blochii</i>	Hottentot	Awaiting publication	None	Commercially exploitable species	40-50% optimally exploited	11
<i>Sarpa salpa</i>	Streple/Karranteen	Awaiting publication	None	Commercially exploitable species	>50% underexploited	8
<i>Galeorhinus galeus</i>	Soupin shark	Vulnerable	None	Not listed	40-50% optimally exploited	8
<i>Sparodon durbanensis</i>	White musselcracker	Awaiting publication	None	No-sale recreational species	Not assessed	7
<i>Umbrina robinsonii</i>	Belman/Tasselfish	Awaiting publication	None	No-sale recreational species	>25% collapsed	7
<i>Carcharhinus brachyurus</i>	Bronze whaler	Near threatened	None	Not listed	Not assessed	7
<i>Rhabdosargus globiceps</i>	White stumpnose	Awaiting publication	None	Commercially exploitable species	>25% collapsed	6
<i>Liza richardsonii</i>	Harder/southern mullet	Not assessed	None	Commercially exploitable species	25-40% overexploited	6
<i>Rhinobatos annulatus</i>	Lesser sandshark	Least concern	None	Not listed	Not assessed	6
<i>Galeichthys feliceps</i>	White sea-catfish	Not assessed	None	Not listed	25-40% overexploited	5
<i>Galeichthys ater</i>	Black sea-catfish	Not assessed	None	Not listed	>50% underexploited	5
<i>Mustelus mustelus</i>	Blackspotted smoothhound	Vulnerable	None	Not listed	40-50% optimally exploited	5

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linedish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths <i>et al.</i> 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Diplodus cervinus</i>	Zebra	Awaiting publication	None	No-sale recreational species	Not assessed	4
<i>Triakis megalopterus</i>	Spotted gullyshark	Near threatened	None	No-sale recreational species	Not assessed	4
<i>Pomadasys olivaceum</i>	Piggy	Not assessed	None	Commercially exploitable species	40-50% optimally exploited	3
<i>Spondyllosoma emarginatum</i>	Steentjie	Awaiting publication	None	Commercially exploitable species	Not assessed	3
<i>Petrus rupestris</i>	Red steenbras	Awaiting publication	None	Prohibited species	>25% collapsed	3
<i>Scomber japonicus</i>	Chub mackerel	Least concern	None	Commercially exploitable species	25-40% overexploited	2
<i>Callorhynchus capensis</i>	St Joseph shark	Least concern	None	Not listed	Not assessed	Not assessed
<i>Caranx sexfasciatus</i>	Bigeye kingfish	Least concern	None	No-sale recreational species	Unknown	Not assessed
<i>Lichia amia</i>	Garrick/leervis	Not assessed	None	No-sale recreational species	>25% collapsed	Not assessed
<i>Trachinotus africanus</i>	Southern pompano	Not assessed	None	No-sale recreational species	Not assessed	Not assessed
<i>Carcharhinus leucas</i>	Zambezi shark	Near threatened	None	Not listed	Not assessed	Not assessed
<i>Chirodactylus grandis</i>	Bank steenbras	Not assessed	None	Not listed	Not assessed	Not assessed
<i>Dasyatis chrysonota</i>	Blue stingray	Least concern	None	Not listed	Not assessed	Not assessed

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linefish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths et al. 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Gymnura natalensis</i>	Diamond ray	Data deficient	None	Not listed	Not assessed	Not assessed
<i>Dichistius multifasciatus</i>	Banded galjoen	Not assessed	None	No-sale recreational species	Not assessed	Not assessed
<i>Dinoperca petersi</i>	Cave bass	Not assessed	None	Not listed	Not assessed	Not assessed
<i>Elops machnata</i>	Springer	Least concerned	None	No-sale recreational species	Not assessed	Not assessed
<i>Pomadasys commersonnii</i>	Spotted grunter	Not assessed	None	No-sale recreational species	25-40% overexploited	Not assessed
<i>Notorynchus cepedianus</i>	Cowshark	Data deficient	None	Not listed	Not assessed	Not assessed
<i>Neoscorpis lithophilus</i>	Stonebreem	Not assessed	None	No-sale recreational species	40-50% optimally exploited	Not assessed
<i>Isurus oxyrinchus</i>	Shortfin mako	Vulnerable	None	Not listed	25-40% overexploited	Not assessed
<i>Merluccius capensis</i>	Shallow-water hake	Not assessed	None	Commercially exploitable species	40-50% optimally exploited	Not assessed
<i>Liza tricuspidens</i>	Striped mullet	Not assessed	None	Commercially exploitable species	Not assessed	Not assessed
<i>Mugil cephalus</i>	Flathead mullet	Least concern	None	Commercially exploitable species	Not assessed	Not assessed
<i>Myliobatis aquila</i>	Eagle ray	Data deficient	None	Not listed	Not assessed	Not assessed
<i>Carcharias taurus</i>	Spotted ragged-tooth shark	Vulnerable	None	No-sale recreational species	Stable to declining	Not assessed
<i>Oplegnathus conwayi</i>	Cape knifejaw	Not assessed	None	No-sale recreational species	Not assessed	Not assessed

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linefish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths <i>et al.</i> 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Platycephalus indicus</i>	Bartail flathead	Data deficient	None	Not listed	Not assessed	Not assessed
<i>Argyrosomus japonicus</i>	Dusky kob	Vulnerable	None	Commercially exploitable species	>25% collapsed	? 17 (<i>Argyrosomus</i> spp.1 above)
<i>Poroderma africanum</i>	Pyjama shark	Near threatened	None	No-sale recreational species	Not assessed	Not assessed
<i>Poroderma pantherium</i>	Leopard catshark	Data deficient	None	No-sale recreational species	Not assessed	Not assessed
<i>Epinephelus marginatus</i>	Yellowbelly rockcod	Endangered	None	Commercially exploitable species	25-40% overexploited	Not assessed
<i>Acanthopagrus vagus</i>	Riverbream	Awaiting publication	None	No-sale recreational species	>25% collapsed	Not assessed
<i>Argyrops spinifer</i>	King soldierbream	Awaiting publication	None	Not listed	Not assessed	Not assessed
<i>Boopsoidea inornata</i>	Fransmadam	Awaiting publication	None	Commercially exploitable species	Not assessed	Not assessed
<i>Cheimereus nufar</i>	Santer	Awaiting publication	None	Commercially exploitable species	Optimally exploited	Not assessed
<i>Chrysoblephus cristiceps</i>	Dageraad	Awaiting publication	None	Commercially exploitable species	>25% collapsed	Not assessed
<i>Chrysoblephus gibbiceps</i>	Red stumpnose	Awaiting publication	None	Commercially exploitable species	Not assessed, estimated at 1-5% of historical values	Not assessed
<i>Cymatoceps nasutus</i>	Black musselcracker	Awaiting publication	None	Commercially exploitable species	Not assessed, estimated at ~20% of historical values	Not assessed
<i>Gymnocrotaphus curvidens</i>	John Brown	Awaiting publication	None	No-sale recreational species	Not assessed	Not assessed

Species	Common Name	IUCN Category (IUCN 2011)	List of Threatened and Protected Species issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007	Marine Living Resources Act, 1998 (Act No. 18 of 1998)	SA Marine Linefish Species Profiles (Mann 2013) where Status is underexploited, optimally exploited, overexploited or collapsed (see Griffiths <i>et al.</i> 1999 for definition).	Prioritising species for research, conservation and management according to Lamberth and Joubert (2014). Weighting out of 100 for Southern Cape species.
<i>Lithognathus mormyrus</i>	Sand steenbras	Awaiting publication	None	Not listed	Not assessed	Not assessed
<i>Pachymetopon aeneum</i>	Blue Hottentot	Awaiting publication	None	Commercially exploitable species	Not assessed	Not assessed
<i>Pachymetopon grande</i>	Bronze bream	Awaiting publication	None	No-sale recreational species	Not assessed	Not assessed
<i>Pageillus natalensis</i>	Sand soldier	Awaiting publication	None	Not listed	Not assessed	Not assessed
<i>Polysteganus undulosus</i>	Seventy four	Awaiting publication	None	Prohibited species	>25% collapsed	Not assessed
<i>Pterogymnus laniarius</i>	Panga	Awaiting publication	None	Not listed	>50% underexploited	Not assessed
<i>Rhabdosargus holubi</i>	Cape stumpnose	Awaiting publication	None	No-sale recreational species	Not assessed	Not assessed
<i>Rhabdosargus sarba</i>	Natal stumpnose	Awaiting publication	None	No-sale recreational species	25-40% overexploited	Not assessed
<i>Sphyaena jello</i>	Pickhandle barracuda	Not assessed	None	Not listed	Not assessed	Not assessed
<i>Sphyrna zygaena</i>	Smooth hammerhead	Vulnerable	None	Not listed	Not assessed	Not assessed

3.3.13 Invertebrates

The focus on the CFR's exceptionally high floristic diversity has somewhat overshadowed its faunal diversity and, in consequence, there is a lack of information on insect species diversity within the CFR, although their functional significance is appreciated. The consensus view is that diversity is low (Johnson 1992), although several local scale studies of specific host plants and their herbivores suggest that insect richness might be much higher than is generally thought to be the case (e.g. Cicadellidae: Davies 1988a,b; gall-forming insects: Wright & Samways 1998). However, few groups have been subject to careful surveys, and most comparisons have been qualitative and based on examinations of studies that differ substantially in their methods.

There is no comprehensive species list available for the GNRC. Such lists are essential as inventories of what occurs in the reserve, especially in terms of Red Data and endemic species, and as baseline information for long-term monitoring. The invertebrate species list is updated through baseline data collection. Additional information on the insects of the CFR can be obtained from the Iziko Museums of South Africa (www.iziko.org.za).

To date, there have not been any major co-ordinated efforts to carry out Red List assessment of invertebrate taxa in South Africa (Samways *et al.* 2012). Nonetheless, Red Listing has been undertaken for a few specific taxa on an *ad hoc* basis by expert groups (Samways 2002). The butterflies of South Africa are currently being assessed according to the latest IUCN criteria (IUCN 2012) as part of the South African Butterfly Conservation Assessment (SABCA) project, and a preliminary assessment was published in 2009 (Henning *et al.* 2009). Eight butterfly species have been characterised as Critically Endangered in the Western Cape Province.

The South African abalone, *Haliotis midae*, is listed as a Protected species in the *List of Threatened and Protected Species* issued in terms of NEMA: Biodiversity Act (2004), Notice 151 of 2007. A protected species according to this listing is "Indigenous species of high conservation value or national importance that require national protection".

To date 80 terrestrial and 107 marine invertebrate species have been recorded in the GNRC. *Circellium bacchus* (Flightless dung beetle) is a vulnerable species with a recorded population in Buffalo Valley Contract Nature Reserve. New records are continuously added to the CapeNature State of Biodiversity (SOB) database.

3.4 Cultural heritage context

Evidence of the Khoi-San living in the area is noted by the abundant shell middens (food dumps), ostrich shells and pottery pieces found along the coastline.

Excavations of a series of archaeological sites along the southern coast of Africa have recovered items left behind by what may have been a progenitor population (Marean 2010). According to Marean (2010) the population size of *Homo sapiens* plummeted over much of the African continent because of cold and dry climatic conditions between 195 000 and 123 000 years ago. The planet was locked in an ice age during that period which claimed the animals and plants that humans ate. A group of people managed to survive the long glacial stage that lasted until about 123 000 years ago. One of the few areas where humans could have survived during this climate crisis is the southern coast of Africa, because it harbours an

abundance of shellfish and edible plants. The combination of nutrient-rich shellfish and low-fiber, energy-laden carbohydrates from geophytes would have provided an ideal diet for early modern humans during this tough period. Discoveries at the archaeological sites along the southern coast and adjacent areas are now forming part of a greater 'paleo landscape' research project. Although there are no archaeological sites on the GNRC under exploration at present, it is believed that the nature reserve complex will form part of the greater 'paleo landscape' along the southern coast.

Surveys of palaeontological sites, especially of fossilised animal tracks, have been undertaken in 2013 and 2015 and reports have been submitted to CapeNature (Helm 2013, 2015). Evidence of fossilised elephant and buffalo tracks and possibly lion and turtle tracks was recorded on GNRC.

3.5 Socio-economic context

The GNRC falls within the Knysna Local Municipality, a Category B municipality. This forms part of the Eden District Municipality.

The Greater Knysna Municipal Area is made up of socially and racially diverse communities. Due to in-migration, the area has experienced rapid growth of a predominantly poor population. Knysna and Sedgefield are the two primary urban settlements where the main retail and commercial activities are concentrated. On the plateau above the town lies the agricultural nodes of Karatara and Rheenendal.

The total population of the Knysna Municipal area was an estimated 71 200 in 2013 .The average growth rate of the population from 2004-2013 is 2.2%. The total number of households in the Knysna Municipal Area was 22 746 in 2013. Approximately 26% of the working population has attained a matric certificate and approximately 9.2% of the population has attained a tertiary qualification.

The majority of the population of Knysna Municipality can be considered youthful with 48% of the population below the age of 30 and 23% younger than the age of 15. Sixty eight percent (68%) of the population are of an economically active age (15-65 years) and 9% of the population can be considered retired (over the age of 65).

The proportion of the formally employed population is declining, while 16% of the economically active segment of the population is unemployed. Close to 84% percent of the economically active segment of the population is employed in either the formal or informal markets. The youth unemployment rate is showing an increasing trend (2001 to 2011). The economic downfall of 2008 left scars of poverty and unemployment in the Greater Knysna Municipal Area and poverty pockets are prevalent in areas such as Sizamile, the Northern Areas, Rheenendal and Karatara which are adjacent to the reserve.

The holiday village of Buffalo Bay at the eastern end of the GNRC is bordered on either side by the terrestrial nature reserve to the north and the MPA to the south. There is a mixed rural and small urban areas congregation to the north of the reserve which includes the small settlements of Karatara and Rheenendal (MCA 2008). George, a major industrial and commercial town is about 60 km away.

The major land-uses are:

- (a) Forestry (pine plantations) with associated saw-mills.
- (b) Farming consisting of dairy farms, vegetables and citrus and also game farms.
- (c) Urban development, specifically ribbon development has spread along the coast at a rapid rate over the past decade. Uneconomical agricultural land has been rezoned and urban settlements have spread in the form of holiday houses, bed and breakfast enterprises, hotels and golf courses.

The Garden Route is a major tourist and retirement area. The population of the small towns in this area triple in size during the summer and Easter holidays due to influx of South African tourists, but steady tourism is recorded throughout the year with a slight decrease during August.

Activities within the towns are based on tourism, where hotels and accommodation enterprises are predominant. Adventure companies specialising in outdoor sports are also active. A fleet of four commercial line angling boats (ski-boats) and a much larger fleet of recreational fishing boats operate from the Knysna lagoon (MCA 2008).

3.5.1 Protected Area Advisory Committee

A Protected Area Advisory Committee has been established. It consists of local stakeholders and the invitational list stands at approximately 50 members. Meetings are held annually and are well attended.

3.5.2 Local economic development

Management strives to implement projects through which local people can benefit. These projects include employing local residents to do alien vegetation clearing, maintaining fire breaks and as contract staff when normal day to day work needs to be done.

Work opportunities are created through different conservation management initiatives. These initiatives include gate guards, gardening services, guiding, as well as cleaning services.

Further work opportunities are also created through externally-funded projects managed by CapeNature. These include alien vegetation removal, as well as fire break maintenance projects through ICM. Although these projects only provide temporary work opportunities within CapeNature, they also contribute to contractor and skills development. A Coast Care team works under supervision of CapeNature staff once a week.

Another contributor to creating work opportunities on CapeNature land is to allow private concessionaires to operate on the reserves. This does not only create additional work opportunities, but also generates additional income for CapeNature.

3.5.3 Non-consumptive utilisation

Water sports, swimming, fishing, birding, hiking and picnicking are the most popular recreational activities in the GNRC.

3.5.4 Consumptive utilisation

Small-scale firewood is harvested in a stand of alien *Acacia cyclops* (Rooikrans) by local contractors.

Local boat fishermen from the Fairview community north of Groenvlei Lake have traditional access rights to store their boats on Groenvlei and fish for alien species in the vlei as a supplementary food source.

A small-scale sand collection project is underway where windblown accumulated sand covering the tar road to Buffalo Bay is collected by local communities.

Collection of washed out red bait (*Pyura stolonifera*) is allowed in the MPA area of Buffalo Bay. Persons with valid bait collecting permits may collect their legal daily limit. This usually happens after heavy seas. There is the potential to grant this use right to one or two specific Buffalo Bay inhabitants who in turn can sell the bait as an income. This would secure clear benefits to the local community.

Natural Resource User Groups, specifically locally based groups have been invited to investigate the potential to harvest plants/parts of plants on firebreaks immediately prior to their maintenance or construction. One such investigation has happened on regularly maintained (annually) firebreaks but proved to be fruitless due to the young growth. This initiative will be reassessed when firebreaks need to be cleared through old veld.

Shore-angling is currently allowed as a form of resource use, provided individuals are in possession of a valid angling license. There are approximately 120 licensed subsistence fishers in the area of which approximately 20 make fairly regular use of the angling spots along the coastline of the GNRC.

3.5.5 Commercial utilisation

There is one tour operator that regularly conducts overnight guided tours in the area and who makes use of Goukamma trails and overnight facilities.

One licenced whale watching outfit conducts regular boat-based tours from the Knysna Lagoon and into the MPA.

Three surf schools operate mostly over weekends and season period in Buffalo Bay. These are currently licenced through the Knysna Municipality, but a co-licencing arrangement should be investigated and implemented.

3.5.6 Non-commercial access

The safe swimming beach at Buffalo Bay is considered the beach of Knysna and Rheenendal and as such is well utilised during weekends and season periods.

Access to the GNRC for spiritual, traditional and cultural groups will be carefully considered due to the relatively small size and sensitive nature of the reserve.

3.5.7 Volunteers

Both national and international volunteers are active in the reserve and are managed within all functions of the reserve's operations when they are active. Volunteer numbers are relatively low.

Volunteers who assist with ecological monitoring projects on the GNRC include the CREW, the Mountain Club of South Africa, the Lakes Bird Club, local recreational anglers and divers.

3.5.8 Youth development

Environmental education and awareness are carried out in conjunction with the Community Conservation component of CapeNature and focuses on specific environmental days such as Marine Week. It also encourages outings to the reserve by community groups or schools, and EE is then executed by either the Community Conservation Component or staff at the GNRC.

There are two approaches to formal EE on the GNRC. The one entails staff visits to local schools and the other entails school visits to the reserve. Touch pools, booklets and worksheets are used in lessons. A field day is facilitated once a year where the learners are brought to the GNRC for interpretation.

The formal education programme theme is focused on marine and estuary systems. This compliments the terrestrially focused Outdoor Classroom run in the Outeniqua Nature Reserve.

Three local schools around the GNRC (i.e. Smutsville Primary, Karatara Primary and Rheenendal Primary) are targeted in the formal education programme. The target group is Grade 6 learners as they become the leaders of the Primary Schools when they enter Grade 7. It is hoped that the message regarding the importance and functioning of marine ecosystems will filter down through their leadership.

3.5.9 Researchers and Students

In the past, accommodation in a unit at Groenvlei has been provided for students doing research in the GNRC. This unit is however no longer being utilised for students, as it has become dilapidated. There is a plan to rebuild a student quarter at Groenvlei to accommodate two students (see 5.4.4 below).

There is no doubt that the provision of accommodation for students has facilitated research on the reserve over the years, as accommodation along the Garden Route is quite expensive, especially for students.

Most of the research undertaken has been on the MPA (Lombard *et al.* 2004; Götz 2005; Pradervand & Hiseman 2006; Götz *et al.* 2007, 2008, 2009a,b,c; Kerwath *et al.* 2007, 2008, 2013; Van Zyl 2011; etc.), Groenvlei Lake (Martin 1960; Coetsee 1980; Ratte 1989; Kirsten 2008; Roets *et al.* 2008; Parsons 2009; Phair *et al.* 2015; etc.), the Goukamma Estuary (Kaselowski 2012; James & Harrison 2008; etc.), dune systems (Helström 1996; Tinley 1985; etc.) and vegetation (Van der Merwe 1976; Coetsee *et al.* 2015).

Good relationships have been established with various research institutions over the years (e.g. NMMU, University of Stellenbosch, University of Cape Town, University of the Western Cape, SAIAB, Rhodes University, SANBI). In certain cases monitoring data collected within the GNRC are feeding into national databases (SABAP, CWAC, SANBI's Threatened Species

Programme, SAIAB, etc.) which are being used in research projects. Research needs are identified at reserve level and communicated with relevant research institutions where possible. A research register is kept on the reserve to keep record of researchers visiting the reserve and to ensure feedback is received from them regarding their study results.

3.6 Operational management within Goukamma Nature Reserve Complex

3.6.1 Infrastructure

Infrastructure on GNRC (Table 3.10) has been developed and maintained for:

- a) Operations, which consists of numerous stores, garages, workshops, offices, vehicle ferry across the river, information kiosks and signage;
- b) Tourism, which consists of overnight facilities, picnic areas, entrance gates, laundry, ironing room, stores, trails, jetties and boardwalks;
- c) Staff accommodation;
- d) Access and services, which consists of roads, fences and water reticulation.

A slipway, built on municipal land which provides launching facilities for boats into the MPA is situated in Buffalo Bay and managed on behalf of CapeNature by the Buffalo Bay Ski Boat Club. The map in Figure 3.11 shows the location of the linear and point infrastructure on the GNRC.

A register and details of all buildings and structures on GNRC is provided in Table 3.11.

Table 3.10: Infrastructure located within the Goukamma Nature Reserve Complex.

