CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Maintenance Management Plan: Dunes and Beaches

DEPARTMENT: Environmental Management,
Coastal Management Branch

VERSION: 001

DATE: 17 November 2017

Enquiries: Darryl Colenbrander
Head: Coastal Policy Development and Management Programmes
E-mail: Darryl.Colenbrander@capetown.gov.za
Tel: +27 21 487 2355

Maintenance Management Plan: Dunes and Beaches

Acknowledgements:

With thanks to the eThekwini Municipality: Coastal, Stormwater and Catchment Management Department for use of their dune EMP template and generic information as well as the KZN Department of Economic Development, Tourism and Environmental Affairs.

If you are viewing an electronic version of this report, please consider your environmental responsibility before printing it.

Table of Contents

Table of Figures

Glossary of terms and abbreviations

Accretion:	The process where coastal sediment returns to the visible portion of the beach through natural processes.
Aeolian processes:	Processes that are driven by winds, including the ability of the wind to shape the surface of the Earth.
Beach:	The sandy portion of the coastline between the LWM and HWM.
Backshore:	The portion of the beach between the foreshore (between LWM and HWM) and coastline.
Beach berm:	A beach berm is the nearly horizontal portion of a beach formed by the deposition of sediment by receding waves. The berm has a crest (top) and a face - the latter being the slope leading down towards the water from the crest.
Beach maintenance:	Re-profiling of beaches for purposes of preventing the accumulation of sand and subsequent smothering of adjacent infrastructure by wind and tides.
Biodiversity:	The variety of living organisms, their genetic makeup and ecological communities.
CCT:	City of Cape Town Metropolitan Municipality, established in terms of the Local Government: Municipal Structures Act, 1998 read with the Province of the Western Cape: Provincial Gazette 558 dated 22 September 2000.
Contractor:	Refers to the party/person contracted by the CCT to carry out dune or beach rehabilitation and maintenance.
CPP:	Coastal Public Property as defined in the ICM Act
DEA&DP:	Provincial Department of Environmental Affairs and Development Planning, Western Cape.
Dune:	A dune is a hill or mound of sand built by coastal processes. Dunes occur in different forms and sizes and are formed by interaction of the wind, waves and vegetation.
Dune maintenance:	The process of retaining the dune in a functional state before and after it has been rehabilitated.
Dune rehabilitation:	The process of restoring or reconstructing the dune after it has been damaged due to natural processes or human activities or a combination of both.
ECO:	Environmental Control Officer
EIA:	Environmental Impact Assessment
EM:	Environmental Management Department, CCT.
Foredune:	The first and often prominent ridge of sand behind and parallel to the beach above the HWM, usually vegetated.
HWM:	Refers to the highest line reached by coastal waters, but excluding any line reached as a result of: - exceptional or abnormal weather or sea conditions; or - an estuary being closed to the sea.
Embryo dune:	Small mounds of sand at the top of the beach, above the HWM and usually right in front of the foredune. This dune is the most dynamic dune type, growing upwards and outwards to the sea or can be completely removed by storm waves.
Hummock dunes:	A sand dune that forms around vegetation.
ICM Act:	Integrated Coastal Management Act (Act No. 36 of 2014).

Indigenous species:	Plant species native to Southern Africa.
Invasive plant species:	Are those plant species that do not occur naturally within a region and are able to establish themselves in a natural or semi-natural habitat. They impact destructively upon biodiversity, including degeneration or elimination of indigenous species.
LWM:	Refers to the lowest line to which coastal waters recede during spring tide.
Maintenance:	Actions performed to keep a structure or system functioning or in service on the same location, capacity and footprint.
MMP:	Maintenance Management Plan for maintenance purposes defined or adopted by the competent authority.
NEMA:	National Environmental Management Act (Act No.107 of 1998).
ORV:	Off-road vehicle
Primary dunes:	The first dunes above the intertidal zone

Executive Summary

Given the extent of Cape Town's coastline (approximately 240 km) and the frequent interventions that are required for beach and dune maintenance, applying for an Environmental Authorisation or getting a MMP approved (in terms of the requirements of NEMA) for each intervention on a piecemeal and ad hoc basis, is not pragmatic for the CCT and places an administrative burden on both the CCT as well as the Competent Authority. A generic MMP is proposed in order to enable the CCT to conduct its dune and beach maintenance and rehabilitation on City-owned land more efficiently whilst remaining compliant with the requirements of NEMA.