Reserve Name	Feature Name	Location	Feature Type
Goukamma	B001 - Security	Goukamma	Security kiosk
Goukamma	B002 - Toilet	Goukamma	Tourism - toilet
Goukamma	B003 - Store	Goukamma	Operations - store
Goukamma	B004 - House	Goukamma	Tourism - accommodation
Goukamma	B005 - House	Goukamma	Tourism - accommodation
Goukamma	B006 - House	Goukamma	Tourism - accommodation
Goukamma	B010 - House first floor	Goukamma	Tourism - accommodation
Goukamma	B010 - House ground floor	Goukamma	Tourism - accommodation
Goukamma	B010 - House basement	Goukamma	Operations - store
Goukamma	B011 - Carport	Goukamma	Tourism - accommodation
Goukamma	B012 - Toilet	Goukamma	Tourism - toilet
Goukamma	B013 - Classroom	Goukamma	Tourism - Interpretation Centre
Goukamma	B014 - Plant room	Goukamma	Operations - pump house

Reserve Name	Feature Name	Location	Feature Type
Goukamma	B015 - House	Goukamma	Operations - staff house
Goukamma	B016 - House	Goukamma	Operations - staff house
Goukamma	B017 - Store	Goukamma	Operations - pump house
Goukamma	B018 - House	Goukamma	Operations - staff house
Goukamma	B019 - Store	Goukamma	Operations - store
Goukamma	B020 - Carport	Goukamma	Operations - store
Goukamma	B021 - Store	Goukamma	Operations - store
Goukamma	B022 - Store	Goukamma	Operations - store
Goukamma	B023 - Store	Goukamma	Operations - store
Goukamma	B024 - Garage	Goukamma	Operations - store
Goukamma	B025 - Garage	Goukamma	Operations - store
Goukamma	B026 - Store	Goukamma	Operations - store
Goukamma	B027 - Garage	Groenvlei	Operations - store
Goukamma	B028 - Garage	Groenvlei	Operations - store
Goukamma	B029 - House	Groenvlei	Operations - staff house
Goukamma	B030 - Shelter	Groenvlei	Operations - pump house
Goukamma	B031 - Carport	Groenvlei	Tourism - accommodation
Goukamma	B032 - House	Groenvlei	Tourism - accommodation
Goukamma	B033 - Store	Groenvlei	Operations - staff house
Goukamma	B034 - Toilet	Groenvlei	Operations - staff ablutions
Goukamma	B035 - House	Groenvlei	Operations - staff house
Goukamma	B036 - Lapa	Groenvlei	Tourism - accommodation
Goukamma	B037 - House	Groenvlei	Tourism - accommodation
Goukamma	B038 - Ablution	Groenvlei	Tourism - accommodation
Goukamma	B039 - House	Groenvlei	Tourism - accommodation
Goukamma	B040 - Plant room	Groenvlei	Operations - store
Goukamma	B041 - Boat house	Groenvlei	Operations - boathouse
Goukamma	B042 - Office	Groenvlei	Operations - inspection quarters
Goukamma	B043 - House	Groenvlei	Operations - staff house

Reserve Name	Feature Name	Location	Feature Type
Goukamma	B044 - Store	Groenvlei	Operations - store
Goukamma	B045 - Carport	Groenvlei	Operations - carport
Goukamma	(B027) - House	Buffalo Valley	Tourism – Vlei Lodge
Goukamma	(B028) - House	Buffalo Valley	Tourism – Forest Lodge
Goukamma	(B029) - House	Buffalo Valley	Tourism – River Lodge
Goukamma	(B029) - House	Buffalo Valley	Operations - staff
Goukamma	(B029) - Store	Buffalo Valley	Operations - store

3.6.1.1 Roads/Jeep Tracks

The main access roads to the GNRC are the N2 freeway that runs along part of the northern boundary of the reserve; the R346 public road to Buffalo Bay which cuts across the eastern part of the nature reserve complex, and the public road which provides access to the beach and MPA on the western side.

The N2 freeway falls under the management of the South African National Roads Agency Limited (SANRAL). A proposal by SANRAL to toll this road has been on the table for several years. Part of the proposal is to construct a toll gate near Groenvlei Lake. There is serious concern about road kills along the N2 near Groenvlei Lake. Medium to large mammals (such as honey badgers, otters, etc.) are killed on the N2, when they are trying to cross the road to move inland or to move in the other direction, particularly at the eastern and western limits of the lake where they try to get around the lake. A formal meeting with SANRAL and the local authority needs to be set up to discuss the possibility of constructing underpasses for these species.

The R346 is a tarred road and maintained by the provincial Dept of Transport. The section of the road that cuts through the GNRC near the estuary has been a continuous problem because of damage caused to the road and other infrastructure every time there is an excessive flooding event, not to mention the threat to the estuary (erosion, oil spillage, etc.). The main problem is the fact that the section of the road is located within the floodplain of the Goukamma River.

The western public access road (DR1594) which leads from the N2 to the beach and MPA on the western side is a gravel road managed by the Eden District Municipality. The first 350 m of the road was tarred in 1968 at the cost of a previous owner of the Lake Pleasant Chalets & Lodges. Since then the tarred portion has become narrower and busier with each passing year. A request has been received from neighbouring landowners to appeal to the district municipality to upgrade this road. Furthermore, there are ownership issues with the two roads linking this public road with the western gates of the reserve. The ownership of these roads is currently uncertain and this needs to be clarified. If not, this could cause problems in the future if the legal parameters of these roads, their use and their maintenance are not established.

Roads within the GNRC are mostly gravel and are accessible by all vehicles, except low slung sedans. These are public roads that are used by tourists to access the GNRC. Day to day maintenance of these roads falls under the management of the GNRC while larger maintenance projects fall under the Public Works Department and are included in the User Asset Management Plan (U-AMP)

Jeep tracks are exclusively used for management purposes and are only accessible by 4x4 vehicles. Due to the high risk of soil erosion the grading of jeep tracks within the GNRC is not allowed. Regular assessments and maintenance work are conducted as part of the ICM programme.

3.6.1.2 Trails

GNRC has a network of day hiking trails providing access for hikers to the remote areas and other popular tourist sites. Trails are vulnerable to erosion due to the substrate largely being sandy and particularly prone to erosion at sites with steep slopes. Annual maintenance is conducted as part of ICM. Minor maintenance is carried out by the GNRC staff.

3.6.1.3 Buildings

Maintenance and repairs of buildings are prioritised and included on the schedule of the Department of Public Works (DPW). Minor maintenance and repairs to buildings are identified and attended to by management.

Table 3.11 provides a register and details of all buildings and structures on the GNRC. It, however, does not include all the buildings that are on Buffalo Valley Contract Nature Reserve.

Table 3.1.1: Register and details of all buildings and structures on the Goukamma Nature Reserve Complex.

BUILD NO	RENTED TO	CENTER	ASPECT	TYPE	DATE ERECTED	MATERIAL	ROOF TYPE	FLOOR SURFACE AREA	MOST RECENT RENOVATION	PLANNED RENOVATION	CONDITION	RESERVE DESCRIPTION
GOU4	Tourism officer	Goukamma	HQ	Student accom	1930	Wood	Asbestos	48	2008	2010	Poor	woodhouse
GOU6	null	Goukamma	HQ	Store room	1969	Wood	Asbestos	50	2007	2010	Good	D store
GOU8	null	Goukamma	HQ	Pack room	1961	Asbestos	Asbestos	10	2008	2011	Reasonable	Landcruiser store
GOU14	null	Goukamma	HQ	Visitor centre	1930	Wood	Iron	40	2008	2010	Reasonable	Information Centre
GOU15	null	Goukamma	HQ	Toilet block	1961	Brick	Tile	20	2006	2011	Reasonable	Gate toilet
GOU16	null	Goukamma	HQ	Toilet block	1961	Brick	Tile	20	2008	2011	Reasonable	Info centre toilet
GOU22	null	Goukamma	HQ	Store & garage	1961	Brick	Asbestos	150	?	2009	Reasonable	Lorry store
GOU79	null	Goukamma	HQ	Gatehouse	2007	Wood	Asbestos	6	Never	2009	Good	Gatehouse
GOU45	null	Goukamma	Groenvlei 1	Nat.Cons. house	1935	Brick	Asbestos	200	2008	none	Reasonable	G1
GOU46	null	Goukamma	Groenvlei 1	Office, ablution, store	1968	Wood	Asbestos	50	2004?	none	Good	Groenvlei office
GOU47	null	Goukamma	Groenvlei 1	Workshop, garage, store	1966	Wood/iron	Iron	60	2002	2008	Good	Groenvlei workshop
GOU49	NIMMU	Goukamma	Groenvlei 1	Student accom	1968	Wood/iron	Iron	50	2008		Reasonable	Student quarters
GOU50	NIMMU	Goukamma	Groenvlei 1	Student accom	1968	Wood/iron	Iron	50	2008	2009	Reasonable	Student quarters
GOU80	NIMMU	Goukamma	Groenvlei 1	Ablution	2009	Wood/fibre cement	Iron	18	Never	none	Good	Student quarters ablution
GOU55	Tourism	Goukamma	Groenvlei 1	B/camp sleeping	1993	Wood	Thatch	32	1997	2009	Reasonable	Bushcamp top quarters

BUILD NO	RENTED TO	CENTER	ASPECT	TYPE	DATE ERECTED	MATERIAL	ROOF TYPE	FLOOR SURFACE AREA	MOST RECENT RENOVATION	PLANNED RENOVATION	CONDITION	RESERVE DESCRIPTION
				Quarters No. 1								
GOU56	Tourism	Goukamma	Groenvlei 1	B/camp sleeping Quarters No. 2	1993	Wood	Thatch	32	1997	2009	Reasonable	Bushcamp lower quarters
GOU57	Tourism	Goukamma	Groenvlei 1	B/Camp communal area, kitchen	1993	Wood	Thatch	100	1997	2009	Reasonable	Bushcamp lapa
GOU58	Tourism	Goukamma	Groenvlei 1	B/Camp toilet & shower unit	1993	Wood	Thatch	20	1997	2009	Reasonable	Bushcamp toilets
GOU59	Tourism	Goukamma	Groenvlei 1	B/Camp Connecting boardwalk	1993	Wood	NA	150	1997	2009	Reasonable	Groenvlei boardwalk

3.6.1.4 Fences

In the GNRC all internal fences have been removed. Boundary fences shared with properties which stock livestock are intact and are being maintained by the relevant landowners. The GNRC is largely fenced, although conditions of fences adjacent to properties which pose no livestock threat are poor. The maintenance of the northern boundary fence has been prioritised to prevent nuisance animals from entering the reserve. Some areas of fencing are not needed and, in partnership with neighbours, management removes these fences once they are in need of repair. Tourism management barriers have been placed at a number of popular tourist sites to restrict unauthorised access.

3.6.1.5 High Sites

Currently only Trigonometric Beacon 233 is registered as a high site in the CapeNature database. The site is used as a weather station and, in the past, as a radio repeater site by CapeNature. Unfortunately, due to solar panel theft on two occasions, the radio repeater has been removed.

3.6.1.6 Signage

Signboards are located at all major vehicle and hiking entrance points to the GNRC.

Fire index and safety signboards are located at the six entrances to the reserve.

Various interpretive signboards are located at the high use areas in Buffalo Bay, Rowwehoek and Platbank to provide information to visitors about the conservation of the area.

3.6.2 Environmental Management

No waste disposal sites are available within the GNRC. All waste from GNRC is removed off the reserve and disposed of at the municipal waste transfer site in Knysna (Waste by Rail).

The GNRC office is currently initiating a recycling project.

Potable water is abstracted from a six point spike at approximately 30 m distance from the Goukamma Estuary for use at the Goukamma Station. Although slightly salty this water is used in all facilities. It is envisaged to upgrade the existing rainwater reticulation system specifically for drinking water purposes.

Water for domestic use (ablutions) is currently extracted from the Groenvlei Lake for use at the Groenvlei Station. This water is not potable and rainwater is used for drinking. It is envisaged to upgrade the existing rainwater reticulation system.

A separate water system exists on Buffalo Valley. Potable water is extracted from a borehole on the property and supplies all Buffalo Valley facilities with water.

There are two types of sewerage treatment systems on the GNRC. At Groenvlei the units are connected to a biolytix system and at Goukamma and Buffalo Valley there are septic or conservancy tanks with French drain soak-aways.

4) THE PLANNING CONTEXT OF THE GOUKAMMA NATURE RESERVE COMPLEX

4.1 Regional and Provincial Planning of the Goukamma Nature Reserve Complex

The GNRC is situated along the coast of the Garden Route area in the Western Cape Province of South Africa, approximately 40 km east of George and 20 km west of Knysna. The GNRC falls within the boundaries of Knysna Local Municipality and the Eden District Municipality.

The greatest strength of Knysna Municipality is its unique, natural resource base. The most significant of these include mountainous areas, rivers, indigenous vegetation, coastal dune systems, coastal cliffs, beaches, lagoons and vleis. This natural resource base sustains the economy through eco-tourism, agricultural activities, and forestry, the dominant sectors of the economy (MCA 2008).

The ecological value of the natural environment, the profound impact that the natural resource base has on the economy, as well as the fact that nature is the single most significant factor influencing sense of place, have implications for the way in which this natural resource base should be protected.

There has, however, been significant destruction of key natural resources. This is manifested in the loss of valuable unprotected indigenous vegetation, urban sprawl, significant and ever increasing development pressure on environmentally sensitive areas, and controversial developments (e.g. marina development, golf courses, low density residential estates).

The rich natural resource base drives the relatively strong and growing economy. Knysna's economy constitutes 20% of the Southern Cape's economy. Trade contributes 31% and the construction industry more than 10% to the local economy. Forestry, while experiencing a reduction in the number and size of plantations (by some 50%), remains an important sector and sustains many livelihoods in the municipal area. Tourism is estimated to contribute between 20% and 22% to the local economy, and while there may be an overabundance of some tourism related activities such as B & B's, significant potential still exists in others such as eco-tourism (MCA 2008).

Key challenges in Knysna Municipality relate to stark contrasts in the socioeconomic and demographic profile - the most notable being a minority of very wealthy residents versus a majority of very poor residents living in the area (MCA 2008). Some 46% of low-income households living in the municipal area are affected by poverty. The division between the wealthy and poor correlates strongly with racial groupings. The black and coloured populations are among the poorest residents of Knysna.

The spatial development vision for Knysna is: *"Creating a community which co-exists within a unique natural, socioeconomic and cultural environment that is a model of sustainability"* (MCA 2008).

Goukamma Nature Reserve and all the areas proposed in the reserve's expansion strategy are identified as Core 1 or Core 2 in the SDF. Core 1 areas include all areas with formal conservation status, and Critical Biodiversity Areas (CBA) identified through a systematic

conservation planning process. Core 2 areas are those that are currently not yet exhibiting high levels of biodiversity loss, but which should be protected and restored in order to ensure biodiversity pattern and ecological process targets can be met, as well as ESA, CBA aquatic buffer areas, coastline and coastal processes, river and ecological corridors and mountain catchment areas. This indicates that the reserve expansion strategy included in this plan is in line with the regional planning strategy.

The vision of the Knysna IDP is: *“Knysna, where people and nature prosper!”*, and the mission: *“To provide affordable quality services, alleviate poverty, and facilitate social and economic development on the Greater Knysna Municipal Area through integrated development planning, skills development and the sustainable use of resources”* (Knysna Municipality 2012). In order to achieve the vision of the IDP, the following strategic objectives have been identified:

- Objective 1: To promote access for all citizens to equitable, appropriate and sustainable infrastructure and services within a safe environment.
- Objective 2: To ensure ecological integrity through sustainable practices of municipal governance.
- Objective 3: To create an enabling environment for economic growth that attracts investors, encourages innovation and facilitate pro-poor interventions.
- Objective 4: To facilitate real opportunities for youth, women, and disabled and appropriate care for the aged.
- Objective 5: To ensure a municipality that is committed to an innovative approach, prudent investment of public funds, good governance, financial viability and optimal institutional transformation that accommodates diversity in service delivery.
- Objective 6: To develop progressive strategies to optimise the use of available human resources.
- Objective 7: To establish a common vision and create coherence in government’s work by seeking close partnerships with citizenry.

All of these are of relevance to the GNRC.

4.2 Expansion of the Goukamma Nature Reserve Complex

The expansion of protected areas in South Africa is informed by the NPAES (SANBI & DEA 2010). This strategy provides a broad national framework for protected area expansion in South Africa by identifying large areas which should be targeted for formal declaration and introduces a suite of mechanisms which could aid in achieving this.

In response to the NPAES which calls on provinces to develop implementation plans in support of the NPAES and in support of provincial conservation efforts and priorities, CapeNature has produced a Protected Area Expansion Strategy and Implementation Plan (Purnell *et al.* 2010). This CapeNature strategy addresses the formal proclamation of priority natural terrestrial habitats in the Western Cape Province as protected areas to secure biodiversity and ecosystem services for future generations. Although aligned to the concepts and goals of the NPAES, this strategy is informed by immediately available resources and therefore highlights some different spatial priorities.

Due to limited expertise and resources, the current CapeNature Protected Areas and Expansion Strategy and Implementation plan does not highlight priority marine zones for expansion nor appropriate mechanisms to be applied in marine environments. As a result

thereof we are guided by the NPAES only when considering areas for Marine Protected Areas expansion. It should, however, be noted that at the 5th World Parks Congress which took place in Sydney (Australia) in 2014, South Africa pledged to triple ocean protection in the next ten years (Baard 2014).

Successful expansion has occurred to the north east of Goukamma in the past two years. A willing landowner has entered into a Stewardship Agreement at the level of Contract Nature Reserve. A management agreement has been signed with the landowner where CapeNature is appointed as the managing authority for a period of 30 years. The proclamation of the property as a nature reserve is in process. As such, the property has been included in this management plan.

The following expansion opportunities do exist for the GNRC to expand the conservation estate. They will be dealt with under the following two different sections namely, Provincial Nature Reserve and Marine Protected Area.

4.2.1 Provincial Nature Reserve

- West of Goukamma Nature Reserve there is a contiguous group of privately owned properties that are largely undeveloped (total 379 ha). These properties capture Sedgefield Thicket Fynbos (LT), Groenvlei Coastal Forest (VU), Wilderness Forest Thicket (VU) and a small section of Sedgefield Sandplain Fynbos (CR) based on the fine-scale vegetation map for the area (Vlok *et al.* 2008; Holness *et al.* 2010).

The area falls within two recognised sensitive areas namely, the Knysna Coastal Corridor and the Knysna Lakes drainage system according to Lombard *et al.* (2005), as well as identified Critical Biodiversity Areas (Figure 4.1; Holness *et al.* 2010; Vromans *et al.* 2010). Most of these properties are not being actively managed and most owners are absent. Alien plant infestations are present and increasing unchecked (K. Spencer, CapeNature, pers. comm.). Approximately 75% of the area is owned by a single landowner. Attempts have been made in the past to establish a conservancy and enter into co-management agreements with landowners, but these have been largely fruitless. Recent negotiations during 2014 indicate a change in ownership and a positive attitude towards conservation. The stewardship process is currently underway. It is hoped that all owners will agree and adopt the current Goukamma management on their properties.

- East of Goukamma Nature Reserve there is a contiguous group of privately owned properties that are also currently undeveloped (total size 299 ha). Three of these properties directly east of GNRC comprise Southern Cape Dune Fynbos (according to SA vegetation map; Mucina & Rutherford 2006), which is moderately protected (Pence 2014). The other two properties east of these comprise about 50% Southern Cape Dune Fynbos and 50% CR and hardly protected Knysna Sand Fynbos. According to the fine-scale vegetation map, the properties contain Sedgefield Thicket Fynbos (LT), Wilderness Fynbos Thicket (VU), Hoogekraal Sandplain Fynbos (EN), and Hartenbos Primary Dune (EN) (Vlok *et al.* 2008; Holness *et al.* 2010; Vromans *et al.* 2010). All these properties fall into identified Critical Biodiversity Areas (Figure 4.1; Holness *et al.* (2010); Vromans *et al.* 2010).

A development application has been submitted for the two properties adjacent to Goukamma and is seen as an opportunity to enter into formal Stewardship Agreements with the landowners.

- North of Goukamma Nature Reserve is a fairly narrow buffer strip of Southern Cape Dune Fynbos (according to SA vegetation map, Mucina & Rutherford 2006) or Sedgefield Thicket Fynbos (according to Vlok *et al.* 2008). This land is currently managed by Mountains to Ocean (MTO), but is not under plantation. Sections of this fynbos are mowed to encourage grass growth as fodder for forestry mules.
- North east of the Buffalo Valley section of Goukamma Nature Reserve is a narrow strip of Southern Cape Dune Fynbos and endangered Knysna Sand Fynbos, with good examples of Southern Cape Coastal Forest widening in the east (Mucina & Rutherford 2006). According to fine-scale vegetation map, this section consists of endangered Hoogekraal Sandplain Fynbos, with vulnerable Wilderness Forest Thicket along the banks of the Goukamma River (Vlok *et al.* 2008; Holness *et al.* 2010). These areas also fall within identified Critical Biodiversity Areas (Figure 4.1; Vromans *et al.* 2010).



Figure 4.1: Critical Biodiversity Areas and marine expansion map for Goukamma Nature Reserve Complex showing important areas for expansion (Götz et al. 2009; Holness et al. 2010).

- To the South East of Goukamma there is a state owned property managed by the District Municipality, comprising Southern Cape Dune Fynbos (size 38 ha). This property was managed by the Western Cape Nature Conservation Board between 2000 and 2009 in a management agreement. This agreement has since lapsed and efforts to renew the agreement have been on hold due to a dispute of ownership between the District and Local Municipalities.

4.2.2 Marine Protected Area

According to Lombard *et al.* (2004), the existing (National) MPA network does not provide sufficient protection for marine biodiversity in South Africa. Furthermore, they identified the area immediately to the west of the Goukamma MPA, as a priority for protection. Clark and Lombard (2007) stress that proposed priority areas for protection should only be used as a guideline as they are based only on the best information available at present and only indirectly consider certain aspects such as the potential economic and socio-economic costs of selecting a particular area for enhanced conservation status. Such issues can only really be taken into account in much more detailed site-specific analyses where a range of conservation planning options can be work-shopped with those directly affected by any proposed changes in conservation status. Most significantly, they also state that perhaps more important than expanding the existing MPA network, would be concentrating on improving management within existing MPAs and upgrading the levels of protection in those MPAs that allow for the exploitation of living resources. In other words, thought should be given to rezoning sections of the Goukamma MPA to include no-take areas from the shore.

Clark and Lombard (2007) performed an additional detailed fine-scale analysis within the Agulhas Bioregion, extending from Cape Point to the Mbashe River, and used key (sensitive) habitat types to determine additional areas that would need to be protected in order to meet conservation targets. The guiding principles used to determine these areas included requirements to minimize total reserve area, to minimize known threats and to promote adjacency (areas next to existing MPAs). Identified priority areas from this study that fall within the management area, are:

- Priority Area 11 – located immediately to the west of the Goukamma MPA. This area was highlighted as it could contribute significantly to some sub-tidal geology types and to the Groenvlei-Swartvlei coastal dune system.
- Similar recommendations have been made by Chalmers *et al.* (2009), with the following scenarios being proposed for enhancing conservation through the existing MPA network:
 - Extend the offshore boundary of the Goukamma MPA, as motivated by Götz *et al.* (2008, 2009a; Figure 4.2), to include deeper reef areas and enhance protection of these habitats and linefish species.
 - Restriction of shore fishing in some areas of the Goukamma MPA and the southern portion of the Robberg MPA to enhance protection of coastal linefish species.

Several studies (Götz 2005; Götz *et al.* 2009a; Kerwath *et al.* 2007, 2008; Pradervand & Hiseman 2006; Van Zyl 2011) have shown support for a rezonation of the MPA to a closure of shore based angling and a re-alignment of the offshore boundary.

Benefits of MPAs include the restoration of marine ecosystems and natural ecosystem functioning, increased species diversity and natural size and age structure of protected fish populations (Kerwath *et al.* 2013; Smith *et al.* 2015). This results in benefits to fishery, such

as a spillover of subadult and adult fish and the production of eggs and larvae that can be distributed over a large area.

The options for the desired state:

The GNRC is currently a no-take area for ski-boat angling and spearfishing but shore-based angling is allowed. The proposed new offshore boundary of the MPA, as motivated by Götz *et al.* (2009a), which includes additional sub-tidal reef habitat, is shown in Figure 4.2. A proposed priority conservation zone (Clark & Lombard 2007) to the west of the Goukamma MPA is also identified as a priority for conservation and includes two major oyster harvesting sites that will need to be considered with the commercial permit holders.

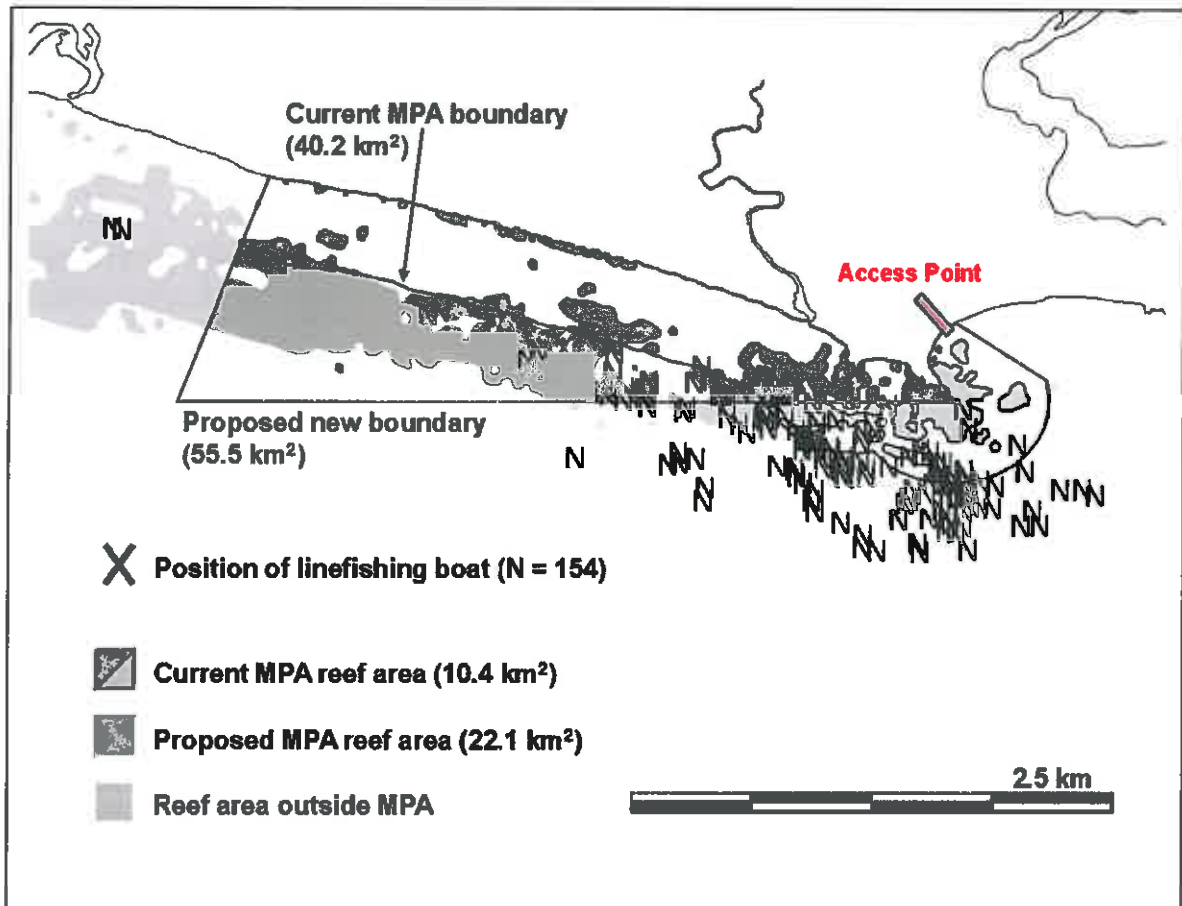


Figure 4.2: Proposed re-alignment of Goukamma Marine Protected Area as proposed by Götz *et al.* (2009a).

5) CONSERVATION DEVELOPMENT FRAMEWORK OF GNRC

5.1 Sensitivity analysis

Sensitivity mapping of reserve biodiversity, heritage and physical environment forms is the main informant of spatial planning and decision-making in protected areas. It is intended to:

- inform all planned and ad-hoc infrastructure development e.g. location of management and tourism buildings and precincts, roads, trails, firebreaks;
- inform whole-reserve planning and formalisation of use and access as a Reserve Zonation Scheme; and
- support conservation management decisions and prioritisation.

The sensitivity maps allow for direct comparison of sites both within and between reserves to support CapeNature's planning at local and regional scales. The process highlights:

- sites with the highest regional conservation value;
- areas where human access or disturbance will have a negative impact on biodiversity or heritage, and specific environmental protection is required;
- areas where physical disturbance or infrastructure development will cause higher environmental impacts, and/or higher construction and on-going maintenance costs; as well as
- areas where there is significant environmental risk to infrastructure.

The method ensures that the location, nature and required mitigation for access, activities, and infrastructure development within protected areas can be guided by the best possible landscape-level biodiversity informants.

The process accommodates both expert-derived information and more objective scientific data and the decisions are defensible and based on a transparent process.

Biodiversity, heritage and physical features are rated on a standard scale of 1 to 5, where 1 represents no or minimal sensitivity and 5 indicates maximum sensitivity (Figure 5.1). Additional features such as visual sensitivity, fire risk and transport costs can also be included. Higher scores represent areas that should be avoided for conventional access and infrastructure, or where specific mitigation would be required in order to address identified environmental sensitivity. A score of 5 typically represents areas where mitigation for conventional access or infrastructure development would be extensive, costly or impractical enough to be avoided at all costs, or features so sensitive that they represent a 'no go' area. For biodiversity features highest scores represent high priority sites where conservation management cannot be compromised.

Sensitivity maps cannot replace all site-scale investigation, but they are ideal for rapidly reviewing known environmental risks, and guiding whole-reserve planning to minimise overall negative environmental impact.

A decision tree / hierarchical approach is used for the sensitivity analysis. This method is based on the premise that if a portion of the landscape is demarcated as highly sensitive in one of the categories considered in the analysis then, regardless of the sensitivity in other categories, that portion will be considered to be highly sensitive in the overall scoring. The decision tree approach thus allocates the highest allocated sensitivity in any of the input categories as the ultimate sensitivity class for that particular portion. The benefits of using this approach is that

a landscape unit which is scored as highly sensitive for one feature category but has low sensitivity in all other feature categories will retain the high sensitivity scoring. Furthermore, as new and improved data becomes available, there is the possibility of adding this data to the sensitivity layer without having to re-analyse the data from the beginning.



Figure 5.1: CapeNature method for sensitivity scoring and synthesis (Kirkwood in prep.).

5.1.1 Goukamma Nature Reserve Complex Sensitivity Analysis

See Table 5.1 and Figure 5.2.

- The GNRC, comprising Goukamma Nature Reserve, Buffalo Valley and Goukamma MPA, is a coastal and estuarine reserve system.
- Terrestrial habitats according to the SA vegetation map are all least threatened (Mucina & Rutherford 2006; Pence 2014), but according to the fine-scale vegetation map compiled for the GRI, Sedgefield Sandplain Fynbos is Critically Endangered (CR), Hartenbos Primary Dune and Groot Brak River and floodplain are Endangered (EN), and Groenvlei Coastal Forest and Wilderness Forest-Thicket are Vulnerable (VU) (Vlok *et al.* 2008; Holness *et al.* 2010; Vromans *et al.* 2010).
- Groenvlei Lake is one of two closed freshwater coastal lakes in South Africa and has been separated from the sea for 4000 to 7000 years. It drains inward (endorheic system) and is

dependent on rainfall and groundwater. It is a special habitat which still harbours some relic estuarine species, such as estuarine roundherring, which contribute to its unique character (River Health Programme 2007).

- Goukamma Estuary is ranked 68th out of 247 estuaries in South Africa in terms of its conservation importance, based on estuary size, habitat, zonal type rarity and biodiversity importance (River Health Programme 2007). It has a large catchment area which is utilised for forestry purposes (plantations), and large sections of indigenous forest which are not being utilised. Water extraction is limited in the upper catchment and water is of a very high quality. In the lower reaches of the Goukamma River, water extraction is limited to supplying holiday houses and camp sites in Buffalo Bay.
- The estuary mouth breaches naturally at 2.5 – 3.0 m above mean sea level (Kaselowski 2012). Various reports, studies and discussions indicate that an “as natural as possible” management programme for the estuary should be maintained. Mechanical manipulation is used as a last resort in emergency situations only. Farmers along the low-lying floodplain have however raised concerns about the no-interference management approach.
- When the river mouth is closed, there is extremely low or no river inflow and a further increase in the height of the sand bar at the mouth prevent seawater from entering the estuary or water from draining from the estuary into the sea. Studies have indicated that both marine migrant and estuarine resident fishes utilise the Goukamma Estuary.
- Transverse mobile sand dunes transferred sand via the headland by-pass dune system into the Buffalo Bay beaches prior to 1921. This sand movement into the Goukamma River was regarded as problematic as it would close the mouth and cause inundation of forests and farms in the catchment area. To stabilize the dune system alien vegetation was planted on the mobile dunes from 1921 until Cape Nature Conservation took over the management in 1956. This has stopped the Goukamma River mouth from “tail wagging” and caused it to permanently migrate to the east.
- Three flood events in 1993, 2006 and 2007 resulted in significant erosion of the frontal dune at the mouth and the stream bank, damage to the picnic area and access road, loss of the gatehouse and substantial undercutting and destruction of the main access road to Buffalo Bay. These high intensity, short duration storm events increase the potential for the recreational facilities and provincial road from being undermined by erosion, which present major management decisions to CapeNature and the Dept of Transport. Risk of flooding is therefore an important criterion that needs to inform the sensitivity analysis and zonation.
- West of the Goukamma Estuary mouth, the intertidal zone is composed of wave cut limestone platforms, exposed reefs and sandy beach. Sand-stone headlands and intertidal areas of rounded boulders and deep rock pools predominate to the east, from Rowwehoek to Walker point.
- The dunefield south of Groenvlei Lake has the highest vegetated dunes in South Africa, rising to 202.3 masl (Tinley 1985; Helstrom 1996). These dunefields are classic examples of compound ascending parabolic dunes and are of high conservation value (Tinley 1985; Lombard *et al.* 2005). The wind-rift dune ridges above Buffalo Bay and east of the Goukamma River mouth are also unique dunes requiring formal protection according to Tinley (1985).

It is clear that the GNRC includes a high proportion of physically sensitive environments. There are extensive mobile or semi-stabilised coastal sand habitats and large areas potentially prone to either direct inundation or wave action by seawater. Within Goukamma itself, inundation

occurs as a result of the estuary mouth closing coinciding with high rainfall and rising water levels in the estuary.

No analysis of view sheds or visual sensitivity could be performed due to time constraints. The visual sensitivity of the reserve should be considered as high throughout unless specifically demonstrated otherwise by proper analysis.

Physical and biodiversity sensitivities that were included in the analysis are as per the table below (Table 5.1).

Table 5.1: Summary overview of physical and biodiversity components used in the sensitivity analysis of Goukamma Nature Reserve Complex (terrestrial section; see Figure 5.2).

Component	Category	Dataset	Criteria	Sensitivity score		
Physical	Slope (degrees)	Slope calculated from 5 m resolution DEM (courtesy Centre for Geographical Analysis, Stellenbosch University) http://146.23.2.21.108/Downloads/sudem/SUDEM_Product_Description.pdf	> 30° Effectively off-limits for infrastructure development due to extreme risk of erosion and instability, or extreme engineering mitigation and associated construction costs required.	Highest sensitivity	5	
			5°-30° The Wankoe Formation consisting largely of ancient dunes combined with the slope lends this geological feature to be considered more sensitive than in other areas. Strongly avoid for infrastructure development – cut and fill or other difficult and expensive construction method required. Appropriate engineering mitigation essential to prevent erosion and slope instability. Highest initial and on-going cost due to slope stabilisation and erosion management required.	High sensitivity	4	
			0°-5° Preferred areas for any built infrastructure, lowest risk of erosion or instability, lowest construction and on-going maintenance costs.	Lowest sensitivity	1	
	Substrate	Vlok <i>et al.</i> (2008) vegetation map	Mobile sands (e.g. drift sands) and beaches, and other loose sands corresponding to unstable, erosion-prone or mobile substrates are identified as sensitive features.	Highest sensitivity	5	
	Flood risk (Hydrological)	Areas at or below 5 m above sea level	5 m resolution DEM (courtesy Centre for Geographical Analysis, Stellenbosch University)	Highest sensitivity	5	
			Depressions	Mapped by reserve staff (these need to be updated and verified in the field)	Highest sensitivity	5
				Within 200 m of a depression	High sensitivity	4
	Biodiversity	Rivers	1: 50 000 NGI Rivers	Within 200 m of perennial river	Highest sensitivity	5
				Within 100 m of non-perennial river	Highest sensitivity	5
		Wetlands	NFEPA	Wetland	Highest sensitivity	5
Within 200 m of wetlands				High sensitivity	4	

Component	Category	Dataset	Criteria	Sensitivity score	
	Vegetation status (Conservation status of GRI vegetation units (Holness <i>et al.</i> 2010; Vromans <i>et al.</i> 2010)	GRI vegetation map (Vlok <i>et al.</i> 2008)	Critical (Sedgefield Sandplain Fynbos)	Highest sensitivity	5
			Endangered (Hartenbos Primary Dune, Groot Brak River and floodplain)	High sensitivity	4
			Vulnerable (Groenvlei Coastal Forest, Wilderness Forest-Thicket)	Moderate sensitivity	3
			Least threatened (Sedgefield Thicket-Fynbos, Kleinkrantz Drift Sands, Wilderness Estuary, Wilderness Wetlands)	Lowest sensitivity	2

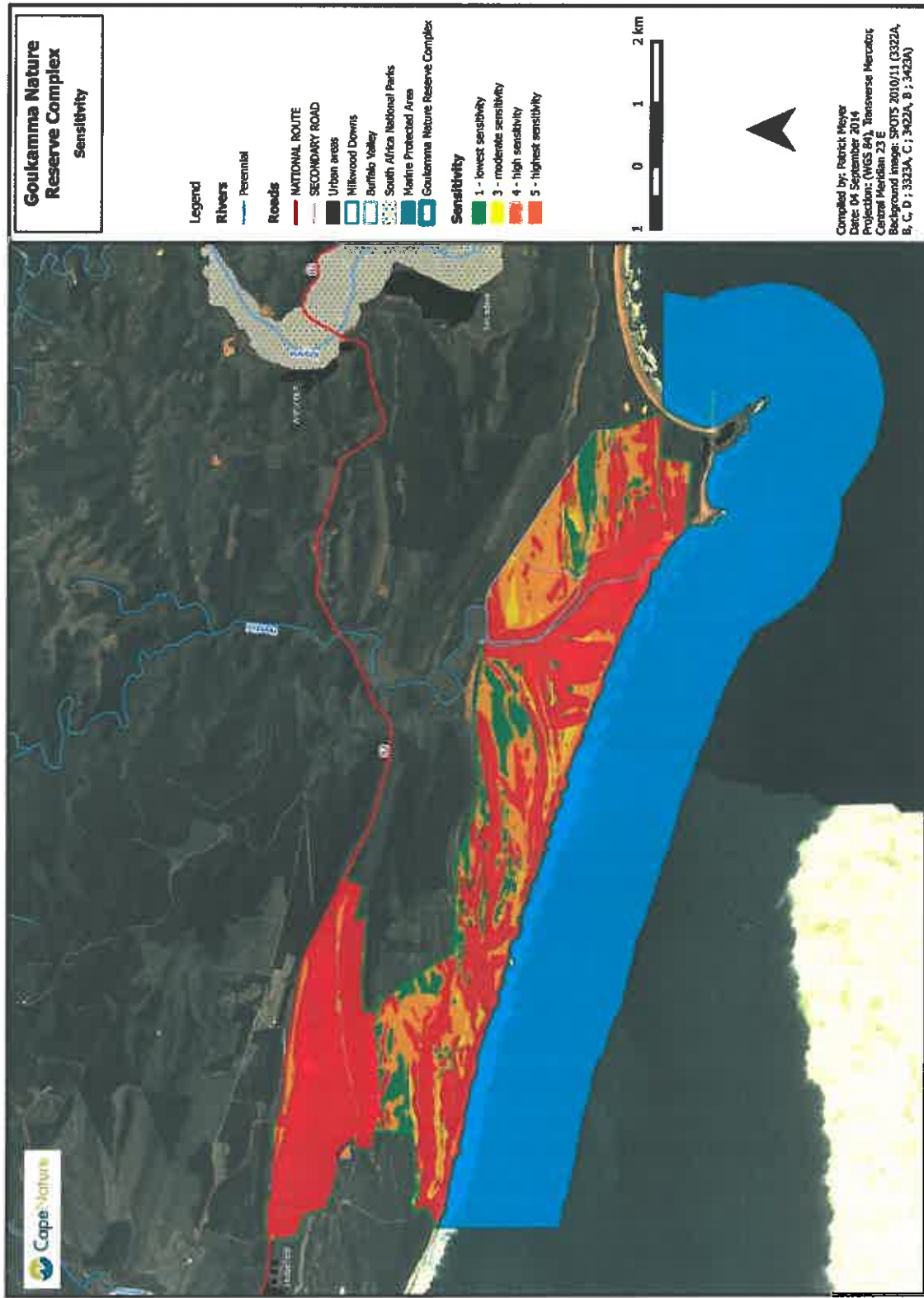


Figure 5.2: Sensitivity map of the Goukamma Nature Reserve Complex (terrestrial section).

Results

Although 47 % of this reserve complex is underlain by gentle slopes and a large proportion (55%) of the reserve complex contains least threatened vegetation, these areas largely correspond to areas prone to flooding or currently underwater resulting in the overall sensitivity of the reserve being high with 90% of the reserve area having high to highest sensitivity (see Table 5.2).

Thus even though the vulnerability status of the vegetation is largely low, the overall sensitivity of the nature reserve complex is high.

Table 5.2: Summary of total and percentage area captured by the main features contributing to the sensitivity analysis illustrated in Figure 5.2.

Sensitivity score	Slope and geology		Vegetation		<= 5 m below sea level		NFEPA wetlands		Overall score	
	Area (ha)	Area (% of total)	Area (ha)	Area (% of total)	Area (ha)	Area (% of total)	Area (ha)	Area (% of total)	Area (ha)	Area (% of total)
1	1224	47	1432	55					240	9
2										
3			675	25					71	3
4	658	25	221	9			188	7	659	25
5	728	28	291	11	650	25	100	4	1640	65

5.2 Zonation

Protected area zonation provides a standard framework of formal guidelines for conservation, access and use for particular areas. Zonation goes beyond natural resource protection and must also provide for:

- appropriate visitor experience;
- access and access control;
- environmental education; and
- commercial activities.

Ideally, zonation development should be done at the same time as infrastructure development planning. Good planning must aim to reduce cumulative environmental impacts and the long-term operating costs of all activities. Zonation and infrastructure development planning must be guided by:

- existing infrastructure and use;
- potential future infrastructure and access requirements; and
- careful evaluation of overall impact, construction costs and operating costs vs. likely benefits; for alternatives for every component.

Zonation requires input from all appropriate internal CapeNature stakeholders, and is a key component of the management plan which is to be evaluated during the Public Participation Process.

CapeNature's zonation categories (see Table 5.3) were developed by an internal workshop process completed in September 2010. Existing protected area zoning schemes worldwide

were examined to develop a simple and powerful scheme that provides for the required range of visitor experience, access and conservation management. Particular effort was made to maintain consistency with the best developed South African zonation schemes, in particular those of South African National Parks (SANParks) and Ezemvelo KZN Wildlife. CapeNature's zonation categories have fewer tourism-access categories, but provide more detailed and explicit guidelines with regard to zone objectives and characteristics. Furthermore, CapeNature's zonation includes new zones specifically required in the context of highly sensitive biodiversity sites and zoning of privately owned Contract Nature Reserves.

Table 5.3: Guide to CapeNature Zones on the Goukamma Nature Reserve Complex.