This MMP has been prepared to enable the immediate and on-going management that is required and which has resulted from historically made poor land use and planning decisions as well as from cumulative and/or extreme coastal storm events. This MMP is submitted in compliance with the requirement of Activity 18 and 19 of the 2014 NEMA regulations.

Introduction

Coastal dunes are formed by aeolian and tidal processes which result in the accumulation of sand above and around the HWM. These dune systems may either be highly dynamic and mobile systems, or relatively sedentary if they are well vegetated Functional and vegetated dune systems form an integral part of Cape Town's coastal environment and are beginning to play a key role in building resilience to climate change induced pressures, such as sea-level rise, storm surges and shifting wind regimes. Cape Town's coastal system is primarily a wind driven environment, affected by alternating seasonally dominant winds from the south-east and north-west, resulting in marked variations of seasonal sand deposition and erosion along Cape Town's beaches. These dynamics are further affected by winter swells and associated high seas.

Naturally occurring beach ecosystems consist of tidal zones, embryo dunes and hind dune areas. Well established and functional dune systems act as buffers which play an important role in protecting many aspects of the coastline (including property, infrastructure, recreational areas and biodiversity) against accretion, erosion, wave damage during storms, flooding, wind-stress and over wash. They also contribute to the aesthetic and cultural appeal of Cape Town's beaches. Dune systems also act as a reservoir of sand to replenish and maintain the integrity of the beach during and post erosion events. The sand barrier provided by dune systems also allows for the development of more complex plant communities to establish by preventing salt water inundation and protection from sea spray and strong winds.

Dune systems occupy the transitional space between land and sea masses and are thus subject to harsh environmental conditions. Vegetation cover plays a crucial role in the evolution of dune landscapes, acting as a windbreak and trapping the deposited sand particles by reducing wind energy. Natural erosion will always have some impact on dune systems but if additional anthropogenic pressures - such as inappropriate construction of hard infrastructure, run-off from stormwater systems, excessive trampling by pedestrians walking through dune areas etc. are not well managed, dune vegetation can be severely damaged or destroyed. Dunes stripped of vegetation are no longer effective at trapping and retaining windblown sand which, over time, leads to the disruption of the natural cycle of advance and retreat of the dune system. With the reduced vegetation cover, the loss of sand from such systems is likely to be expedited through erosion. The ability of dunes to act as effective coastal barriers will therefore be lost. Furthermore, when they become unstable they begin to migrate landward which results in an excess amount of sand in areas where it is undesired.

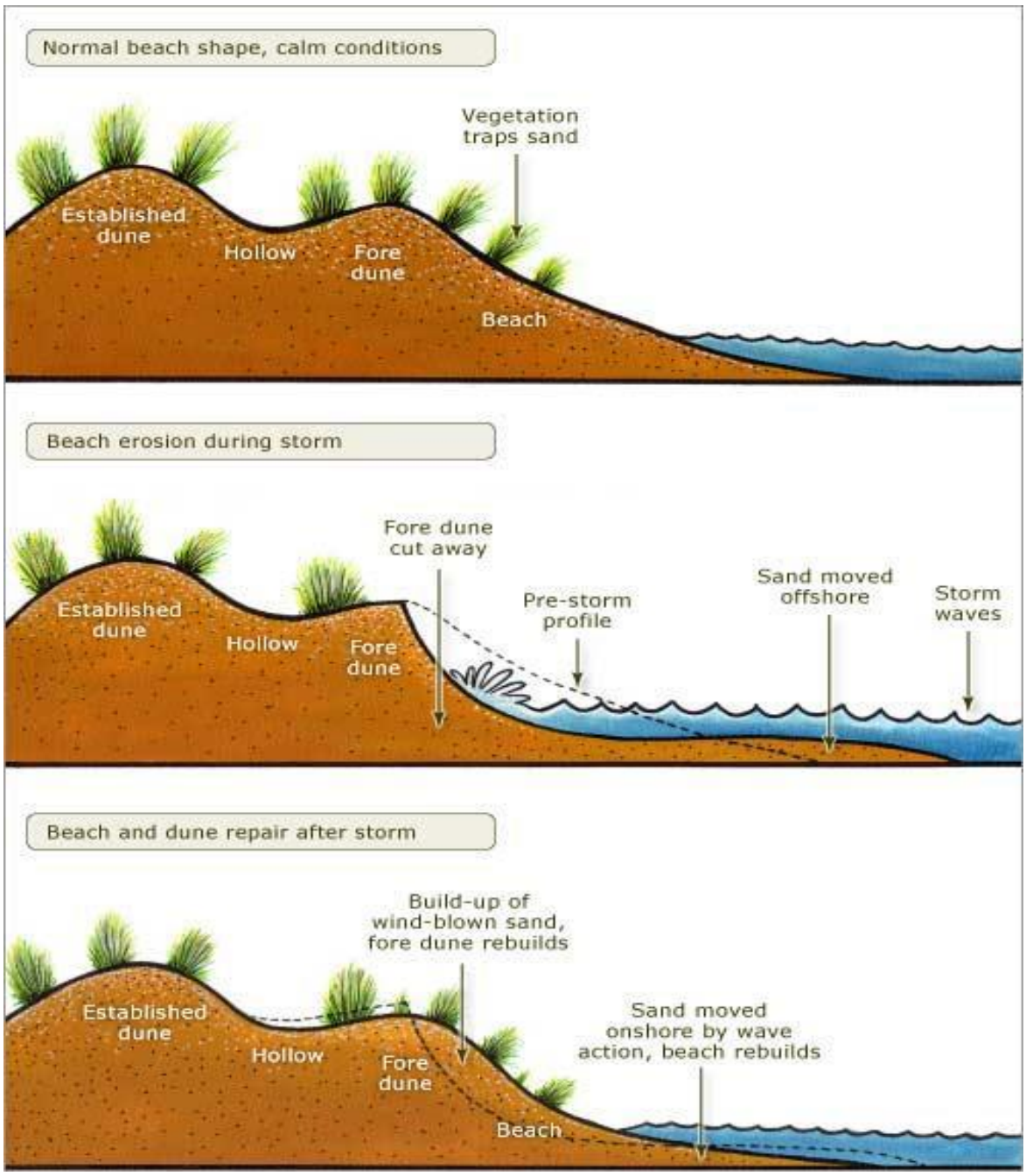


Figure 1: Beach and foredune profiles.

Beaches and fore dunes (the dunes closest to the sea) are in a constant state of change in response to waves and wind. Upper panel: fore dunes are formed when vegetation traps wind-blown sand. Middle panel: the front face of a fore dune is eroded when waves during storms crash onto the dunes and wash away plants and sand. Lower panel: the dunes form again as vegetation is re-established on an exposed site and begins to trap sand (eThekwini, 2011).

Problem statement

1.1 Large scale alteration of Cape Town's coastline

Cape Town's coastline extends for 307 kilometres along the West Coast, around the Cape Peninsula, and beyond False Bay to the Kogelberg coast in the east. Historically, Cape Town's coastline consisted of mobile dune systems that migrated significant distances inland and which were, by and large, unimpeded by infrastructure. However, as a result of urban development over centuries, those expansive sand dune systems have been severely compromised and transformed (Figure 2).