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Wilderness / Wilderness (declared)	<p><i>Users:</i> To provide an experience of solitude in pristine landscapes with minimal evidence of human presence or use.</p> <p><i>Conservation:</i> To limit visitor numbers and use to minimise impact.</p> <p>Minimal management intervention for visitor or biodiversity management.</p> <p>Include sensitive or threatened habitats & species in this low use zone when contiguous sites meet the criteria for wilderness.</p>	<p>Completely wild and rugged landscapes (or being restored to this).</p> <p>Areas where users have little chance of encountering any other human presence or group.</p> <p>Sight or sound of human activities outside zone barely discernible and at far distance; Preferably no human impact or infrastructure inside the zone other than trails.</p> <p>Natural burning regimes, with no active fire management and road/firebreak infrastructure.</p> <p>Areas with minimal invasive Alien Plant infestations, where IAP control can be done without vehicle access.</p> <p>Area must meet the definition and requirements of the National Environmental Management: Protected Areas Act 57 of 2003. If formally declared in terms of the act, zone = "Wilderness (declared)"; if not = "Wilderness".</p>	<p>"Leave-no-trace" activities:</p> <p>Overnight hiking, without any sleeping facilities, formal campsites, or with only basic, un-serviced shelters. "Carry in, Carry out" principle for all food and waste.</p> <p>Guided or unguided nature observation.</p> <p>No fires</p>	<p>No infrastructure of any type if possible.</p> <p>No roads or vehicle tracks.</p> <p>No structures except small existing buildings of cultural, historic or aesthetic value. These can be used as un-serviced sleeping shelters for hikers & provided with composting toilets.</p> <p>Narrow permanent walking trails.</p> <p>No signage except small, unobtrusive markers for closed routes, or at trail junctions.</p> <p>NB – in the mountainous, slow-growing fynbos of the Western Cape, the traditional wilderness concept of access without defined trails is unsafe and rapidly results in undesirable user-created trails and erosion.</p>	<p>Unguided visitor access only on foot.</p> <p>Visitors have freedom to use various trails.</p> <p>Use of donkeys, horses or other animals with an official guide only on designated historical routes and trails, or existing roads, and only where this will not cause trampling, erosion or any degradation.</p> <p>Limits on visitor numbers and/or control of routes and access so that zone objectives are met.</p> <p>Use of non-motorised canoe or flotation device on rivers can be acceptable where entry is by foot or by river from outside the zone.</p> <p>No fires</p> <p>No vehicle access</p> <p>No access without zone permit</p>	<p>Visitor Management:</p> <p>Manage to conserve natural and cultural resources, ecological processes and wilderness integrity.</p> <p>Leave no trace ethic.</p> <p>Restrict numbers of visitors and allow for no-use rest periods if required.</p> <p>Limited management interventions. Management measures may be carried out in extreme conditions, but tread lightly principles must apply.</p> <p>Since visitor use cannot be intensively managed, re-route trails away from any areas with sensitive local habitats or plant and animal species.</p> <p>Trail layout, design and construction must reduce maintenance requirements.</p> <p>Conservation Management:</p> <p>Habitats with minimal management requirements, typically natural burning zones.</p> <p>Prevent or restore visible trampling or any other impact.</p> <p>Rehabilitate non-essential roads to natural vegetation. Re-zone essential roads out of Wilderness Zoning.</p> <p>Consumptive Use:</p> <p>Not compatible</p>

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
<p>Primitive</p>	<p>Users: To provide an experience of solitude in natural landscapes with little nearby evidence of human presence.</p> <p>Can provide access to and buffer Wilderness Zones.</p> <p>Conservation: To limit visitor use, numbers and infrastructure to minimise impact in sensitive environments.</p> <p>To reduce need for management of users and visitor impacts.</p> <p>Allows for minimal or more intensive management intervention.</p> <p>Include extensive areas of sensitive or threatened habitats & species in this low use zone when sites do not meet the criteria for wilderness.</p>	<p>Intrinsically wild appearance & character.</p> <p>Areas where users will seldom encounter other human groups or presence.</p> <p>Any visible human impact or infrastructure inside the zone is unobtrusive.</p> <p>Human activities outside zone may be audible or visible in places.</p> <p>Areas remote from management centres, or otherwise difficult or expensive to access for management.</p> <p>Areas that might not meet the criteria for Wilderness but can serve as undeveloped visual buffers for Wilderness.</p> <p>Areas that may have natural burning regimes, with no active fire management and road/firebreak infrastructure OR areas that require active fire management to stay within thresholds of concern.</p>	<p>Guided or unguided nature observation</p> <p>Primarily intended for hiking or walking access.</p> <p>Only allows for 4x4 routes or vehicle access if specifically considered and noted.</p> <p>Only allows for non-hiking accommodation node if specifically considered and noted.</p>	<p>Deviation from natural state to be minimised.</p> <p>Infrastructure should not be visible from Wilderness Zones.</p> <p>May provide isolated, small, unobtrusive accommodation facilities for up to 16 guests on restricted footprints, particularly for overnight hiking trails.</p> <p>May have defined or beaconed hiking routes, management access roads, tracks and firebreaks.</p> <p>All roads, tracks or trails to be located and constructed to reduce maintenance, visibility and erosion. Where un-surfaced tracks will result in erosion, use concrete strip or interlocking pavers to stabilise. Re-route unstable or erosion-prone road sections if this will lower long-term visual and environmental impact.</p> <p>New roads for visitor access only justified if also required for management access.</p> <p>Avoid wide surfaced roads or roads and tracks wider than required for a single vehicle.</p>	<p>Visitor access only by permit.</p> <p>Control of visitor numbers, frequency and group sizes to meet zone objectives.</p> <p>Only users of facilities/activities will access to this zone.</p> <p>Defined or non-defined hiking and day trail routes.</p> <p>On foot always.</p> <p>Bicycle, 2x4 or 4x4 vehicle, or horseback on designated routes only.</p> <p>No access without zone permit</p>	<p>Visitor Management:</p> <p>Manage to conserve natural and cultural resources, ecological processes and wild appearance & character.</p> <p>Restrict numbers of visitors and allow for no-use rest periods if required.</p> <p>All facilities will be small, very basic, self-catering and distributed to avoid contact between users.</p> <p>There should be limited if any interaction between groups.</p> <p>Since visitor use usually cannot be intensively managed, re-route trails away from any areas with sensitive local habitats or plant and animal species.</p> <p>Trail layout, design and construction must reduce maintenance requirements.</p> <p>Visible & audible human impacts from adjacent zones should be mitigated.</p> <p>Conservation Management:</p> <p>Habitats with lower or higher management requirements. May be natural burning zones.</p> <p>Usually remote areas so roads and trails should be planned and constructed assuming infrequent maintenance.</p> <p>Prevent or restore visible trampling or any other visitor impact.</p> <p>Rehabilitate non-useful roads to natural vegetation.</p> <p>Consumptive Use:</p> <p>Sustainable use can be appropriate under controlled circumstances subject to a formal assessment and application in accordance with CapeNature policies.</p>

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Nature Access	<p>Users: To provide easy access to natural landscapes with low expectation of solitude at all times.</p> <p>Can buffer between development and wilderness or Primitive Zones.</p> <p>Conservation: To manage and direct visitor use, and plan infrastructure to minimise impact on sensitive environments.</p> <p>To actively manage users and visitor impacts.</p> <p>Allows for minimal or more intensive biodiversity management intervention.</p> <p><i>Provide additional protection to localised sensitive or threatened habitats, species or other features by Special Management Overlays</i></p>	<p>Areas with extensive lower sensitivity habitats:</p> <p>Areas able to accommodate higher numbers of visitors regularly, with no identified sensitive or regionally rare biodiversity.</p> <p>Popular view or access sites.</p> <p>Extensive areas able to accommodate roads, trails and tracks without high risk of erosion and degradation.</p> <p>Areas accessible for regular management of roads and trails.</p> <p>Areas where roads and trail infrastructure can be located with low visibility from the surrounding landscape, particularly from adjacent Primitive or Wilderness Zones.</p> <p>Usually areas that require active fire management with firebreaks to stay within thresholds of concern, but may also include natural burning regimes.</p>	<p>Guided or unguided nature observation.</p> <p>Day hiking trails and/or short trails.</p> <p>Bird hides, canoeing, mountain biking & rock-climbing where appropriate.</p> <p>Other activities if specifically considered and approved as part of specific reserve zoning scheme.</p> <p>Motorised 2x4 self-drive access on designated routes.</p> <p>No accommodation or camping.</p> <p>Frequent interaction with other users.</p>	<p>Some deviation from natural/pristine state allowed particularly on less sensitive or already disturbed/transformed sites.</p> <p>No accommodation; but ablation facilities may be provided.</p> <p>May have defined or beacons hiking routes, tourism and management access roads, and management tracks and firebreaks.</p> <p>Infrastructure should be designed to reduce impacts of higher visitor numbers.</p> <p>Roads open to the public should be accessible by 2x4 sedan. Full width tarred or surfaced roads or roads and tracks to accommodate two vehicles are appropriate.</p> <p>Un-surfaced roads may be surfaced if a road planning exercise has confirmed that the location is suitable.</p>	<p>No special access control or permits required for this zone.</p> <p>Will cater for larger number of visitors than primitive zone.</p> <p>Vehicle access on dedicated routes, with pedestrian access from parking areas or adjacent Development Zones.</p> <p>On water – only non-motorised crafts allowed unless specifically noted.</p>	<p>Visitor Management:</p> <p>More frequent monitoring of these areas is necessary to prevent damage or degradation.</p> <p>More frequent footpath maintenance must be scheduled for busy routes, with particular attention paid to use of railings or other access control to prevent damage to sensitive areas.</p> <p>Unless visitor access can definitely be intensively guided and managed, re-route trails away from any sensitive local habitats or plant and animal species.</p> <p>Trail layout, design and construction must be specified to reduce maintenance requirements under higher use.</p> <p>Visible & audible human impacts to adjacent Primitive or Wilderness Zones should be mitigated.</p> <p>Conservation Management:</p> <p>Habitats with lower or higher management requirements. May be natural burning zones.</p> <p>Prevent or restore visible trampling or any other visitor impact.</p> <p>Rehabilitate non-useful roads to natural vegetation.</p> <p>Consumptive Use:</p> <p>Sustainable use may be appropriate subject to a formal assessment and application in accordance with CapeNature policies.</p>

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Development – Low Intensity	<p>Users: To provide access to adjacent natural landscapes with no expectation of solitude.</p> <p>To provide primarily self-catering accommodation or camping.</p> <p>Can provide for Environmental Education accommodation and access into surrounding landscapes.</p> <p>Conservation: To locate the zone and infrastructure to minimise impact on sensitive environments.</p> <p>To actively manage users and visitor impacts on adjacent sensitive areas.</p> <p><i>Provide additional protection to sensitive or threatened habitats, species or other features by Special Management Overlays</i></p>	<p>Areas with existing degraded or transformed footprints. Natural or semi-natural habitats only where essential to minimise impacts over whole reserve.</p> <p>Areas able to accommodate high numbers of visitors regularly, with no identified sensitive or regionally rare biodiversity.</p> <p>Areas able to accommodate roads, trails and accommodation infrastructure without risk of erosion or degradation.</p> <p>Areas easily accessible from reserve management centre.</p> <p>Areas where risk of fire damage to infrastructure is low or can be mitigated without unacceptable impacts on surrounding environment.</p> <p>Areas where new infrastructure can be located with low visibility from the surrounding landscape. Areas not visible from Primitive or Wilderness Zones.</p> <p>Areas with available potable water, and not sensitive to disposal of treated wastewater via soak away.</p>	<p>Picnicking.</p> <p>Walking or bicycle access into adjacent areas.</p> <p>Self-catering accommodation and camping.</p> <p>Meeting, workshops or mini-conference activities for no more than the number of people that can be accommodated overnight in the zone.</p> <p>Can provide for Environmental Education accommodation and access into surrounding landscapes, but this must be carefully planned not to conflict with visitor use.</p>	<p>Reception offices.</p> <p>Self-catering accommodation and camping for up to 100 guests in total at any time¹</p> <p>Single small lodges for up to 30 guests are permissible if all facilities are contained in a compact footprint, this represents the total accommodation for the zone, and any restaurant or catering facilities are for overnight guests only.</p> <p>If possible roads should be narrow with separate incoming and outgoing routes; otherwise double vehicle width roads are strongly advisable for safety and usability.</p> <p>Roads in this zone should be surfaced to reduce management cost and environmental impacts.</p> <p>Development and infrastructure may take up a significant proportion of the zone, but planning should ensure that area still provides relatively natural outdoor experience.</p>	<p>Motorised self-drive 2x4 sedan car access.</p> <p>Tour bus access.</p> <p>Parking areas.</p> <p>This zone should be used to provide parking and walk-in access for day visitors to adjacent Nature Access zone if possible.</p>	<p>Visitor Management:</p> <p>Use infrastructure solutions such as railings, hard surfacing and boardwalks to manage undesirable visitor impacts.</p> <p>Accept negative impacts on natural habitats in this zone unless these are specifically addressed in a Special Management Overlay.</p> <p>Frequent footpath and road maintenance must be scheduled for high impact routes.</p> <p>Visible impacts to adjacent Zones should be considered and mitigated.</p> <p>Conservation Management:</p> <p>Provide access and generate revenue.</p> <p>Management should aim to mitigate the impacts of the high number of visitors.</p> <p>Largely transformed habitats with lower management requirements. Usually fire exclusion areas.</p> <p>Prevent or rehabilitate visible trampling or any other visitor impact.</p> <p>Plan for a compact overall development footprint, avoiding dispersed infrastructure that will increase fire risk and/or environmental footprint. This is most critical in fire-prone environments.</p> <p>Consumptive Use:</p> <p>Sustainable use may be appropriate subject to a formal assessment and application in accordance with CapeNature policies.</p>

¹ Although 100 guests seem high this is in line with CapeNature sites that would fall within this zone definition, e.g. configured as 10 x 4-sleeper self-catering units and 15 campsites.

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
<p style="text-align: center;">Development – High Intensity</p>	<p><i>Users:</i> To provide access to adjacent natural landscapes with no expectation of solitude.</p> <p>To provide low and/or higher density accommodation.</p> <p>May provide some conveniences such as restaurants and shops.</p> <p>Conservation: To locate the zone and infrastructure to minimise impact on sensitive environments.</p> <p>To actively manage users and visitor impacts on adjacent sensitive areas.</p> <p><i>Provide additional protection to sensitive or threatened habitats, species or other features by Special Management Overlays</i></p>	<p>Areas with extensive degraded or transformed footprints. Natural or semi-natural habitats only where benefits outweigh impacts.</p> <p>Areas able to accommodate very high numbers of visitors regularly, with no identified sensitive biodiversity.</p> <p>Areas able to accommodate roads, trails and accommodation infrastructure without risk.</p> <p>Areas easily accessible from reserve management centre.</p> <p>Areas where risk of fire damage to infrastructure is low or can be mitigated without unacceptable impacts on surrounding environment.</p> <p>Areas where new infrastructure can be located with low visibility from the surrounding landscape. Areas not visible from Primitive or Wilderness Zones.</p> <p>Areas with available potable water, and not sensitive to disposal of larger amounts of treated wastewater.</p>	<p>Restaurants and small shops.</p> <p>Picnicking.</p> <p>Walking or bicycle access into adjacent areas.</p> <p>Accommodation in small hotels, lodges and higher density self-catering accommodation and/or camping.</p> <p>Meetings, workshop or mini-conference activities for no more than the number of people that can be accommodated overnight in the zone.</p>	<p>High density tourism development nodes.</p> <p>Modern amenities including restaurants & shops.</p> <p>Self-catering accommodation and camping for over 100 guests in total at any time.</p> <p>Lodges or small hotels.</p> <p>Roads in this zone must be surfaced to reduce management cost and environmental impacts.</p> <p>Development and infrastructure may take up a significant proportion of the zone, but planning should ensure that area still provides relatively natural outdoor experience.</p>	<p>Tour bus access.</p> <p>Motorised self-drive sedan car access.</p> <p>Parking areas.</p> <p>Air access only permitted if considered and approved as part of zoning scheme and there is no possibility of faunal disturbance.</p>	<p>Visitor Management:</p> <p>Management action will focus mostly on maintenance of facilities & providing high quality experiences.</p> <p>Use infrastructure solutions such as railings, hard surfacing and boardwalks to manage undesirable visitor impacts.</p> <p>Accept substantial impact on natural habitats in this zone unless these are specifically addressed in a Special Management Overlay.</p> <p>Frequent landscape, footpath and road maintenance must be scheduled for high impact areas.</p> <p>Visible impacts to adjacent Zones should be mitigated.</p> <p>Conservation Management:</p> <p>Provide access and generate maximum revenue.</p> <p>Management should aim to mitigate the biodiversity impacts of the high number of visitors only in sensitive areas (if any) identified by Special Management Overlay.</p> <p>These are highly transformed habitats with lower management requirements. Natural fire exclusion areas.</p> <p>Prevent or rehabilitate visible trampling or any other visitor impact.</p> <p>Plan for a compact overall development footprint, avoiding dispersed infrastructure that will increase fire risk and/or environmental footprint. This is most critical in fire-prone environments.</p> <p>Consumptive Use:</p> <p>Sustainable use unlikely to be compatible.</p>

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Development - Management	<p>Location of infrastructure and facilities for Reserve Administration & especially conservation management facilities</p> <p>Not compatible with tourism and access.</p>	<p>Areas with extensive degraded or transformed footprints. Natural or semi-natural habitats only where benefits at reserve scale outweigh local impacts.</p> <p>Areas able to accommodate high disturbance, with no identified sensitive biodiversity.</p> <p>Areas providing easy access to reserve and infrastructure.</p> <p>Areas very close to zones requiring highest management intervention, especially Low/High intensity Zones.</p> <p>Areas where risk of fire damage to infrastructure is low or can be mitigated without unacceptable impacts on surrounding environment.</p> <p>Areas where new infrastructure can be located with low visibility from the surrounding landscape. Areas not visible from Primitive or Wilderness Zones.</p> <p>Areas with available potable water, and not sensitive to disposal of treated wastewater.</p>	n/a	<p>Any reserve management infrastructure including offices, sheds, garages, stores, etc.</p> <p>Roads required to access these should be surfaced to reduce long-term maintenance costs and environmental impact.</p> <p>NOTE Reserve administrative offices may also be located within visitor reception facilities in Development - Low/High Intensity Zones</p>	none	<p>Visitor Management: n/a</p> <p>Conservation Management: Frequent footpath and road maintenance must be scheduled for high impact routes.</p> <p>Accept some impact on natural habitats in this zone unless these are specifically addressed in a Special Management Overlay.</p> <p>Visible impacts to adjacent Zones should be mitigated.</p> <p>Management should aim to contain all activities within the smallest possible footprint.</p> <p>Largely transformed habitats with lower management requirements. Usually fire exclusion areas.</p> <p>Prevent or restore trampling or any other management impact.</p> <p>Plan for a compact overall development footprint, avoiding dispersed infrastructure that will increase fire risk and/or environmental footprint. This is most critical in fire-prone environments.</p> <p>Consumptive Use: Sustainable use unlikely to be possible in small zone.</p>

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Development - Production	Commercial or subsistence farming. (only applicable to privately owned & managed Contract Nature Reserves)	Areas identified for production farming. Areas with extensive degraded or transformed footprints. Natural or semi-natural habitats only when use of these areas is supported by a bioregional plan and specialist site assessment.	May allow agri-tourism	Any agricultural infrastructure.	May allow agri-tourism	Agricultural best practise to support surrounding natural areas, particularly with regard to river and wetland buffer areas.
Development - Private Areas	Private dwelling and surrounds. (only applicable to privately owned & managed Contract Nature Reserves)	Private homestead. Areas with existing degraded or transformed footprints. Natural or semi-natural habitats only when use of these areas is supported by a bioregional plan and specialist site assessment.	n/a	Dwellings and private accommodation areas. Roads to access these.	No access by the public without permission from landowner.	Should have no negative impacts on the surrounding conservation area.

Protection Zones

Zone	Zone Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Species / Habitat / Cultural Protection	<p>Users: This zone's primary purpose is conservation and research. Limited tourism use only if compatible with conservation objective.</p> <p>Conservation: Protection of species or habitats of special conservation concern. Restrict access to prevent disturbance and/or damage.</p>	<p>Larger areas where uncontrolled public access is undesirable due to presence of regionally critically rare and endangered fauna, flora, habitat.</p> <p>Typical example would be a seabird breeding colony, particularly for threatened species.</p>	<p>Research. Nature observation under strictly controlled conditions only if specifically noted.</p>	<p>Usually none, but footpaths and tracks to allow management access may be permitted. Where visitor access is permitted, strict access control infrastructure is required to delimit access routes, and if necessary screen visitors. I.e. hides, boardwalks, screened routes, and paths with railings may be appropriate.</p>	<p>Public / Tourism access normally not allowed. May be permitted under very tightly controlled conditions, to be determined per site.</p>	<p>Visitor Management: Prevent visitor access or restrict numbers of visitors and allow for no-use rest periods if required. Infrastructure layout, design and construction must be designed and maintained to highest environmental standards. Conservation Management: Feature specific – as required. Prevent any negative impacts on identified feature/s. Consider removal and/or rehabilitation of non-essential infrastructure. Consumptive Use: Not compatible.</p>

Special Management Overlays

Special management overlays provide an indication of areas requiring special management intervention within the above zones. Overlays would typically only be applied where zoning does allow visitor or management access, but special measures are required, particularly to ensure protection of important and sensitive features or sites. Overlays should include specific indication of permitted activities, access, facilities/infrastructure and management guidelines that differ from the rest of that zone. Overlay requirements can be flexible, adapted to the requirements of the feature/s they protect.

Overlay	Overlay Objective	Characteristics	Visitor Activities	Facilities / Infrastructure	Visitor Access	Management Guidelines
Cultural	Protection of localised important Cultural Feature.	Can overlap any zone. Permanent, temporary or temporal zone to manage important cultural or heritage features.	Specific activities dependent on ability to manage activity and feature in question.	Usually none, but specific infrastructure dependent on feature in question.	Specific access dependent on ability to manage access and feature in question.	Feature specific – as required.
Species / Habitat	Protection of localised important Biodiversity Feature	Can overlap any zone. Permanent, temporary or temporal zone to manage important and sensitive species and/or habitats. Typically only applied where visitor impacts are expected.	Specific activities dependent on ability to manage activity and feature in question.	Usually none, but specific infrastructure dependent on feature in question.	Specific access dependent on ability to manage access and feature in question.	Feature specific – as required.
Visual	Protection of sensitive view sheds and particularly for Wilderness Zone view sheds.	Can overlap any zone. Sensitive view sheds and particularly for areas within Wilderness Zone view sheds.	Specific activities dependent on ability to manage activity and feature in question.	No roads, firebreaks or buildings. No visible infrastructure. Trails may be appropriate.	Walking access likely to be appropriate.	Feature specific – as required.
Natural Resource	Access to identified sustainable consumptive use resources as per a resource management plan.	Can overlap any zone except Wilderness and Protection zones. Areas with identified natural resources formally assessed as not sensitive to harvesting and where an approved sustainable harvesting plan is in place.	Harvesting of identified resources.	None	Specific access dependent on feature in question.	Feature specific – as required.

Research is usually permissible in all zones, except Species/Habitat protection or Cultural Protection where it may be restricted. Research that requires destructive harvesting or manipulation of more than a few square metres of habitat should not be considered in any of the Protection overlays, except where research outputs are considered essential for management of that ecosystem, research cannot be done at an equivalent site elsewhere, and research results are certain to contribute substantially to management objective.

GNRC's zonation (see Figure 5.3):

- The section of the GNRC (within the MPA) around Buffalo Bay is a popular destination with high visitor use to the estuary and MPA especially during holiday seasons.
- **Primitive Zone:** Areas beyond the existing heavily accessed portion of the reserve are zoned as primitive zone, with access permitted with a visitor permit. These areas provide opportunities for solitude and limit visitor impacts overall. This zone includes the greater part of the reserve. The three tourism facilities (River, Forest and Vlei lodge) on Buffalo Valley and the Mvubu Lodge next to Groenvlei also fall within this zone, as none of these facilities accommodate more than four to six people.
- **Nature Access Zone:** This zone includes the public road to Buffalo Bay and the access road to the Goukamma Station. It also includes the estuary, beach area and Groenvlei Lake as no permits are required to visit these sites. Licences for angling are however required as well as a permit to launch a boat onto Groenvlei Lake.
- **Development - Management Zone:** This includes the existing staff housing, stores, workshop, etc. at the Goukamma Station, the existing staff house near the entrance to Buffalo Valley (which is ear-marked as the site for the new office complex of GNRC), and the inspection quarters and staff accommodation at the Groenvlei Station. Visitors to the estuary at the Goukamma Station require a day permit if picnicking or if they are booked in at the facilities.
- **Development – Low Intensity Zone:** The existing tourism infrastructure (three rondawels, Otters Rest lodge and Fish Eagle Loft; Spotted Grunter and Galjoen units; picnic area) at the Goukamma Station as well as the proposed campsites fall within this zone. At the Groenvlei Station, the three converted bushcamp chalets, the Mvubu bushcamp and the proposed new lodge or two self-catering units as indicated in Section 5.4 below fall within this zone.
- **Development - High Intensity Zone:** None planned.

The proposed rezoning of the existing MPA can also be seen in Figure 5.3. The proposed zonation scheme entails two zones namely:

- **Controlled zone** – (100 m from the highwater mark) shore angling with rod and line at any time of day is allowed but bait collection, all net fishing and spearfishing is not allowed.
- **Restricted zone** – (remainder of the MPA) no take zone where no shore angling, spearfishing, netting or bait collection are allowed.

However, specific areas would require specific control measures. These are proposed in Table 5.4.

Table 5.4: The specific control measures per area proposed for the rezoning of the Goukamma Marine Protected Area.

Area	Specific control measures	
	NOT ALLOWED	ALLOWED
1	All consumptive utilization	All non-consumptive utilization
2	a) Bait collection. b) Spearfishing. c) Net fishing.	a) Shore fishing with a rod and line within national set bag and size limits.

		b) Commercial washed out red bait collection by local right holders.
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A concept document was developed and presented at the 2010 National MPA Forum. The DEA: Oceans and Coasts as Chair of the Forum formally accepted the proposal in 2012. During 2014 Anchor Consultants was appointed by CapeNature to facilitate the process of proclamation of the proposed changes. A public meeting was held to determine the response from stakeholders. The resultant report, incorporating these preliminary comments has been presented to the Minister for approval where after the formal proclamation process will follow.