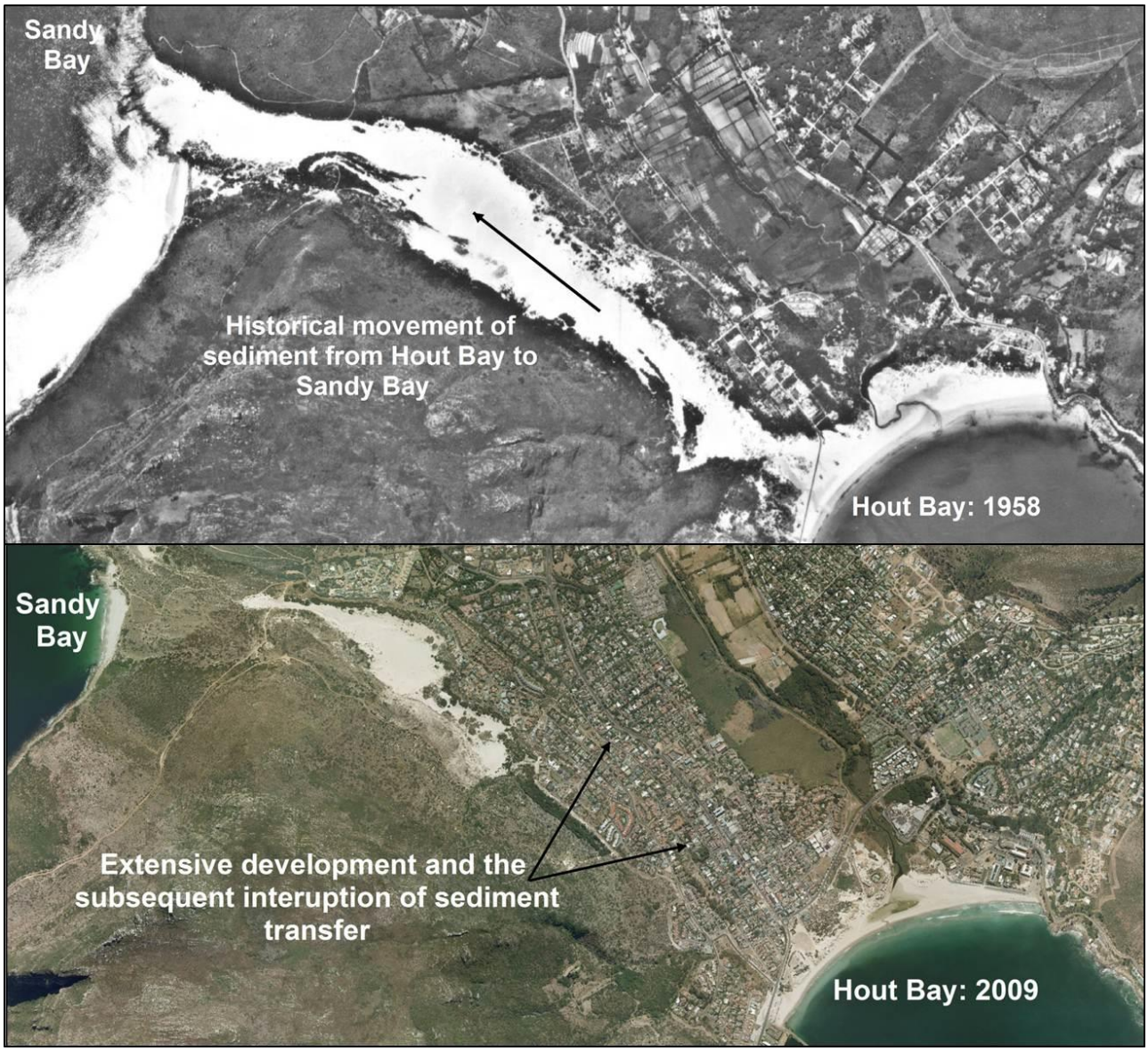


Figure 2: sediment by-pass and dune systems that have been severely altered by coastal development.

Within Cape Town, and as a crude proxy for the degree of the state in which coastal ecosystems have been altered, approximately 75% of Cape Town's coastline within 100 metres of the HWM has been developed and altered by some form of infrastructure. In some areas along the coastline development has encroached upon the frontal dunes and bypass systems, disturbing the natural balance between erosion and replenishment, resulting in a loss of beach in some areas. Furthermore, the damage, degradation and destabilization of dunes may result in properties and infrastructure being subjected to large amounts of windblown sand, inundation from the ocean, structural

damage from wave attack and undermining by erosion. With a diminished reservoir of sand, erosion of the beach may lead to shoreline regression. To avoid this, the maintenance and rehabilitation of dune and beach systems is important.