The zonation of the GNRC is shown in Figure 5.3.

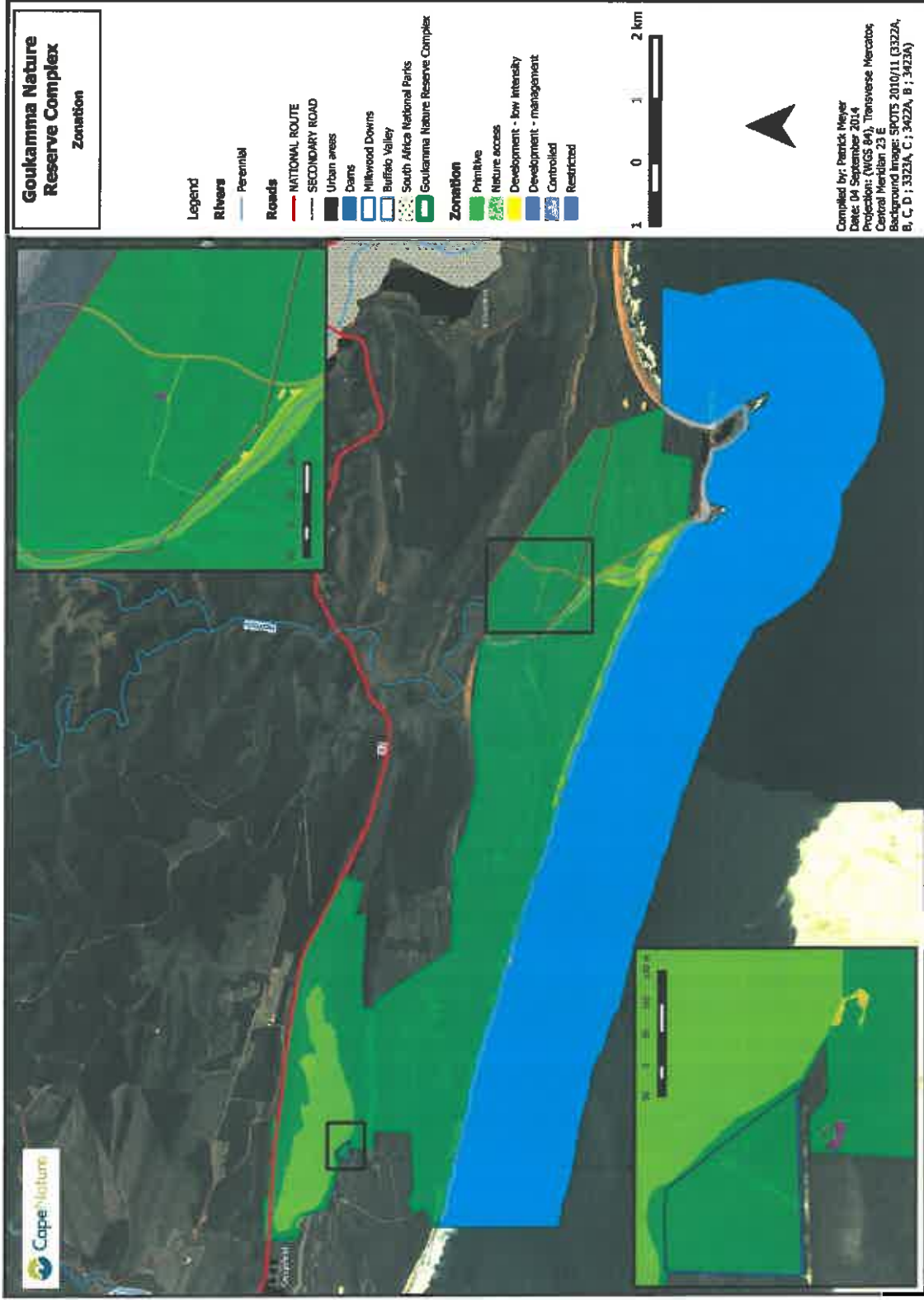


Figure 5.3: Zonation map of Goukamma Nature Reserve Complex.

5.3 Access

The National Environment Management: Protected Areas Act, 2003 (Act No. 57 of 2003) advocates access to and benefits from protected areas.

Access to the GNRC and its facilities are provided to the public at various points. Two types of access are provided: open access and controlled access. These are listed in Table 5.5 and spatially mapped in Figure 5.4.

Along the western boundary open access to Groenvlei Lake and the MPA is provided to the public at two points. The point which provides access to the MPA is not actively managed. This does cause enforcement difficulties, particularly with night fishing which is currently prohibited through management, but not legislated. The only legislation available to enforce is illegal entrance to a nature reserve without a permit. However, as other users are allowed access without a permit, preventing night fishing is a difficult issue to address through legislation. Revised regulations need to be drafted and accepted through the re-alignment and rezonation process of the MPA. On the eastern side, open access is also provided to the public at various points along the public access road to Buffalo Bay. The MPA access at Buffalo Bay is a high use area where the problem of night fishing is also evident. There is open access to the popular beach at Buffalo Bay, which is part of the Goukamma MPA; it is well sign posted.

Access to the GNRC for environmental education purposes are accommodated on request. These activities are done in collaboration with the Community Conservation Component Partners, i.e. Government institutions, are encouraged to utilise this reserve for outings, which is then coupled with relevant EE activities.

Where specific groupings (i.e. Khoi San) express the need to collaborate with CapeNature on heritage or cultural projects that they wish to execute, the Community Conservation Component, as well as other relevant components (Conservation Management, Tourism, etc.) will form part of a Project Development Group and Project Management Unit when this project comes to fruition.

Table 5.5: Public access points to the Goukamma Nature Reserve Complex (see Figure 5.4).

No.	Locality	Name	Type of Access	Activity
1	Western access to beach and MPA	Platbank access	Open access	Access to MPA and beach at western boundary (Platbank).
2	Western access to Goukamma NR	Western 4X4 access	Controlled access (locked gate)	Access for management purposes only.
3	Access to Groenvlei Station	Groenvlei Station access	Controlled access	Access to tourism accommodation and management facilities at Groenvlei Station.
4	Western Groenvlei Lake access near Lake Pleasant	Lake Pleasant access	Controlled access	Access to Groenvlei Lake.
5	Western Groenvlei Lake access at caravan park	Caravan park access	Controlled access	Access to Groenvlei Lake.

No.	Locality	Name	Type of Access	Activity
6	N2 – Groenvlei Lake access	Groenvlei slipway/jetty access	Open access	Access point from N2 to the jetty and slipway on northern side of Groenvlei Lake.
7	N2 – Old house access	Old house access	Controlled access	Access to old house from N2 for management purposes only.
8	N2 – Mielie Rug access	Mielie Rug access	Controlled access	North eastern access to Groenvlei Lake for management purposes only.
9	Eastern access from Ganzvlei 208	Ganzvlei 4X4 access	Controlled access	Eastern access from Ganzvlei property for management purposes only.
10	Northern access to Goukamma Estuary from Buffalo Valley	Northern Goukamma Estuary access	Open access	Northern access to Goukamma Estuary from Buffalo Valley.
11	R346 public road to Buffalo Bay	Buffalo Bay R346 public road	Open access - Public road (tarred)	Public access road to Buffalo Bay.
12	Access road via Buffalo Valley to Goukamma Station	Buffalo Valley access road	Controlled access	Access to Goukamma Station and Buffalo Valley tourism facilities.
13	Access to eastern section of Buffalo Valley	Buffalo Valley eastern section access	Controlled access	Access to eastern section of Buffalo Valley for management purposes only.
14	Access to eastern section of Goukamma NR along northern boundary	Goukamma eastern section access along northern boundary	Controlled access	Access to eastern section of Goukamma NR along northern boundary for management purposes only.
15	Access to eastern section of Goukamma NR.	Eastern section access	Controlled access	Access to eastern section of Goukamma NR for management purposes only.
16	Main gate to Goukamma Station	Goukamma main gate	Controlled access	Main entrance gate to reserve office, accommodation and tourist facilities at Goukamma Station.
17	Access to Goukamma Estuary	Goukamma Estuary access	Open access	Access to Goukamma Estuary.
18	Access to MPA, Goukamma Estuary and beach from Rowwehoek	Rowwehoek access	Open access	Access to MPA, beach and Goukamma Estuary from Rowwehoek.
19	Access to the MPA and beach from Buffalo Bay (various points)	Buffalo Bay access to MPA	Open access	Access to MPA and beach from various points in Buffalo Bay.

CapeNature is a partner in a number of servitude agreements for which the respective partners are provided access to land managed as part of the GNRC. Current servitudes are listed in Table 5.6.

Table 5.6: Servitudes and management agreements of the Goukamma Nature Reserve Complex.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected
15 January 2014	Stewardship Contract Nature Reserve	Thesen Trust	30 years	Buffalo Valley (Weltevrede 214 Portions 1 and 2)
March 2000	Management Agreement (Hire Contract)	Knysna Municipality (previously Sedgefield Municipality)	10 years	The contract covers a piece of municipal land north of Buffalo Bay which has been managed and continues to be managed by CapeNature towards conservation goals.
23 January 2004	Milkwood Downs management lease agreement	WWF-SA	99 year lease	Milkwood Downs property (Portion 38 (Portion of Portion 33) of Ruygte Vally 205).



Figure 5.4: Access on Goukamma Nature Reserve Complex.

5.4 Concept Development Plan

5.4.1. History

Proposed developments, largely consisting of substantial infrastructure maintenance, were presented to a Quarterly Ecological Meeting (QEM) (Oudtshoorn, 25th February 2011) and discussed. It was decided that there was a need for a Development Plan for the GNRC.

A workshop was convened on Goukamma Nature Reserve on the 6th June 2011 and attended by the Conservation manager, Tourism officer, Tourism manager, the then Ecological planner of tourism infrastructure, Ecological Coordinator, Regional Ecologist, Conservation Services Manager and the then Area Manager.

All proposed sites were visited and development options at both the Goukamma and Groenvlei Stations were discussed. In order to fully understand the development plan the current layout at each of the stations is illustrated in Figure 5.5 (Goukamma Station) and Figure 5.12 (Groenvlei Station).

For a description of the existing infrastructure please refer to the Reserve Infrastructure Management Programme. All existing building numbers are in the format "GOU###" and their details have been extracted from the Reserve Infrastructure Register and attached in Table 3.11.

5.4.2. Guidelines

The infrastructure development plan for the GNRC as compiled by Spencer (2011) is based on the following principles:

- Developments must give due consideration to issues of sense of place and specific site locations. Developments must be aesthetically pleasing and blend in with the natural environment.
- Developments must take place on existing footprints first and in certain instances, which are duly considered, extended footprints.
- Greenfield sites will need to be fully assessed according to relevant legislation before approval.
- Environmental impacts will need to be properly addressed for each development.
- All developments must maximize return to the environment by means of environmentally friendly systems such as solar/wind energy, rainwater capture and "touch the earth lightly" construction methods.
- Developments will be restricted to the "Low Intensity Development" and "Development – Management" zones at the Groenvlei and Goukamma Stations (as shown in the Goukamma Zonation map in Figure 5.3).
- Structures and/or buildings will be kept to what is absolutely essential (e.g. gate houses, picnic shelter, radio masts, boreholes, reservoirs, signboards, interpretative signs, hiking trails, roads and possible overnight accommodation).
- All new developments must have a business plan to ensure that return on capital is achieved in a business manner and that operational costs and inputs are secured in conjunction with the development.

5.4.3. Proposed developments at the expanded Goukamma Station

The current Goukamma Station has recently expanded in size and extent with the inclusion of the Buffalo Valley Contract Nature Reserve under the management of the Goukamma Nature Reserve Complex.

The current layout of Goukamma Station (including some of the structures on Buffalo Valley Contract Nature Reserve) is shown in Figure 5.5.

Proposed major changes in the design of the layout at the expanded Goukamma Station include the following:

- Moving the main entrance to the reserve northwards along the R346 to where the current entrance to Buffalo Valley Contract Nature Reserve is;
- Moving the office from the staff housing area to a suitable site closer to the new entrance on Buffalo Valley Contract Nature Reserve;
- Reducing the size of the current picnic site to a smaller site and rehabilitating the remainder of the old site;
- Establishing camp sites as a new type of tourism facility on the reserve;
- Improving the access road through the use of grass blocks;
- Improving the drinking water supply through installation of a rainwater reticulation system.

Figure 5.6 shows the location of the development nodes at the expanded Goukamma Station (indicated as Sites 1, 2 & 3). The details of the proposed developments at each of these three nodes are illustrated in Figures 5.7 (Site 1), 5.8 (Site 2) and 5.9 (Site 3).

Rerouting of the section of the R346 that falls within the floodplain of the Goukamma River is becoming a high priority that needs to be addressed by the Dept of Transport (in collaboration with the relevant role players). This section of the road remains a continuous problem because it falls apart each time there is a major flooding event.



Figure 5.6: Location of the three nodes (indicated as Sites 1-3) of proposed developments at the expanded Goukamma Station.

The proposed developments at Site 1 are shown in Figure 5.7 and the details are explained below.

5.4.3.1 Picnic site

Current:

- The current picnic site is made up of the northerly blue block (labelled 'picnic site') and the two red areas (labelled 'rehabilitation site') (Figure 5.7).
- There are two ablution blocks (GOU15; GOU16), one interpretation centre (GOU14), two canoe stands, one tap, 13 fireplaces, nine sun shelters and nine cement tables and chairs.
- The current gate house (GOU79) and entrance gate are located at the south eastern end of the red area.

Proposal:

- To close 60% of the current picnic area (red blocks) including the current gate house entrance. The gate house will be moved to the existing entrance of Buffalo Valley Contract Nature Reserve.
- To move all fireplaces and all sun shelters into the new picnic area (northerly blue block).
- To upgrade and maintain the existing interpretation centre.
- To expand the water system and install four more taps in the new picnic area.
- To rehabilitate the existing gravel road to a single-lane, two-track road with four to six passing areas. Tracks must preferably be paved with grass blocks. This road development extends to Site 2 (Figure 5.8).

5.4.3.2 Camp site 1

Current:

- The site is currently being used as a storage area. A building, known as the 'Lorry Store' (GOU22) takes up 70% of the site and the remaining open area is used for storing gravel (Figure 5.7).
- An ablution block, which served the larger picnic area, exists in the south eastern "dog leg" of the yellow block.

Proposal:

- To demolish the 'Lorry Store';
- To rehabilitate the entire site and investigate options for a possible campsite.

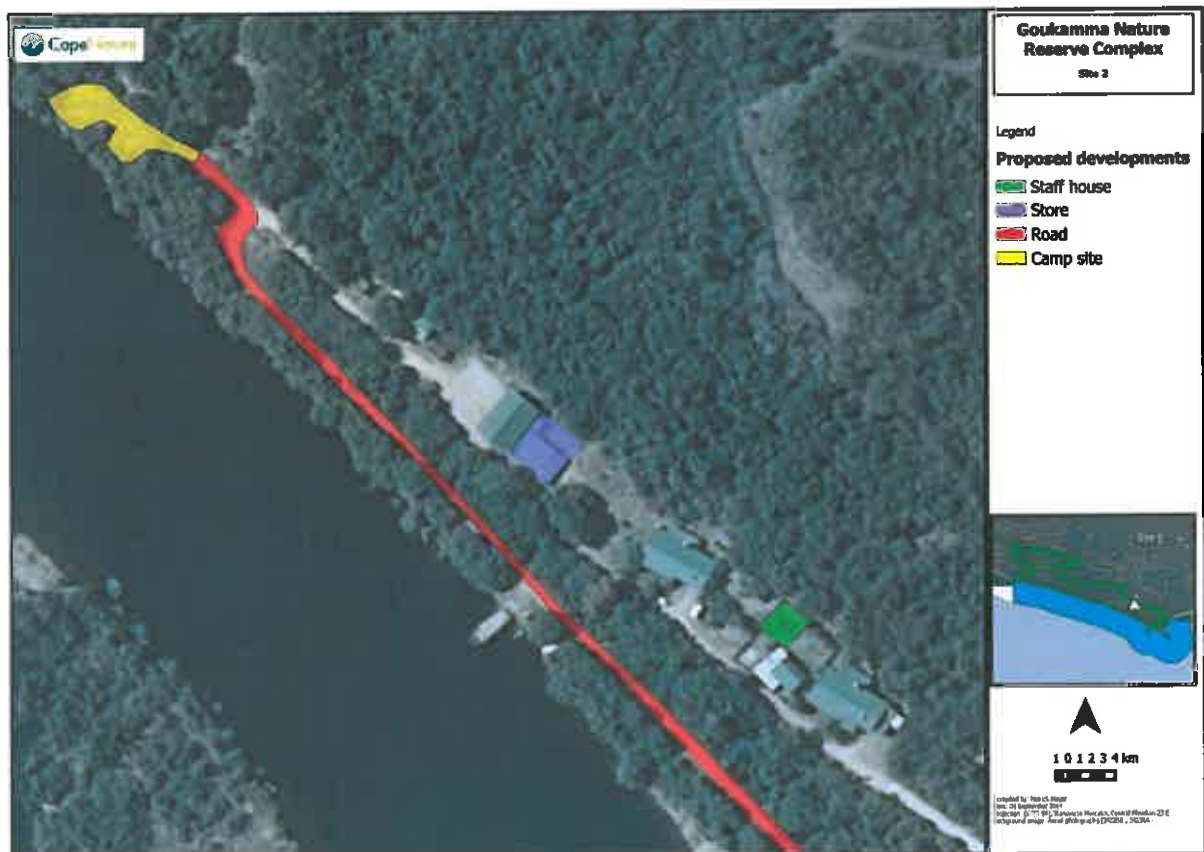


Figure 5.8: Details of Site 2, showing the proposed location of the second camp site, the store and staff house at the expanded Goukamma Station.

5.4.3.4 Store

Current:

- The current building consists of a wooden frame with asbestos side panels and has two small store rooms and an exterior covered space called 'D Store' (GOU6; GOU8) (Figure 5.8).

Proposal:

- To demolish the existing structure;
- To rebuild a new brick and mortar structure of approximately the same size, linking it to the adjacent existing brick and mortar building allowing internal linkages and resulting in a store/laundry/ironing area for tourism operations and a general storage facility for reserve operations;
- To demarcate and pave the vehicle parking and loading area on the existing footprint.

5.4.3.5 Staff house

Current:

- The current site consists of a fenced garden area which contains a wooden staff house (GOU4) (Figure 5.8).

Proposal:

- To convert the existing building into a garage for vehicle storage or to demolish it.
- To construct a new staff house in the area.

Figure 5.9 shows the proposed developments at Site 3. These are explained below.

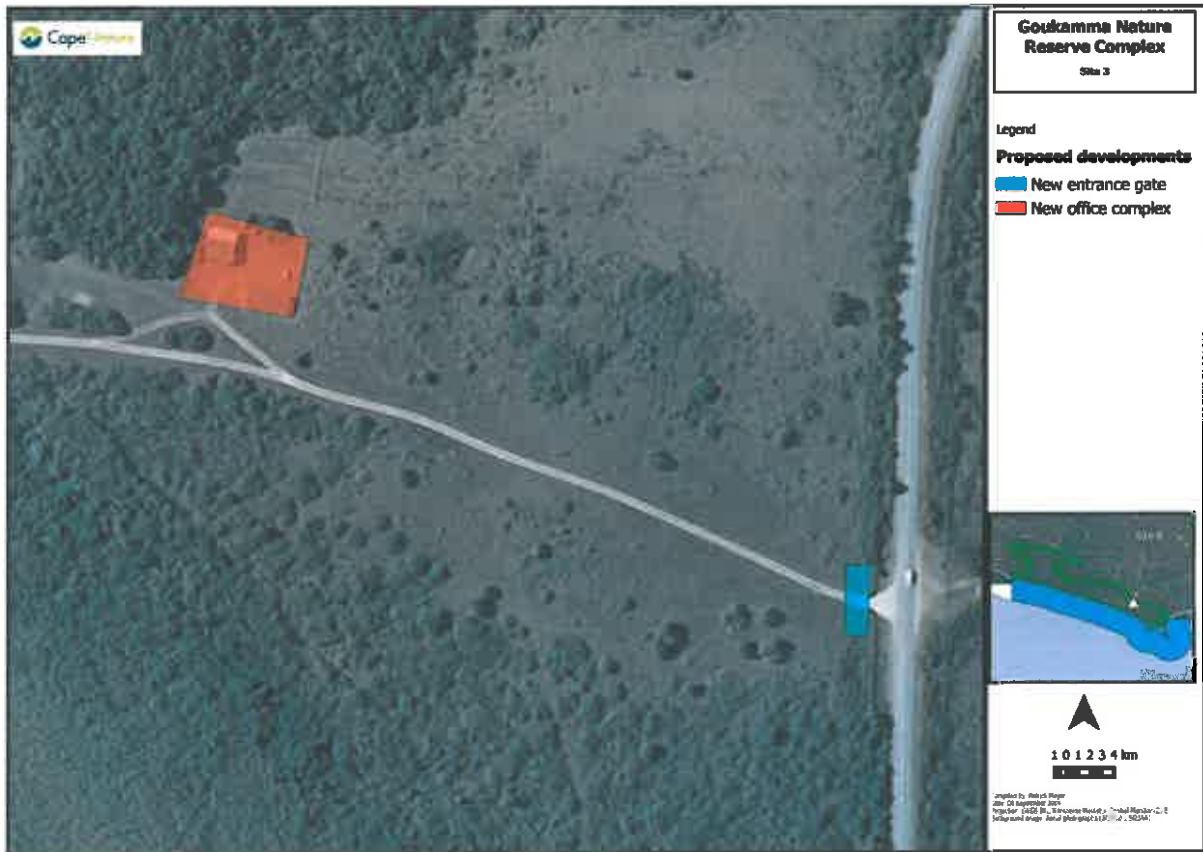


Figure 5.9: Details of Site 3, showing the proposed location of the new office complex and entrance gate at the expanded Goukamma Station.

5.4.3.6 New Office Complex

Current:

- The current site has a brick and mortar building of approximately 12 m x 15 m and a covered area of approximately 25 m x 8 m (Figure 5.9).
- The area has been previously disturbed and is clear of trees and bushes.

Proposal:

- To design and develop an office complex consisting of a meeting facility, a small kitchen, an operations room, administration office, tourism office, two operations offices, and adequate storage and parking areas.

5.4.3.7 New Gate Entrance

Current:

- The current entrance gate to Buffalo Valley Contract Nature Reserve has a metal gate with two wooden pole side walls (Figure 5.9).

Proposal:

- To install the existing Goukamma gatehouse (GOU79) at this entrance.

5.4.3.8 Rainwater capturing system

Figure 5.10 shows the proposed sites where the rainwater catchment infrastructure will be constructed.

Current:

- The current layout has four buildings equipped with guttering and downpipes, ten asbestos 2 500 litre rainwater capture tanks, a sub-standard piping system and mono-pump leading to six raised asbestos 2 500 litre holding tanks and an outflow pipe system to one staff house (Figure 5.10).

Proposal:

- To install additional guttering on one building;
- To install filter traps at all down piping;
- To move the existing holding tanks to a lower level;
- To install a pressure pump system with suitable filter system;
- To install a new piping system running where possible along the sides of roads to and from holding tanks;
- To install one drinking tap in the kitchen of each of the nine buildings.