The majority of Cape Town's historic dune systems are now in a heavily altered state and no longer function naturally. Given the impracticality of phased retreat of most of the affected and relevant infrastructure along most of Cape Town's coastline these systems require intensive and integrated management approaches to stabilise them. The importance of this is realised given that the drivers of dune migration are still in place i.e. deposition of sediment from the ocean on beaches as well as persistent and strong south easterly and north westerly winds. Further, Cape Town's coastline is experiencing ongoing development, increasingly restricting the area within which these systems would normally function. Thus, the process of dune and beach rehabilitation and management is an important responsibility within local government and one which is on-going. If such systems are not managed correctly, they will revert to their historic and natural pathways with dire consequences for both public and private infrastructure (Figure 3).

Figure 3: mobile dune systems pose a significant threat to coastal infrastructure if not managed correctly and persistently

(Source: Aerial Perspective)

As a result of urbanisation in close proximity to the coast, these systems are now functioning within an altered environment often leading to:

- Excessive sand build-up altering the normal expected profile of fore-dunes;
- Excessive build-up of sand against or on hard infrastructure such as buildings, roads and walkways;
- Inability of natural dune vegetation to become established within a mobile sand environment;
- Loss of dunes, particularly embryo and hummock dunes;
- The loss of sediment-bypass systems with the result being the formation of dunes where they did not previously exist, and
- Loss of sediment supply on the lee side of sediment by-pass systems and ultimately the potential loss of beaches.

These challenges are further exacerbated by:

- Multiple informal access points across the dunes which creates blow-outs and erosion points;
- A net loss of sand from the system due to the removal of sand from hard infrastructure off site;
- Little to no active management of remaining dune belts;
- Pressures associated with a warming climate i.e. sea-level rise, storm surges, coastal erosion, beach regression and changing rainfall patterns.

It is important to recognise that due to the wind-dominated nature of Cape Town's coastline, dune systems are highly mobile and dynamic. With the increasingly altered and 'fixed' state of Cape Town's coastline as a result of extensive development, there is no alternative but to stabilise these systems and effectively retain them in a managed state. The extent, intensity, and value of coastal development (from both a real estate and service delivery perspective) by and large eliminates the option of phased retreat of infrastructure to make way for coastal processes, such as migrating dune systems. Thus, the on-going management and maintenance of vegetated coastal dunes and beaches is one of the most cost effective and ecologically sensitive means of managing the coastal environment in Cape Town. The value of this approach is also recognised in its contribution to the spectacular aesthetic and recreational appeal of Cape Town's beaches.

1.2 Compliance with NEMA EIA Regulations

The dynamic nature of Cape Town's extensive coastline in tandem with its highly altered and developed state requires that the CCT must intervene frequently to retain the functional integrity of dune systems or to mitigate against damage to coastal infrastructure from migrating dune systems. Typically, these activities include the following:

- Mechanical movement of sand that may have accumulated on, against or near infrastructure;
- Mechanical re-profiling of beaches to prevent the build-up, and over spilling of, beach sand onto, against or near coastal infrastructure;
- Bulk movement of sand to repair blow-outs and reshape compromised dune profiles;
- 'Topping', re-shaping and re-vegetating dunes that have grown too tall;

- Clearing access paths from sand build up and redistribution of sand on the beach, dunes or in inter-tidal areas;
- Reconstructing primary and hummock dunes that have been eroding by extreme storm events;
- Returning clean sand that has accumulated on roads and other built infrastructure to suitable areas on the beach or dunes;
- Manual removal of historic gravel and stone spoil from beach and dune areas;
- Planting of vegetation and installation of irrigation systems as part of dune rehabilitation projects;
- Stabilization of sand with brushwood, netting, kelp or mulch;
- Installation of post and rail fencing and barriers to prevent public from walking over sensitive dune systems;
- Installation of wooden/polywood walkways;
- Removal of alien vegetation;
- Removal of irrigation systems that require repair or replacement;
- Maintaining and repairing stormwater outlets along beaches and dune systems;
- Installation of refuse bins, benches, signage, fencing and bollards, and
- Removal of broken benches, fencing, signage, bollards, rubble and poles.

However, and in terms of the NEMA EIA regulations, some of these activities trigger listed activities (as identified in section 2.1) and as such require environmental authorisation.

1.3 A Maintenance Management Plan for Dunes and Beaches

The CCT is mindful that this MMP does not absolve the CCT from the general "Duty of Care" set out in Section 28(1) of the NEMA, viz.: "Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimize and rectify such pollution nor degradation of the environment".

The CCT further acknowledges that this MMP only relates to the listed activities as defined in section 2.1. If the CCT undertakes any other activity not defined in this MMP, the responsibility lies with the CCT in obtaining an Environmental Authorisation in terms of NEMA. Should it be necessary for the MMP to be amended, the CCT will consult with DEA&DP.

Legislative Context

The following legislative bodies bare relevance to the rehabilitation and maintenance of dunes and beaches.

2.1 The National Environmental Management Act (Act No. 107 of 1998)

The following listed activities contained in the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 defined in Government Notice (GN) No. R. 983, R. 984 and R. 985 (as amended) are identified as falling within the ambit rehabilitation and managements and maintenance of dunes and beaches.

Activity 18 of GN No. R. 983 (as amended):
"The planting of vegetation or placing of any material on dunes or exposed sand surfaces of more than 10 square meters, within the littoral active zone, for the purpose of preventing the free movement of sand, erosion or accretion, excluding where –

(i) the planting of vegetation or placement of material relates to restoration and maintenance of indigenous coastal vegetation undertaken in accordance with a maintenance management plan; or

(ii) such planting of vegetation or placing of material will occur behind a development setback".

Activity 19A of GN No. R. 983 (as amended):
"*The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from—*

(i) the seashore;
(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or
(iii) the sea; —

but excluding where such infilling, depositing, dredging, excavation, removal or moving—

(a) will occur behind a development setback;
(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;
(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;
(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or

where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies."

2.2 The Constitution of the Republic of South Africa (Act No. 108 of 1996)

The Constitution of the Republic of South Africa forms the foundation of all law, including environmental law, in South Africa. The Bill of Rights is fundamental to the Constitution of South Africa and in, section 24 of the Act, it is stated that:

"Everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

2.3 Integrated Coastal Management Act (Act No. 36 of 2014)

Section 15: Measures affecting erosion and accretion

Subsection (2): "No person may construct, maintain, or extend any structure, or take other measures on coastal public property to prevent or promote erosion or accretion of the seashore except as provided for in this Act, the National Environmental Management Act or any other specific environmental management Act"

2.4 Control of the Use of Vehicles in the Coastal Area Regulations

Control of vehicles in the Coastal Area Regulations (colloquially known as the Off-Road Vehicle Regulations (ORV)) makes provision for permissible activities. Section 3(1)(d) of these Regulations state a permissible activity as being: "the use of a vehicle by an employee or agent of an organ of state acting in the course and scope of their employment or mandate, or by any person contracted by an organ of state, for the purposes of performing the public duties of that organ of state mandated by law".

Aims and Objectives of this MMP

3.1 Aims

The aim of this MMP is to provide a guiding framework to restore, manage and maintain the structure, function and diversity of dune ecosystems within Cape Town by undertaking dune rehabilitation activities timeously, effectively, sensitively and in accordance with applicable legislation. This MMP serves to identify the required management prescriptions for the successful rehabilitation and maintenance of dunes and beaches in Cape Town. Moreover, this plan incorporates the identification of further work required in the short term to improve the containment of wind-blown sand and serves as a guide for improved future management techniques.

3.2 Objectives

The MMP has the following objectives:

- To promote dune and beach rehabilitation and maintenance in an environmentally sensitive manner;
- To minimize management commitments by providing vegetation that regenerates naturally and which stabilizes dune systems;
- To reduce soil erosion and instability of dune systems;
- To stabilize dunes to minimize impacts of wind-blown sand on the natural and built environment adjacent to dunes;
- To facilitate safe public access through CPP within sensitive areas by defining access ways and public areas that can be maintained to a high standard with minimal impact on natural systems;
- To establish a sustainable habitat for coastal fauna and flora, and
- To enhance the visual amenity of Cape Town's beaches by applying best practice landscape design principles.