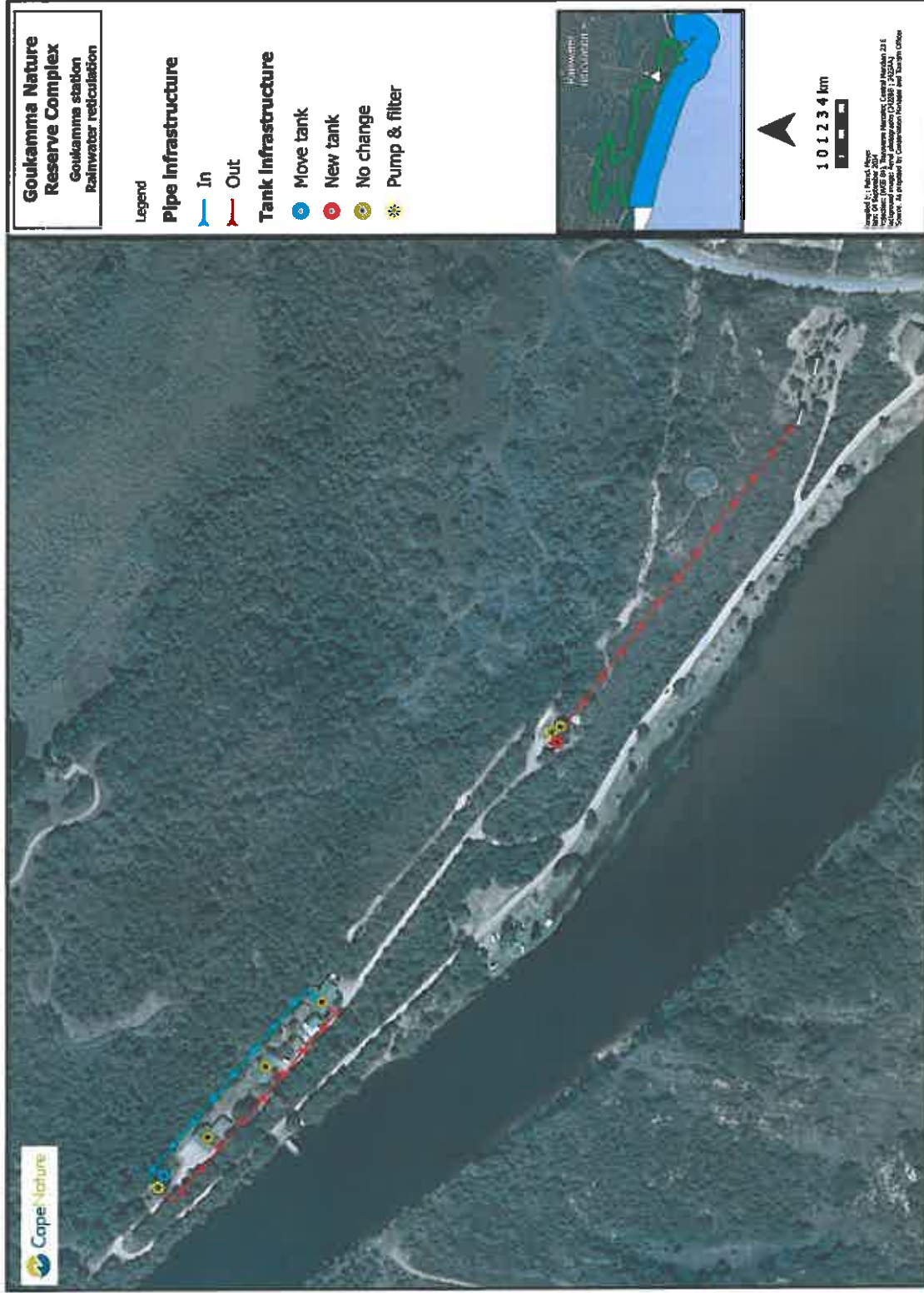


Figure 5.10: Proposed rainwater catchment and utilization system at the expanded Goukamma Station.

5.4.4. Proposed developments at the Groenvlei Station

The current layout of infrastructure at the Groenvlei Station is shown in Figure 5.11.

The following major changes to the existing layout are proposed:

- That the operational aspects of the office, staff house and the workshop be moved to a different site;
- The existing office, staff house and the workshop change function to that of tourism;
- The existing single facility bushcamp becomes three separate self-catering units;
- The existing staff housing area expands in size and function to accommodate the office;
- An improved drinking water supply through the installation of a rainwater reticulation system.
- To install effective environmentally friendly sewage facilities in collaboration with DPW.

The following individual infrastructure developments are proposed and will be dealt with in detail:

- Staff and operations buildings
- Lodge complex
- Bushcamp chalets
- Rainwater capture and reticulation system

Maintenance of the current access road to the Groenvlei Station would need to be addressed in consultation with the local authority and the landowners utilising the road to get access to their properties.



Figure 5.11: Current layout of infrastructure at the Groenivlei Station.

Figure 5.12 shows the location of the development nodes (indicated as Sites 4, 5 & 6) at the Groenvlei Station. The details of the proposed developments at each of these three nodes are illustrated in Figures 5.13 (Site 4), 5.14 (Site 5) and 5.15 (Site 6).

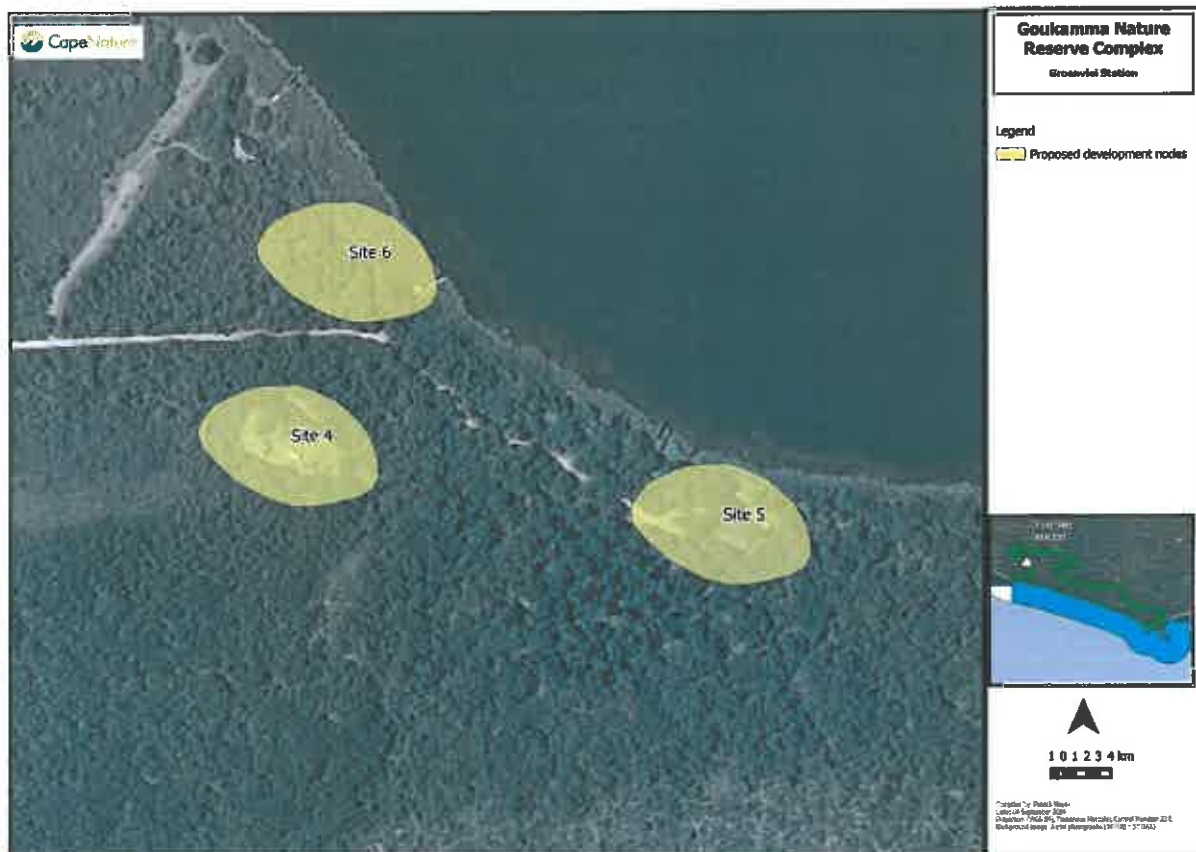


Figure 5.12. Location of the three nodes (indicated as Sites 4, 5 and 6) of proposed developments at the Groenvlei Station.

In Figure 5.13 the proposed developments at Site 4 are shown. The details are explained below.

5.4.4.1 Staff and operations

Current:

- There are two wooden frame and tin-clad staff houses (GOU49; GOU50) and external freestanding ablutions (GOU80), a retaining wall and landscape terracing (Figure 5.13).

Proposal:

- To demolish and rebuild one of the staff houses;
- To demolish and replace the other staff house with student living quarters for two students with a common kitchen/living area;
- To design and develop a small office to accommodate two or three staff members and a small store.
- To provide telephone services to the site;
- To provide a paved parking area.

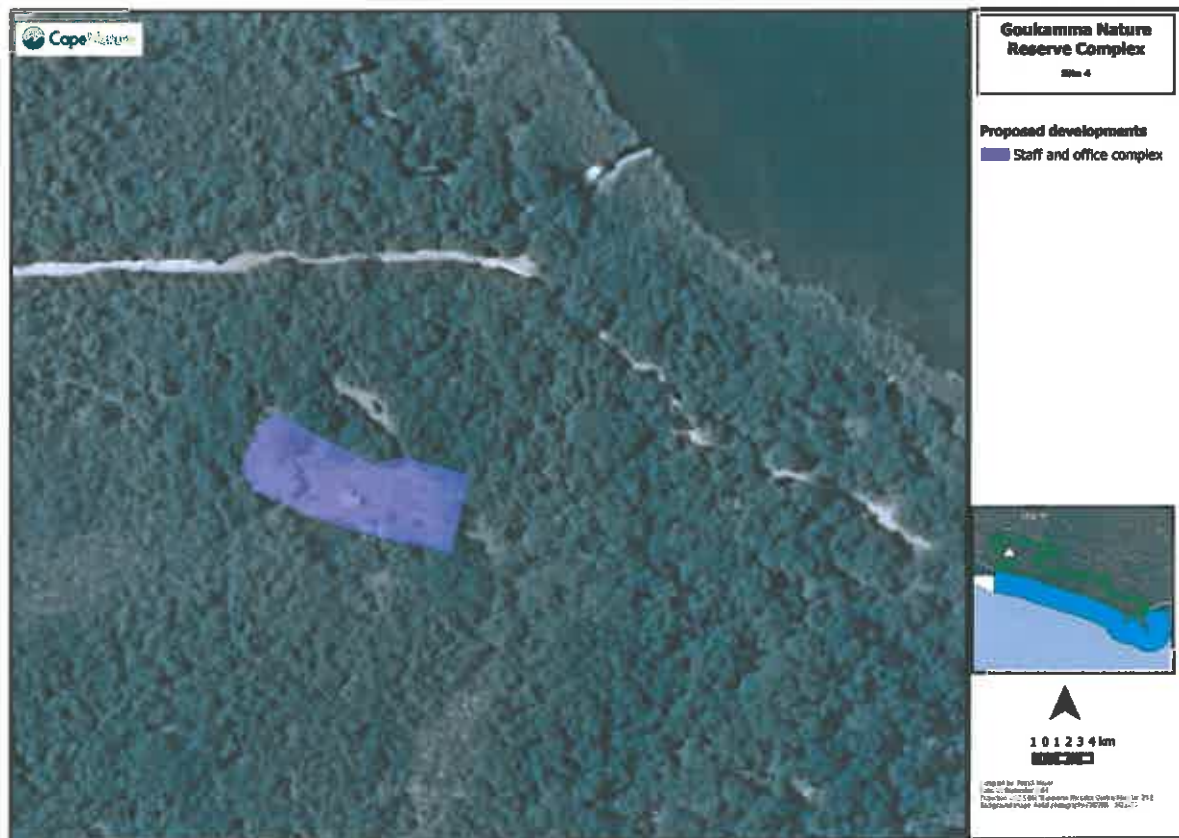


Figure 5.13: Details of Site 4, showing the proposed location of the staff and operations complex at the Groenvlei Station.

Figure 5.14 illustrates the proposed development area at Site 5. Details of the proposed developments are provided below.

5.4.4.2 Lodge

Current:

- There are a brick and mortar staff house (GOU45), a wooden office building (GOU46), a wooden frame and tin-clad workshop and garage building (GOU47) at the site (Figure 5.14), as well as a gravel parking area and a parking facility for one vehicle under shade cloth.
- There are also a wooden boathouse and a brick and mortar pump house.

Proposal:

- To demolish the staff house, the workshop and garage building;
- To design and develop a tourism facility and parking area on the footprint. This facility could be two separate self-catering chalets or a lodge with 10-12 bedrooms. The lodge would need to be outsourced to a concessionaire to operate.
- To convert the existing office into a self-catering facility;
- To erect suitable screening material to separate units where needed;
- To convert the pump house into a small storeroom.



Figure 5.15: Details of Site 6, showing the proposed location of the converted three self-catering units at the Groenvlei Station.

5.4.4.4 Rainwater capturing system

Figure 5.16 shows the proposed sites where the rainwater catchment infrastructure will be constructed.

Current:

- The current scheme has two buildings equipped with guttering and downpipes, one concrete (10 000 litres) and one plastic (5 000 litres) rainwater capturing tanks, a sub-standard piping system leading to one tourism house.

Proposal:

- To install guttering on new buildings, filter traps at all down piping, eight to ten new holding tanks, three pressure pump systems with suitable filter systems, a new piping system running (where possible along the sides of roads) to and from holding tanks.
- To install one drinking tap in the kitchen of each of the nine proposed buildings.



Figure 5.16: Proposed rainwater catchment and reticulation scheme at the Groenvlei Station.

5.4.5 Summary of proposed developments

A summary of the proposed developments in the GNRC is provided in Table 5.7.

The Environmental Impact Assessment (EIA) activities that may be triggered by some of the proposed developments are also highlighted. These need to be considered when the proposed developments are taken forward.

Table 5.7: Summary of proposed developments in the Goukamma Nature Reserve Complex.

No	Development	Priority	Footprint increase/decrease	Footprint type	EIA Triggers
3.1	Picnic site	1	Decrease	Lawns and Building	1) Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark (whichever greater) for fixed or floating jetties and slipways; tidal pools; embankments; rock revetments or stabilising structures including stabilising walls; buildings or infrastructure > 50 m ² (excluding behind a development setback line; within existing ports or harbours activities and will not increase the development footprint or throughput capacity; maintenance of the facilities)
3.2	Camp site	3	Neutral	Building	
3.3	Camp site	3	Neutral	Cleared bush and Building	
3.4	Store	2	Neutral	Lawns and Building	
3.5	Staff house	1	Neutral	Lawns	
3.6	New Office Complex	3	Neutral	Lawns and Building	
3.7	New Gate Entrance	3	Increase	Cleared bush	
3.8	Rainwater capture	1	Neutral	Lawns	
4.1	Staff operations	1	Neutral	Lawns and Building	
4.2	Lodge	2	Neutral	Lawns and Building	1) Resorts, lodges or other tourism accommodation facilities that sleep < 15 within 100 metres from the edge of a watercourse (if no setback line). 2) Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark (whichever greater) for fixed or floating jetties and slipways; tidal pools; embankments; rock revetments or stabilising structures including stabilising walls; buildings or infrastructure > 50 m ² (excluding behind a development setback line; within existing ports or harbours activities and will not increase the development footprint or throughput capacity; maintenance of the facilities)



No	Development	Priority	Footprint increase/decrease	Footprint type	EIA Triggers
4.3	Bushcamp chalets	1	Increase	Cleared bush and Building	1) Resorts, lodges or other tourism accommodation facilities that sleep < 15 within 100 metres from the edge of a watercourse (if no setback line). 2) Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark (whichever greater) for fixed or floating jetties and slipways; tidal pools; embankments; rock revetments or stabilising structures including stabilising walls; buildings or infrastructure > 50 m ² (excluding behind a development setback line; within existing ports or harbours activities and will not increase the development footprint or throughput capacity; maintenance of the facilities)
4.4	Rainwater capture	2	Neutral	Lawns	

6) STRATEGIC IMPLEMENTATION FRAMEWORK

The SIF guides the implementation of the management plan over five years in order to ensure that it achieves its management objectives. The SIF translates the information described in Sections 3, 4 and 5 above into management activities and targets, which will be used to inform annual plans of operation as well as the resources required to implement them. The management targets will form the basis for monitoring of performance in implementing the plan and are thus measurable.

The SIF is discussed under the following sections. The guiding principles of these sections are discussed in the Co-ordinated Policy Framework.

- 6.1 Legal status and reserve expansion
- 6.2 Regional integrated planning and cooperative governance
- 6.3 Ecosystem and biodiversity management
- 6.4 Wildlife management
- 6.5 Fire management
- 6.6 Invasive and non-invasive alien species management
- 6.7 Cultural and heritage resources
- 6.8 Law enforcement and compliance
- 6.9 Infrastructure management
- 6.10 Disaster and risk management
- 6.11 Socio-economic framework
- 6.12 Management effectiveness
- 6.13 Finance and administration management
- 6.14 Human resources management
- 6.15 Occupational health and safety management
- 6.16 Visitor management and services
- 6.17 Tourism development framework

6.1 LEGAL STATUS AND RESERVE EXPANSION					
Objective 4 To expand and secure the conservation estate					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
The GNRC has secure permanent legal conservation status in terms of NEM: PAA.	<ul style="list-style-type: none"> Consolidate and formalise legal status of provincial nature reserve. The protected area is listed in the National Register as required by the Act. 	Executive Director Operations; DEA; DEA&DP; Law Admin Manager.	The GNRC is legally secure.	Year 1-2	NEM:PAA
The GNRC boundary is known and appropriately demarcated and secure.	<ul style="list-style-type: none"> Confirm the boundaries of the Lake Pleasant Resorts land. 	Conservation Manager; Land-surveyor.		Year 1-2	NEM:PAA
The GNRC design (size and shape) are adequate to achieve the conservation objectives in the Management Plan.	<ul style="list-style-type: none"> Identify potential stewardship agreements with the surrounding landowners in line with Western Cape Protected Area Expansion Strategy (WCPAES). Ensure local strategy for GNRC expansion is included in WCPAES. Initiate stewardship agreements with neighbouring landowners. Maintain stewardship agreements with existing neighbouring stewardship sites. Promote the establishment of the Estuary Management Forum and encourage the development of an Estuary Management Plan. Follow-up progress wrt proclamation of the MPA re-alignment and re-zonation. Investigate the expansion of the MPA in a westerly direction. 	Conservation Manager; Programme Manager: Biodiversity Stewardship; Conservation Services Manager; Conservation Officer; Programme Manager: MPAs, Islands & Estuaries; Knysna Municipality; DEA; DWA.	Hectares added to the conservation estate (TBD).	On-going	Western Cape Protected Area Expansion Strategy; Stewardship programme
A buffer zone for the GNRC has been established.	<ul style="list-style-type: none"> Represent Capenature on surrounding Conservancy Committees where appropriate. 	Conservation Manager;		Ongoing	Stewardship programme

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<ul style="list-style-type: none"> Encourage the membership of surrounding Conservancies. Maintain partnership with the surrounding Conservancies. 	Conservation Services Manager; Community Conservation Manager.			

Budget Allocation	Development	
	Operation (5 Year Forecast)	R219 988

REGIONAL INTEGRATED PLANNING AND COOPERATIVE GOVERNANCE					
6.2	REGIONAL INTEGRATED PLANNING AND COOPERATIVE GOVERNANCE				
Objective 1	To conserve and manage biodiversity and natural processes representative of the Southern Cape terrestrial and marine ecological systems.				
Objective 2	To improve the reach and quality of biodiversity management.				
Objective 4	To expand and secure the conservation estate.				
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
The GNRC is integrated into land-use planning outside of the nature reserve.	<ul style="list-style-type: none"> Integrate with the SDFs and IDPs of the Eden District and Knysna Local Municipalities. 	Regional Manager; Protected Areas Manager; Community Conservation Manager; Conservation Services Manager; Scientist: Land-use Advice.	The protected area is integrated into land-use planning outside of the protected area.	Year 1 and 5	Intergovernmental Relations Framework Act, (Act No. 13 of 2005).
Water-use planning outside the GNRC takes into account the objectives of the GNRC.	<ul style="list-style-type: none"> Attend the Knysna and Wilderness Lakes Catchment Management Forum meetings re groundwater abstraction. Attend Goukamma Estuary management forum meetings. 	Conservation Manager.		Ongoing	National Water (Act No. 36 of 1998); Integrated Coastal Management Act (Act No. 24 of 2008)
Establish a functioning Advisory committee for the GNRC.	<ul style="list-style-type: none"> Identify relevant local and regional stakeholders, develop and apply criteria and processes for their involvement in strategic decision-making. Chair all the PAAC meetings as per ToR. 	All members of the RMC; Scientist: Aquatic; Programme Manager: MPAs, Islands & Estuaries.	Advisory committee for the GNRC has been established and is functioning and effective.	Ongoing	Ref Section 10.1.3; Regulations for the proper administration of nature reserves (2012); Integrated Coastal Management Act (Act No. 24 of 2008)

Budget Allocation	Development	
	Operation (5 Year Forecast)	R219 988

ECOSYSTEM AND BIODIVERSITY MANAGEMENT					
<ul style="list-style-type: none"> To conserve and manage biodiversity and natural processes representative of the Southern Cape terrestrial and marine ecological systems. To improve the reach and quality of biodiversity management. 					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
<p>6.3</p> <p>Objective 1</p> <p>Objective 2</p> <p>Compile and implement the Ecological Matrix according to the Ecological Plan of Operation for GNRC.</p>	<ul style="list-style-type: none"> Develop and implement an approved Ecological Matrix for the GNRC. Compile an Ecological Plan of Operations to support the Ecological Matrix. Analyse data, conduct annual review of Ecological Matrix and protocols and re-assess and implement adaptive management strategies. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist.</p>	<p>Ecological Matrix, Plan of Operations compiled.</p>	<p>Annually</p>	<p>Baseline data collection and monitoring manual (2010). Ecological Matrix format. Ecological Plan of Operations.</p>
<p>A biodiversity resource inventory for the GNRC is in place.</p>	<ul style="list-style-type: none"> Identify, list and describe important species (including Red Data Book/ Indicator species and population status), critical ecosystems functions (including hydrological, geomorphological and food web relationships) and threats/pressures. Prioritisation of species for inclusion on the Ecological Plan of Operation. Collect species data and submit to Scientific Services. Analyse data, re-assess and implement adaptive management strategies. 	<p>Conservation Manager; Ecological Coordinator.</p>	<p>SOB database updated.</p>	<p>Ongoing</p>	<p>Baseline data collection and monitoring manual (2010). Ecological Plan of Operations. Ecological Matrix</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<ul style="list-style-type: none"> Hard and digital copies of all documents and publications resulting from all monitoring and research in the reserve must be catalogued and stored at the GNRC office with backup copies sent to Scientific Services. 				
A monitoring programme for the GNRC is being implemented.	<ul style="list-style-type: none"> Review monitoring protocols. Identify monitoring needs of the reserve in consultation with Scientific Services. Establish indicators for monitoring. Implement monitoring activities as per the Ecological Matrix. Report on monitoring activities as per the Ecological Matrix. Analyse data, re-assess and implement adaptive management strategies. Implement relevant monitoring of national projects and/or programmes. Ensure collection of climatic data on the GNRC. 	Conservation Manager; Ecological Coordinator; Regional Ecologist; Manager: Scientific Services.	Relevant monitoring databases updated and analysed.	Ongoing	Baseline data collection and monitoring manual (2010).
A research programme for the GNRC is being implemented.	<ul style="list-style-type: none"> Identify, list, describe and prioritise research needs for the reserve. Develop and implement an applied research programme for the reserve in consultation with Scientific Services. 	Conservation Manager; Ecological Coordinator; Regional Ecologist;	Research needs list maintained. Reports on progress of research projects received and where relevant used to inform management.	Ongoing	CN research needs list; Fynbos Forum research strategy, CN permitting procedure.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<ul style="list-style-type: none"> Results of research projects are fed back to the management of the reserve. Results are used to adapt management of the nature reserve where relevant. Provide support to researchers as per Ecological Matrix and research permit conditions. 	<p>Manager: Scientific Services.</p>			<p>Assist ad hoc researchers to gain access to study sites and accommodation on the reserve.</p>
The GNRC contributes to the maintenance of ecosystem services.	<ul style="list-style-type: none"> Design and implement appropriate fire (Refer to Table 6.5) and alien invasive management (Refer to Table 6.6) programmes. Conduct a trail, jeep track and roads assessment as per ICM standards. Compile maintenance schedule. Implement trail, jeep track and roads maintenance schedule. Close and rehabilitate inappropriate trails, jeep tracks and roads in accordance with assessment report. Implement appropriate restoration programmes where possible. Implement monitoring as per the Ecological Matrix. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist; Catchment Manager; Programme Manager; Fire Programme Manager; AVM; Project Manager; Regional Manager; Protected Areas Manager.</p>	<p>Fire break, road, footpath, fence register and database compiled. Alien density database updated. Annual AVM APO. Annual roads and footpaths APO.</p>	Ongoing	<p>ICM Standard Operating Procedures, ICM & AVM APOs, Fire Management Policy.</p>
Prevent and mitigate soil erosion on the GNRC.	<ul style="list-style-type: none"> Map all erosion sites and ensure photos are taken. 	<p>Conservation Manager; Ecological Coordinator;</p>	<p>Potential erosion substrates mapped. Map of erosion sites.</p>	Ongoing	<p>ICM Standard Operating Procedures, ICM APO,</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Mitigate the impacts of groundwater abstraction on the reserve.	<ul style="list-style-type: none"> Conduct a soil erosion assessment as per ICM standards. Design appropriate rehabilitation techniques and include in erosion maintenance plan. Implement erosion monitoring as per standardised monitoring techniques. Provide input into future applications and monitor proposals for additional water abstraction. Monitor current CapeNature abstraction points at estuary spikes and Groenvlei. Be vigilant for new abstraction points on the Goukamma River and Groenvlei and report these to DWA. Request database for registered abstraction points from DWA. Encourage water users to monitor use. 	<p>Regional Ecologist; Catchment Manager.</p> <p>Conservation Manager; Scientist: Land-use Advice; Scientist: Aquatic.</p>	<p>Site specific erosion stabilisation and rehab plans compiled. Mitigation measures implemented and monitored.</p> <p>Datasheets and reports</p>	Ongoing	<p>Ecological Plan of Operations, Eco Matrix.</p> <p>Ecological Plan of Operations; Development application commenting process</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Conserve and protect rivers.	<ul style="list-style-type: none"> Comments on proposed developments involving future permanent infrastructure being developed within the determined 1: 100 year flood line. Report pollution problems to relevant authorities and assist where possible. Develop and implement a mouth management policy for the Goukamma Estuary. Report illegal activities within the riparian zone to DWA. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist; Catchment Manager; Scientist: Aquatic; Programme Manager: MPA, Islands & Estuaries; Scientist: Landuse Advice.</p>	<p>No infrastructure within the 1:100 year flood line</p> <p>Approved mouth management policy</p>	Ongoing	Baseline & Monitoring Manual 2010; NFEPA
Rehabilitate and conserve wetlands.	<ul style="list-style-type: none"> Identify and map all wetlands and seeps. Start with verification process of aquatic CBA and NFEPA information for the GNRC. Close, re-align or rehabilitate roads that negatively impact on wetlands as identified in road assessment report as per maintenance schedule. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist; Catchment Manager; Scientist: Aquatic; GIS Technician.</p>	Wetland map.	Year 1-2	Working for Wetlands procedures; CDF; NFEPA
Protect flora species of conservation concern.	<ul style="list-style-type: none"> Identify species and localities of populations on the GNRC. Conduct monitoring of populations of plant species of conservation concern on the reserve. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist;</p>	Datasheets completed	Ongoing	Baseline data collection and monitoring manual (2010), Threatened species programme.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Manage consumptive and non-consumptive utilisation of biological resources.	<ul style="list-style-type: none"> Limit activities that may impact on plant species of conservation concern. Establish a database indicating all utilised species and the current extent of their use within the GNRC. Encourage community interest in acceptable utilization programmes. Evaluate all resource use applications in terms of the CapeNature Policy on consumptive utilisation. 	<p>Scientist: Botanist.</p> <p>Conservation Manager; Conservation Services Manager; Ecological Coordinator; Community Conservation Manager.</p>	Database of resources.	Ongoing	CapeNature Policy on consumptive utilisation (2007).

Budget Allocation	Development	Operation (5 Year Forecast)
		R5 059 734

WILDLIFE MANAGEMENT					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems.					
To improve the reach and quality of biodiversity management.					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Objective 1					
Objective 2					
Manage damage causing/nuisance fauna.	<ul style="list-style-type: none"> Promote best practices regarding Damage Causing Animals (DCA) and promote partnerships (e.g. Landmark Foundation). Identify specific nuisance and develop management interventions. 	Conservation Manager; Conservation Services Manager; Programme Manager: Wildlife; Ecological Coordinator; Regional Ecologist.	Number of DCA Incidents recorded. Approved protocols.	Year 1 - 5	GTUP
Reduce conflict between wild animals and the public	<ul style="list-style-type: none"> Remove dogs and other pets entering the reserve. Undertake extension work to promote adaptive and proactive measures to prevent conflict between public and wild animals. 	Conservation Manager. Community Conservation Manager; Conservation Services Manager; Conservation Manager	No dogs or other pets occurring on the reserve. Public awareness and increased reduced incidents	Ongoing Ongoing	CN Pets on the reserve Policy Brochures; Media protocols.

Budget Allocation	Development	
	Operation (5 Year Forecast)	R659 965

FIRE MANAGEMENT					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems					
To improve the reach and quality of biodiversity management.					
To create environmental awareness					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
6.5 Objective 1 Objective 2 Objective 3 Objective 6					
To develop an appropriate Fire Management Strategy (FMS) for GNRC.	<ul style="list-style-type: none"> Revise current strategy. Assess appropriateness of current firebreak network and re-align where appropriate. Negotiate firebreak agreement with neighbours where relevant. Determine and implement thresholds of potential concern for fire management on the GNRC. 	Conservation Manager; Regional Ecologist; ICM Programme Manager; AVM Programme Manager.	FMS	Year 1	Fire Management Policy and Guidelines.
To implement the FMS for GNRC.	<ul style="list-style-type: none"> Implement wild fire control and controlled burns in accordance with the fire management policy. Construct priority firebreaks according to the FMS. Conduct and comply with pre-fire and post-fire season audits. Set and monitor Threshold of Potential Concerns. Ensure that Integrated Catchment Management compliments fire management. 	Conservation Manager; Catchment Manager; Protected Areas Manager.	The objectives of revised FMS. Fire break network Audit reports (maintain score of 90 %)	Year 2 - 5	Fire Management Strategy document. Fire break register; ICM APO Fire Management Policy and Guidelines; Baseline data collection and Monitoring Manual; Ecological Matrix.
Reduce damage causing fires within the scope of the FMS.	<ul style="list-style-type: none"> Conduct risk assessments. Update and implement Fire Protection and Reaction Plans according to risk assessments. 	Conservation Manager; Catchment Manager; Protected Areas Manager.	Zero damage caused by fires. Fire Reports.	Annually	Fire Management Policy and Guidelines;

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<ul style="list-style-type: none"> Implement fuel reduction around infrastructure to minimise risk. 		Risk Assessment reports.		
Establish and maintain partnerships to improve fire management on the GNRC.	<ul style="list-style-type: none"> Attend Uitzicht and Ruigtevlei FPA meetings. 	Conservation Manager; Catchment Manager.	Attendance register and minutes.	Ongoing	Fire Management Policy and Guidelines; FPA operational rules and guidelines.
Wildfires as a result of human negligence are reduced.	<ul style="list-style-type: none"> Create a fire awareness programme for tourists, local communities and staff. All surrounding landowners must be informed to comply with National Veld & Forest Fires Act, 1998 (Act No. 101 of 1998) 	Conservation Manager; Community Conservation Manager; Tourism Manager.	Awareness products.	Ongoing	Fire Management Policy and Guidelines; Fire wise Implementation Guidelines. National Veld & Forest Fires Act (Act No. 101 of 1998)

Budget Allocation	Development	Operation (5 Year Forecast)
		R659 965

6.6 INVASIVE AND NON-INVASIVE ALIEN SPECIES MANAGEMENT					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems					
To improve the reach and quality of biodiversity management					
To create environmental awareness					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Invasive Alien Flora					
Eradicate alien and invasive species within the GNRC on an on-going basis.	<ul style="list-style-type: none"> Identify and map all alien and invasive flora within the GNRC or threatening the Reserve. Ensure that Integrated Catchment Management complements alien management. Attend regional ICM Meetings. Compile and approve a Management Unit Clearing Plan (MUCP) for the GNRC. Implement MUCP in accordance with WfW and ICM standards. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist.	100 % of hectares of IAP's annually cleared versus planned. 100 % total area cleared where IAP's have been controlled to a maintenance phase by Year 5 (TBD).	Ongoing	MUCP; ICM procedures; WfW Operating Procedures.
Monitoring of alien clearing operations on the GNRC to inform adaptive management strategies.	<ul style="list-style-type: none"> Implement record keeping procedures. Evaluate records and adapt clearing strategies as needed. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist.		Ongoing	MUCP; ICM procedures; WfW Operating Procedures.
Implement biological control as a method of IAP management.	<ul style="list-style-type: none"> Investigate viability of using biological control agents and include in MUCP. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist.		Ongoing	WfW and Dept Agriculture Landcare Guidelines
Prevent the introduction of alien and invasive species from neighbouring landowners.	<ul style="list-style-type: none"> Ensure surrounding landowners are aware of relevant legislation. Identify ways in which alien and invasive species might be introduced to the reserve and put 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist.		Ongoing	WfW and Dept Agriculture Landcare Guidelines

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	measures in place to prevent infestation from occurring.	Community Conservation Services.			
Invasive Alien Fauna					
Prevent the introduction of alien and invasive species.	<ul style="list-style-type: none"> Implement pets on the reserve policy. Ensure tourists do not bring any domestic animals into the GNRC. Ensure no introduction of alien and invasive fish species within catchments and rivers (both on and off-reserve) listed as fish sanctuaries. Investigate Memorandum of Understanding (MoUs) with neighbours where domestic livestock is a potential risk. Maintain boundary fences in partnership with landowners. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist. Aquatic Scientist. Tourism Officer. Aquatic technician. Conservation Services.	No of incidents of alien introduction recorded MOU's Fence register.	Ongoing	CN Policy on domestic animals on nature reserves CN Policy on fish utilisation and T
Control alien and invasive species within the GNRC on an on-going basis.	<ul style="list-style-type: none"> Identify alien fauna (including fish species) occurring on the reserve. Monitor and control populations of alien fauna on the reserve. Active control vagrant pets and livestock through acceptable methods. Involve external stakeholders in order to address. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Regional Ecologist. Community Conservation.	Species lists. Monitoring reports Number of control incidents	Ongoing	CN Policy on domestic animals on nature reserves; Baseline Monitoring Manual 2010.

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	Operation (5 Year Forecast)	R3 079 838

CULTURAL AND HERITAGE RESOURCES								
To create environmental awareness To effectively conserve our cultural heritage attributes								
6.7	Objective 3	Objective 7	Key Deliverable	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
			To protect & manage cultural heritage resources.	<ul style="list-style-type: none"> Compile a cultural heritage resource inventory for the GNRC. Maintain database with up to date information. Consult with South African Heritage Resources Agency to develop a Cultural Heritage Resource Management Plan. 	Conservation Manager; Tourism Manager; Ecological Coordinator.	Heritage assets and values being managed consistent to objectives	Ongoing	Cultural Resource Management Plan; Specialists reports.
			Monitor cultural heritage resources.	<ul style="list-style-type: none"> Implement recording and monitoring according to the Ecological Matrix. 	Conservation Manager; Ecological Coordinator		Ongoing	Baseline & Monitoring Manual 2010
			Management interventions for the protection of cultural heritage resources.	<ul style="list-style-type: none"> Implement recommendations as per Cultural Heritage Resource Management Plan. 	Conservation Manager. Ecological Coordinator		Ongoing	Specialists reports

Budget Allocation	Development	
	Operation (5 Year Forecast)	R219 988

LAW ENFORCEMENT AND COMPLIANCE					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems					
To improve the reach and quality of biodiversity management					
To create environmental awareness					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
6.8 Objective 1 Objective 2 Objective 3 Objective 6	<ul style="list-style-type: none"> • A set of relevant legislation & policies be accessible on the GNRC. • Relevant staff must be familiar with the relevant legislation & policies applicable to posting level. • All staff must be able to reference and interpret relevant legislation & policies. • Assess which management activities do not comply. • Review and adjust non-compliant activities to ensure compliance. 	Conservation Manager; Biodiversity Crime Unit (BCU) Programme; Landuse Advisor; Law Admin	Set of Environment legislation & policies. Number of peace officers trained and appointed Number of EMIs trained and appointed. Number of Sea Fisheries Officers trained and appointed.	Year 1	All relevant legislation & policies.
Users are compliant to relevant legislation & policies.	<ul style="list-style-type: none"> • Ensure that users are aware of relevant legislation & policies. • Regular patrols are performed in identified priority areas. • Staff must be formally designated to enforce compliance. 	Conservation Manager; Community Conservation; BCU Programme; Field Rangers	Permit conditions. Do's and don'ts signage & brochures. Patrol reports.	Ongoing	All relevant legislation & policies.
Law enforcement for the GNRC is effective.	<ul style="list-style-type: none"> • Initiate regular meetings with all relevant parties in order to develop and implement a strategic approach to eradicating illegal harvesting and ensuring law enforcement. • Ensure that GNRC staff are adequately capacitated, designated and equipped to ensure effective law enforcement. • Courtesy warnings & Admissions of Guilt Fines (J534's) & arrests are 	Conservation Manager; BCU Programme Manager; Conservation Services; Community Conservation.	Minutes of meetings. Number of peace officers trained and appointed Number of EMIs trained and appointed. Number of Sea Fisheries Officers trained and appointed.	Year 1-5	All relevant legislation & policies.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<p>correctly actioned where appropriate.</p> <ul style="list-style-type: none"> Admissions of Guilt Fines (J534's) & arrest cases are followed through the South African Police Services & Judiciary systems to completion. 		<p>Courtesy warning and J534 documentation. Successful prosecutions.</p>		

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	Operation (5 Year Forecast)	R439 977

INFRASTRUCTURE MANAGEMENT					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems					
To improve the reach and quality of biodiversity management					
To create environmental awareness					
To provide appropriate opportunities and facilities for recreation					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
6.9 Objective 1 Objective 2 Objective 3 Objective 5 Objective 6	<ul style="list-style-type: none"> Ensure the infrastructure necessary to manage the nature reserve effectively, according to the approved CDF, is in place (U-AMP). Assess infrastructure development appropriateness to the CDF in Year 4. Compile a re-alignment plan. 	Executive Director Marketing & Eco-Tourism; Protected Areas Manager; Tourism Manager; Conservation Manager; Regional Ecologist.	Approved re-alignment plan.	Ongoing	CDF; EIA Regulations.
Ensure maintenance of infrastructure and equipment.	<ul style="list-style-type: none"> Map all infrastructure and compile infrastructure register. Ensure that there is adequate operational equipment as required for operational management purposes. Maintenance of Infrastructure as scheduled in registers to ensure upkeep and prevent degradation. Equipment is maintained in good working condition. Liaise with the Departments of Transport and Public Works where required. Immediately affect all minor emergency repairs. Monitor cost effectiveness of infrastructure maintenance. 	Conservation Manager; Ecological Coordinator; GIS technician; DPW; Protected Areas Manager.	Maintenance of infrastructure and equipment is adequate Infrastructure register Maintenance schedules IWP ICM APO	Ongoing	Infrastructure register; U-AMP; ICM document; DPW maintenance schedule; Standard Operating Procedures

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Roads/Jeep Tracks and Trails are managed to minimise impact on the environment.	<ul style="list-style-type: none"> Conduct annual assessment of roads, jeep tracks and trails in the GNRC. Compile a maintenance plan. Implement maintenance schedule as part of the ICM APO. Re-align road network and align with the CDF where required. Rehabilitate where necessary. Monitor use and impact. 	Conservation Manager; Catchment Manager; Ecological Coordinator; Community Conservation Manager	Updated infrastructure register. Maintenance of scheduled infrastructure works. IWP ICM APO	Ongoing	ICM Procedures. Infrastructure register. Public Works schedule.
Buildings are effectively maintained.	<ul style="list-style-type: none"> Maintenance or new infrastructure is appropriately planned, approved by the QEM (where deviating from CDF) and if required the appropriate EIA completed. Provide DPW with works list to reflect maintenance requirements. Monitor Public Works' implementation of the maintenance schedule Ensure energy saving & environmentally sound options are being implemented by DPW (green building principles). 	Conservation Manager; DPW; Tourism Manager; Protected Areas Manager.	Updated infrastructure register.	Ongoing	Infrastructure register; DPW maintenance schedule.
Maintain fences according to legislative requirements.	<ul style="list-style-type: none"> Conduct a fence assessment. Maintain fences as scheduled in infrastructure register. Enter into fencing agreements with neighbours where necessary. Conduct boundary patrols on regular basis and monitor fence condition. 	Conservation Manager; Protected Areas Manager; Field Public Works; Field Rangers	Updated infrastructure register.	Ongoing	Infrastructure register; DPW maintenance schedule.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Environmental Management: Waste Disposal	<ul style="list-style-type: none"> Develop and implement an appropriate recycling system. Maintenance of storage bins as scheduled in registers to ensure upkeep and prevent pollution. Educate visitors and staff on recycling and effective waste management. Ensure that concessionaires comply with the reserves waste management policy. 	Conservation Manager; Tourism Officer; Conservation Assistants	Recycling system. Updated infrastructure register.	Ongoing	Infrastructure register; DPW maintenance schedule.
Environmental Management: Water	<ul style="list-style-type: none"> Maintenance of water reticulation system. Schedule regular inspections. Educate visitors and staff on wise water use. Ensure environmentally sound options are being implemented by DPW by introducing water saving technologies in old and new infrastructure (Green Building principals). 	Conservation Manager; Tourism Manager; Public Works; Protected Areas Manager.	Updated infrastructure register.	Ongoing	Infrastructure register; DPW maintenance schedule.
Environmental Management: Sewage	<ul style="list-style-type: none"> Ensure maintenance of existing septic tanks through ensuring micro-enzymes are added quarterly into the systems. Monitor if there is contamination of water resources and aquatic systems in the reserve by human-induced means. Any discharge to the environment must comply with the National Water Act, 1998. Investigate alternative sewerage treatment options for picnic sites 	Conservation Manager; Tourism Manager; Public Works; Protected Areas Manager	Updated infrastructure register.	Ongoing	Infrastructure register; DPW maintenance schedule.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<ul style="list-style-type: none"> and replace existing septic tanks with improved system. Install self-composting toilets at strategic visitor sites. Install effective environmentally friendly sewage facilities in collaboration with DPW. 				
Environmental Management: Energy	<ul style="list-style-type: none"> Ensure environmentally sound options are being implemented by DPW by introducing energy saving and renewable technologies in old and new infrastructure (Green Building principals). 	Conservation Manager; DPW	Updated infrastructure register.	Ongoing	Infrastructure register. National Guidelines.
Environmental Management: Herbicide, gas and Fuel Stores	<ul style="list-style-type: none"> Upgrade existing stores to OHS standards. Store hazardous materials according to regulations. Maintain fuel and herbicide registers. 	Conservation Managers; OHS Manager; Project Manager.	Health & Safety inspection reports. Updated infrastructure register.	Ongoing	OHS Act and OHS management system.
Management of High Sites.	<ul style="list-style-type: none"> Map all High sites (with photos) Demarcate access and work areas at high sites 	Conservation Managers	All site mapped.	Year 1	Infrastructure register.
Signage is appropriate and effective to support management.	<ul style="list-style-type: none"> Conduct a signage audit. Compile a signage register with maintenance/replacement plan. 	Conservation Managers; Tourism Manager	Updated signage register.	Year 1 Ongoing	Signage register.

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DISASTER AND RISK MANAGEMENT					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems.					
Objective 1	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Reference to Existing Procedures
Key Deliverables					
Disaster prevention and preparedness	<ul style="list-style-type: none"> Conduct a risk assessment and identify areas of potential concern. Compile and implement disaster management plan for GNRC in accordance with relevant legislation. Engage with disaster management units from municipalities. Conduct an annual audit of disaster management plans and mitigation measure readiness. Annual review and exercise of contingency and evacuation plans. 	Conservation Manager; Chief Risk Officer; Catchment Manager	Approved Contingency Plans	Ongoing	Fire Management Policy; Health and Safety Policy; Provincial Disaster Plan.
Disaster response.	<ul style="list-style-type: none"> Train staff and NGOs to ensure capacity to manage and mitigate the effects of disasters. Procure equipment for disaster response and mitigation. Participate and assist district municipality disaster management structure. Activate evacuation and contingency plans. 	Conservation Manager; Chief Risk Officer; Catchment Manager		Ongoing	Fire Management Policy; Health and Safety Policy; Provincial Disaster Plan.
Ensure effective and integrated risk management within a framework of sound corporate governance.	<ul style="list-style-type: none"> Documenting of business processes. On site risk identification and analysis. On site identification of controls/mitigations. Monitoring of risks. 	Protected Areas Manager. Conservation Manager. OHSA Manager; Chief Risk Officer.		Ongoing	Public Finance Management Act (PFMA) Section 38. Risk Management Policy and Strategy.

Budget Allocation	Development
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	Operation (5 Year Forecast)	R439 977
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SOCIO-ECONOMIC FRAMEWORK					
To conserve and manage biodiversity and natural processes representative of Southern Cape terrestrial and marine ecological systems					
To improve the reach and quality of biodiversity management					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
<p>Objective 1</p> <p>Objective 2</p> <p>Objective 6</p> <p>Create access to the conservation economy through the implementation and management of appropriate initiatives and projects.</p>	<ul style="list-style-type: none"> Create jobs through a range of projects. <ul style="list-style-type: none"> - ICM - WfW - Expanded Public Works Programme (EPWP) - Tourism Services (gate-guard; laundry; housekeeping) 	<p>Conservation Manager; Community Conservation Manager; Protected Areas Manager; Tourism Manager; Catchment Manager</p>	<p>Number of EPWP job opportunities (n).</p> <p>Number of EPWP full time equivalents (n).</p> <p>Number of people directly benefitting from Sustainable Livelihood Programmes (n)</p>	Ongoing	ICM Procedures; PFMA; WfW
<p>The GNRC provides community development opportunities through various capacity building interventions, linked to job creation opportunities.</p>	<ul style="list-style-type: none"> Assist with training and capacity building initiatives in the communities. 	<p>Conservation Manager; Community Conservation Manager</p>	<p>Number of person days employment created (n).</p>	Ongoing	<p>People and Conservation Action Plan;</p> <p>CapeNature Communications Policy;</p> <p>The Development of Educational Resources (Corporate Strategic Plan);</p> <p>Youth Development & Environmental Education Programme Strategic Plan.</p>
<p>Manage consumptive utilisation of biological resources.</p>	<ul style="list-style-type: none"> Establish a database indicating all currently utilised species and the extent of their use within the GNRC. Evaluate all resource use applications in terms of the CapeNature Policy on consumptive utilisation. Develop resource use opportunities and manage their implementation and control. 	<p>Conservation Manager; Ecological Coordinator; Regional Ecologist; Conservation Services Manager.</p>	<p>Resource database</p> <p>Resource use process documentation (adverts, comments, MOUs)</p>	Ongoing	<p>CapeNature Policy on consumptive utilisation (2007).</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
The GNRC has spiritual or religious significance.	<ul style="list-style-type: none"> Access to the GNRC for spiritual, cultural and traditional purposes will be allowed subject to permit conditions and with prior approval. 	Conservation Manager; Community Conservation Manager	Number of persons accessing CapeNature protected areas for cultural; traditional, spiritual, and sustainable harvesting activities (n).	Ongoing	People Conservation and Action Plan
Ensure awareness raising initiatives elevate awareness around conservation issues in the GNRC.	<ul style="list-style-type: none"> Assist with the development and implementation of an awareness plan linked to the objectives of GNRC. Disseminate information and material for Environmental Awareness calendar days. Collaborate with partners to arrange events on Environmental Awareness. Present talks, presentations when requested. Liaise with Communication Section to facilitate the production of media releases. Liaise with relevant Programmes and Communication Section for assistance to implement awareness raising events. Implement Firewise awareness programme. 	Conservation Manager; Community Conservation Manager; Conservation Services Manager.	Number of learners provided with Environmental education opportunities (n).	Ongoing	People Conservation and Action Plan; CapeNature Communications Policy; The Development of Educational Resources (Corporate Strategic Plan); Youth Development & Environmental Education Programme Strategic Plan.
Environmental education is provided to promote an understanding of biodiversity and the use of the natural environment as a vehicle for learning and development.	<ul style="list-style-type: none"> Assist with the development and implementation of an environmental education plan linked to the objectives of GNRC. Provide access for formal and informal environmental education 	Conservation Manager; Community Conservation Manager; Conservation Services Manager.		Ongoing	People Conservation and Action Plan; CapeNature Communications Policy; The Development of Educational Resources

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
	<p>programmes as per pre-arranged agreements.</p> <ul style="list-style-type: none"> Assist with formal and informal environmental education programmes conducted in the GNRC. 				<p>(Corporate Strategic Plan);</p> <p>Youth Development & Environmental Education Programme Strategic Plan.</p>
Volunteers actively assist in the management of the GNRC.	<ul style="list-style-type: none"> Investigate opportunities to engage with volunteers in a range of projects. 	<p>Conservation Manager; Community Conservation Manager; Conservation Services Manager.</p>	Number of volunteer hours worked (n).	Ongoing	Volunteer Policy

Budget Allocation	Development	
	Operation (5 Year Forecast)	R219 988

MANAGEMENT EFFECTIVENESS					
To improve the reach and quality of biodiversity management					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
6.12 Objective 2 Implement and maintain the Management Effectiveness Tracking Tool for South Africa (METT-SA)	<ul style="list-style-type: none"> Conduct annual METT-SA assessments. Monitor and improve METT-SA Score through the development of action plans and implementation thereof. 	<p>Programme Manager: Quality Management; Conservation Manager; Ecological Coordinator; Regional Ecologist; Protected Areas Manager.</p>	The GNRC will submit an annual METT-SA assessment.	Ongoing	Standard Operation Procedures.
Auditing systems inform management.	<ul style="list-style-type: none"> Conduct CapeNature integrated auditing system. Compile actions lists to address audit issues. Track action list for progress. Apply adaptive management strategies. 	<p>Programme Manager: Quality Management; Scientific Manager: Biodiversity; Conservation Manager; Ecological Coordinator; Regional Ecologist; Protected Areas Manager.</p>	Internal report including action plans	Ongoing	Integrated Audit
A detailed work plan (APO) identifying specific targets for achieving management objectives is approved by CapeNature.	<ul style="list-style-type: none"> Assess and prioritise actions from audit results into APO. Compile APO in terms of actions identified in the Management Plan. 	<p>Conservation Manager; Protected Areas Manager; Ecological Coordinator</p>	APO	Ongoing	APO guideline document.
Progress reports are compiled.	<ul style="list-style-type: none"> Compile quarterly Biodiversity Monitoring System (BMS) progress reports. Reports as required for EPWP, ICM, WfW, etc. are completed timeously and in the prescribed formats. 	<p>Conservation Manager; Community Conservation Manager</p>	BMS	Ongoing	BMS; EPWP reporting system.

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Implement and review the Management Plan for the GNRC.	<ul style="list-style-type: none"> • Bi-annual assessment on progress of PAMP actions. • Compile annual report on the status of implementation of the PAMP and submit to the Minister. • Assess all PAMP audit results and ensure adaptive management strategies are implemented. • Complete review of PAMP. 	Programme Manager: Quality Management Reserve Management Committee		<p>Ongoing</p> <p>Ongoing</p> <p>Ongoing</p> <p>Year 5</p>	PAMP document; Standard Operating Procedures.

Budget Allocation	Development	
	Operation (5 Year Forecast)	R439 977

6.13 FINANCE AND ADMINISTRATION MANAGEMENT					
Objective 2 To improve the reach and quality of biodiversity management					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
To ensure financial accountability in terms of the PFMA and the Treasury Regulations.	<ul style="list-style-type: none"> Participate in an annual internal audit of the nature reserve financial records. Address any external audit report with findings and recommendations. Provide relevant financial information to reserve management. An operational budget is allocated to fund the critical management needs of the nature reserve. Manage cash flow. Implement Supply Chain Management (SCM) Policy Provide input to relevant SCM reports. Financial management practice enables efficient and effective protected area management. Monthly management reports submitted to reserve management. Acknowledgement of report by Conservation Manager. Variance report checked, signed and returned to Finance Manager. Reserve Management provide input to monthly cash flow forecast. Signed and approved budget provided by 1 April. 	Finance and Admin Manager; Finance Manager; Finance and Admin Officer; Conservation Manager	<p>Audit reports</p> <p>Accurate variance reports</p> <p>Approved budget</p> <p>Relevant SCM reports</p> <p>Monthly management reports</p>	Ongoing	<p>Budgeting process; APO. System and Application Products (SAP) system; Supply Chain Act. Management of Statements of Generally Recognised Accounting Practices (GRAP).</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Identify opportunities that are robust to create a diverse income base.	<ul style="list-style-type: none"> Identify sources of potential income. Maintain new and existing partnerships with external funders / stakeholders. 	Conservation Manager; Executive Director; Business Development; Foundation Manager		Annually	National Regulations with regard to Donations; Sponsorships.
Fixed Asset Management	<ul style="list-style-type: none"> Manage the assets of the reserve in accordance with the relevant legislation. Ensure that all reserve assets are bar coded. Ensure that all reserve assets are verified bi-annually. Provide input into infrastructure asset management plan annually. Fixed Asset Register is approved by the Conservation Manager. Verification Report is approved by the Conservation Manager. Disposal of assets in line with policies. Government immovable Asset Management Act (GIAMA) requirement is met annually. Manage CapeNature and Government Motor Transport assets in accordance with policy. Trip authorisation forms in place. 	Finance and Admin Manager; Finance and Admin Officer; Conservation Manager		Bi-annually / monthly	Standard Operating Procedures (SOP)s and policies. Statement of GRAP; U-AMP guidelines.
Capacity building among staff.	<ul style="list-style-type: none"> Provide relevant financial and Administrative training to reserve staff. 	Conservation Manager; Finance and Admin Manager		Annually	SOP's and policies PFMA

Budget Allocation	Development
	Operation (5Year Forecast)
	R439 977

HUMAN RESOURCE MANAGEMENT							
To improve the reach and quality of biodiversity management							
6.14	Objective 2	Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Reference to Existing Procedures
		Ensure an adequately resourced staff complement on the reserve.	<ul style="list-style-type: none"> Prioritise all critical posts for filling and develop a phased implementation plan in line with approved personnel budget. Ensure resourced (tools and skills) staff in line with approved budget to manage the nature reserve effectively (subject to funding). Ensure on-going assessment of workloads (volumetric analysis) through interventions in consultation with the Organisational Development Unit of the Department of the Premier. Employment relationship is in line with employment contract commitments. Implement an Employment Well-being Programme 	<p>Conservation Manager; Protected Areas Manager; Executive Director: Conservation Management. Executive Directors: Operations and Human Resource Manager (HRM)</p>	Human resource capacity is adequate to manage the protected area effectively subject to funding	Ongoing	Recruitment and Selection Policy; SOPs for Recruitment and Selection; SA Constitution Labour Relations Act; Basic Conditions of Employment Act; Employment Equity Act; Occupational Health & Safety Act; Overtime Policy; Equate System for Job Evaluation; Leave Policy
		Integrate and align organisational and employee performance.	<ul style="list-style-type: none"> Implement effective Performance Management System. Ensure compliance with Code of Conduct. 	<p>Conservation Manager; Protected Areas Manager; Executive Directors: Operations; HRM; Chief Executive Officer</p>	<p>Performance agreements completed and signed for all employees. Performance appraisals completed for all employees.</p>	Annually	<p>Performance Management Handbook; Annual Plan of Operations; Rewards Foundation Policy; Disciplinary Code and Procedures; Code of Conduct</p>

Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Reference to Existing Procedures
Skilled employees on the reserve	<ul style="list-style-type: none"> All staff is skilled to perform according to job specification in the roles they occupy in line with mandatory legislative requirements. Develop personal development plan for all staff on the reserve. Roll out of personal development plan for all staff on the reserve. Reflect capacity development interventions which are supported by mentorship and coaching agreements. Conduct annual skills audit. 	<p>Conservation manager; Protected Areas Manager; HR and Employment Equity and Training Committees</p>	<p>Personal development plan for all staff</p> <p>Mentorship and coaching agreements.</p> <p>Implement Skills Plan according to priorities and budget availability</p>	Annually	<p>Individual Personal Development Plans; Mentorship strategy and toolbox; Skills Development Act; Training Policy; Bursary Policy; Internship Policy</p>

Budget Allocation	Development
	Operation (5 Year Forecast)
	R879 954

6.15 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT					
To improve the reach and quality of biodiversity management					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
Objective 2	To improve the reach and quality of biodiversity management				
To implement policies, procedures and systems to ensure compliance to the Occupational Health and Safety Act. (OS4909H Act).	<ul style="list-style-type: none"> Implement Occupational Health and Safety System. Conduct monthly Health and Safety inspections. Conduct monthly Health and Safety meetings. 	Protected Areas Manager. Conservation Manager. OHSA Manager.	No disabling injuries occur.	Year 1-5	OHS Act; Internal Health and Safety System
To inform the workers, contractors, volunteers, students and the public of these dangers, how exposure could be prevented, and how to work safely.	<ul style="list-style-type: none"> Attend Accredited OHS Training: Hazard Identification and Risk Assessment (HIRA) Attend Accredited OHS Training to renew certificates (OHS Reps & First Aid Officers). Attend in-house OHS Training Workshops. Conduct monthly Toolbox Talks. 	Protected Areas Manager; Conservation Manager; OHSA Reps; Operators of equipment and machinery; First Aid Officers; Designated OHSA risk specific appointments; OHSA Officer; OHSA Manager		Year 1 ongoing	OHS Training Needs Analysis (conducted annually and aligned with legislative requirements and available resources)
Hazard Identification, Risk Assessment and Risk Management and Risk Control are implemented on the GNRC.	<ul style="list-style-type: none"> Conduct regular HIRA processes to determine key risks with highest impact potential. Recommend remedial action plans to address key risks. Follow-up to ensure effective implementation. 	Protected Areas Manager; Conservation Manager; OHSA Manager		Year 1 ongoing	HIRA Report; Safe Operating Procedure
Monitor and review to ensure adaptive management strategies are applied to improve health and safety on the GNRC.	<ul style="list-style-type: none"> Assist in conducting of internal Audit Process to determine effectiveness and level of compliance of implementation of OHS Management Control System. 	Conservation Manager; OHSA Officer; OHSA Manager		Year 1	Worksite Audit Report

Budget Allocation	Development	
	Operation (5 Year Forecast)	R659 965

VISITOR MANAGEMENT AND SERVICES					
To create environmental awareness To provide appropriate opportunities and facilities for recreation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
To plan for and manage visitor facilities.	<ul style="list-style-type: none"> Develop site specific carrying capacity. Monitor and manage visitor numbers and their environmental impact to site specific carrying capacities. Plan for and develop visitor facilities within CDF and local area plans. Survey visitor opinions. Ensure tourism facilities are accessible for disabled persons (where possible). 	Tourism Manager; Tourism Officer; Conservation Manager; Marketing & Eco-tourism	<p>Annual visitor numbers as close to carrying capacity as possible.</p> <p>Annual increase in tourism income.</p> <p>Increase in disabled visitors.</p>	Ongoing	CDF; Strategic Development Plan.
To strive to ensure visitor safety.	<ul style="list-style-type: none"> Assess existing and develop improved security measures. Implement appropriate gate control to ensure safety and compliance. Liaise with local authorities and stakeholders on security issues. 	Tourism Manager; Tourism Officer; Conservation Manager	Zero incidences of crime	Ongoing	Strategic Development Plan.
To promote and manage access to the Reserve.	<ul style="list-style-type: none"> Provide access to visitors. Set site specific management guidelines for user activities different use zones. Implement the Wild Card system. Manage and implement visitor access according to approved guidelines. Monitor pay access points and control access where required. Manage MoUs with concessionaires and tourism partners 	Tourism Manager. Tourism Officer. Conservation Manager.	<p>Annual visitor numbers as close to carrying capacity as possible.</p> <p>Annual increase in tourism income.</p> <p>Increase in disabled visitors. MoUs</p>	Ongoing	Strategic Development Plan. PFMA.

Budget Allocation	Development	
	Operation (5 Year Forecast)	R1 539 919

TOURISM DEVELOPMENT FRAMEWORK					
To improve the reach and quality of biodiversity management					
To provide appropriate opportunities and facilities for recreation					
To promote social and economic opportunities and sustainable utilisation					
Key Deliverables	Management/Monitoring Activities	Responsibility	Indicators	Timeframe	Existing Procedures
<p>6.17</p> <p>Objective 2</p> <p>Objective 5</p> <p>Objective 6</p> <p>To provide nature and recreational opportunities within the GNRC.</p>	<ul style="list-style-type: none"> Implement Strategic Development Plan. Prioritise different types of tourism development within the GNRC according to the CDF. Conduct infrastructure and visitor monitoring to inform mitigation where necessary. Identify different types of tourism activities within the GNRC. Prioritise types of tourism activities within the GNRC and implement. 	<p>Tourism Manager.</p> <p>Conservation Manager.</p> <p>Community Conservation Manager.</p>	<p>Standards are set in specified and approved schedules (including hospitality standards based on those by the South African Grading Council).</p> <p>Development priorities in the correct Zones within the Reserve.</p> <p>Recommendations within these plans implemented.</p> <p>Concessionaire compliance audited</p>	<p>Ongoing</p>	<p>CDF;</p> <p>Strategic Development Plan.</p>
<p>To promote and manage access to the reserve.</p>	<ul style="list-style-type: none"> Provide access to all visitors. Set management guidelines for different use zones. Implement the Wild Card system and provide discounted rates to specific user groups. Monitor pay access points and control access where required. Identify areas requiring special management strategies and protection from visitor use. 	<p>Tourism Manager.</p> <p>Tourism Officer.</p> <p>Conservation Manager.</p>	<p>Successful operation (stable tourist flow and financial success) of Small, medium and macro enterprises and community-based tourist facilities</p>	<p>Year 1-5</p>	<p>CDF.</p>

	<ul style="list-style-type: none"> Facilitate access for disadvantaged groups on request. 				
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Budget Allocation	Development	
	Operation (5 Year Forecast)	R219 988

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DEFINITION OF TERMS

Alien species	Species or genotypes, which are not indigenous to Goukamma Nature Reserve and the surrounding area including hybrids and genetically altered organisms.
Biodiversity	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems (as per the National Environmental Management: Biodiversity Act, 2004 [Act No. 10 of 2004]).
Board	The Western Cape Nature Conservation Board as defined by the Western Cape Nature Conservation Management Act, 1997 (Act No.9 of 1997).
Buffer zone	An area surrounding a protected area that has restrictions placed on its use or where collaborative projects and programmes are undertaken to afford additional protection to the nature reserve.
Co-management	The term 'Co-management' must be understood within the context of Section 42 of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).
Cultural heritage	As defined in Article 1 of the World Heritage Convention (United Nations Educational, Scientific and Cultural Organisation (UNESCO)) 1972 , 'cultural heritage' is considered as "monuments, architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of (...) value from the point of view of history, art or science, groups of buildings, groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of significance from the point of view of history, art or science, sites, works of man or the combined works of nature and man, and areas including archaeological sites which are of (...) value from the historical, aesthetic, ethnological or anthropological point of view." For the purpose of this IMP, living heritage features such as mountains, pools, rivers, boulders, etc. as well as palaeontological features are included under this definition.
Ecotourism	The travel to natural areas to learn about the way of life and cultural history of people, the natural history of the environment, while taking care not to change the environment and contributing to the economic welfare of the local people (adapted from a definition of ecotourism by Hecto Ceballos Lascurain).
Ecological integrity	The sum of the biological, physical and chemical components of an ecosystem and its products, functions and attributes (as per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).
Ecosystem	A dynamic complex of animal, plant and micro-organism communities and their non-living environment interacting as a functional unit (as per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).
Ecosystem services	As defined in Section 1 of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) as "environmental goods and services" meaning: <ul style="list-style-type: none"> a. Benefits obtained from ecosystems such as food, fuel and fibre and genetic resources. b. Benefits from the regulation of ecosystem processes such as climate regulation, disease and flood control and detoxification.

	<p>c. Cultural non-material benefits obtained from ecosystems such as benefits of a spiritual, recreational, aesthetic, inspirational, educational, community and symbolic nature;”</p> <p>For the purposes of this IMP, sustainable water production is also specifically included under this definition.</p>
Environmental degradation	The deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems and the loss of species or undesirable reduction of species population numbers from a specific area from an environmental health perspective
Endorheic	A closed drainage basin that retains water and allows no outflow to other external bodies of water, such as rivers or oceans, but converges instead into lakes or swamps, permanent or seasonal, that equilibrate through evaporation. Such a basin may also be referred to as a closed or terminal basin or as an internal drainage system.
CapeNature	Nature Conservation Service as established in terms of the Western Cape Nature Conservation Management Act No. 9 of 1997.
Indigenous species	In relation to a specific protected area, means a species that occurs, or has historically occurred, naturally in a free state of nature within that specific protected area, but excludes a species introduced in that protected area as a result of human activity (as per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).
Invasive species	<p>Means any species whose establishment and spread outside of its natural distribution range –</p> <ol style="list-style-type: none"> Threaten ecosystems, habitats or other species or have a demonstrable potential to threaten ecosystems, habitats or other species. May result in economic and environmental harm or harm to human health. <p>(As per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).</p>
Joint management	The agreed co-ordination of management and/or management actions by landowners and/or mandated managers on their individual or combined properties in order to achieve common management objectives.
Local community	Any community of people living or having rights or interests in a distinct geographical area (as per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).
Management	In relation to a protected area, includes control, protection, conservation, maintenance and rehabilitation of the protected area with due regard to the use and extraction of biological resources, community-based practices and benefit sharing activities in the area in a manner consistent with the Biodiversity Act (as per the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).
Management authority	In relation to a protected area, means the organ of state or other institution or person in which the authority to manage the protected area is vested (as per the National Environmental Management: Protected Areas Act, 2003 [Act No. 57 of 2003]).
Monitoring	The collection and analysis of repeated observations or measurements to evaluate change in status, distribution or integrity in order to track the impacts of directed management implemented to achieve a stated management objective.

Nature conservation	The conservation of naturally occurring ecological systems, the sustainable utilisation of indigenous plants and animals therein, and the promotion and maintenance of biological diversity (as per the Western Cape Nature Conservation Management Act, 1997 [Act No.9 of 1997]).
Neighbouring community	the communities and people permanently living in the local municipal area/s bordering onto the Nature Reserve.
Natural heritage	As defined in Article 2 of the World Heritage Convention (UNESCO) 1972 'natural heritage' is as: "natural features consisting of physical and biological formations or groups of such formations, which are of (...) value from the aesthetic or scientific point of view, geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of (...) value from the point of view of science or conservation, natural sites or precisely delineated natural areas of (...) value from the point of view of science, conservation or natural beauty." For the purposes of this IMP, this would include the required ecological integrity of the protected area for the production of ecosystem services.
Partnerships	A co-operative and / or collaborative arrangement between the nature reserve management / CapeNature and a third party that supports the achievement of the Nature Reserve management objectives.
Protected areas	<ul style="list-style-type: none"> • Means any area declared or proclaimed as such in terms of section 3 or listed in the Second Schedule to the Western Cape Nature Conservation Management Act, 1997 (Act No. 9 of 1997); or • Means any of the protected areas referred to in section 9 of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).
Protected area management committee	Is the management body that deals with the day-to-day management of the protected area and is chaired by the OIC.
Stakeholders/ interested parties	These are interested individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public. According to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), "stakeholder" means a person, an organ of state or a community contemplated in section 82 (1) (a), or an indigenous community contemplated in section 82(1) (b).
Sustainable	In relation to the use of a biological resource, means the use of such resource in a way and at a rate that would not lead to its long-term decline; would not disrupt the ecological integrity of the ecosystem in which it occurs; and would ensure its continued use to meet the needs and aspirations of present and future generations of people (as per National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
World heritage site	Means a World Heritage Site as defined in the World Heritage Convention Act, No. 49 of 1999 under Chapter 1, section 1 subsection (xxiv).