Implementing the MMP

4.1 Practical application

A clear understanding is needed of the risks to humans and the natural environment, effectiveness and consequences of the various management decisions that are made for Cape Town's beaches. At all rehabilitation and maintenance sites the primary goal is to mitigate the impacts of wind-blown sand in as environmentally sensitive fashion as possible. Approaches to stabilise and rehabilitate dunes vary in cost, resources required, timeframes and techniques according to particular sites and conditions – some sites may be particularly degraded to such an extent that the entire system needs to be re-profiled and planted. Other locations, typically in less altered areas, may still remain relatively functional and which require less maintenance. The following aspects are considered central to a successful MMP:

- Identification of causal mechanisms:
    - Determining the cause of the deterioration and whether it has resulted from natural occurrences or anthropogenic activities.
    - Where human impact is the cause it should be assessed whether the harmful actions are on-going and if the prevention or control of such actions is possible.
- Design of rehabilitation measures
    - *Identify strategies to remove or control as far as possible the cause of the degradation.*
    - *With an understanding of the causal mechanisms, identify management interventions e.g. the type of earthmoving machinery, required volume of sand to be moved, vegetation and the various species to be planted, etc.*
    - *A time schedule must be determined that is cognisant of the growing and non-growing seasons for vegetation specific to Cape Town.*
    - *Timeous allocation of budget.*
- Implementation/Rehabilitation
    - *Reinstating and re-vegetation of the dune.*
    - *Public consultation through a media statement and informing the local Ward Councillor.*
- Maintenance and monitoring
    - *To ensure that rehabilitation is a success, maintenance will be on-going; periodical inspections and evaluations will be conducted until a satisfactory level of vegetation cover is reached.*

Environmental Monitoring

Environmental monitoring will be undertaken on a regular basis in order to ensure compliance with all aspects of the MMP. This monitoring will take the form of regular site inspections as well as remotely, through the CCT's Coastal Monitoring Programme (dune and beach profiles extracted from LiDAR, change in vegetation cover through analysis of aerial imagery, drone photography, etc.)

5.1 Non-compliance with the MMP

Operational difficulties may be encountered that may result in non-compliance. Non-compliance may arise due to poor communication across the CCT's various line departments, staff turnover, budget shortfalls, logistical challenges etc. The CCT's Coastal Management Branch will put in place measures to ensure that the various CCT departments will remain compliant with the MMP as far as possible. Non-compliance with the MMP will be logged, and a report compiled on each non-compliance event will be submitted to DEA&DP post rehabilitation and maintenance work.

Rehabilitation of Dunes

The CCT's Coastal Management Branch will conduct a thorough site assessment to determine whether dune rehabilitation is required or not. The following criteria will be used in this assessment:

- State of dune vegetation and general dune integrity;
- Dune height and the position in relation to the HWM
- Vegetation coverage;
- Species composition, and
- Mobility of the dune and whether this is having a negative impact on surrounding infrastructure.

Whilst this MMP is applicable to the entire area under the CCT's jurisdiction, there are certain areas that are considered priority in terms of dune rehabilitation and maintenance. The location of these, together with GPS coordinates, issue relating to dune maintenance, required intervention and status are included as Annexure A.

The following sections detail the methods that will be applied when conduction dune maintenance and rehabilitation.

6.1 Reforming (rebuilding and reshaping) dunes

Reconstruction of dunes may be necessary when the shape, size or topography has changed significantly. The dimensions of the reconstructed dunes will depend on those of the remnant dune, the location of the dune in relation to infrastructure and the type and availability of sand to be used for the reconstruction or previous design criteria. Several methods can be used to reshape dunes depending on the scale of degradation and resources available. These include the use of earthmoving equipment or sand trapping techniques such as wind-nets, hedgerows, spreading of brush matting and re-vegetation (see section 6.1 for further detail). The following factors will be taken into consideration with regard to the reforming and re-profiling of dunes:

6.1.1 Material

Dune rehabilitation may require various materials, natural or artificial. Availability, applications and costs will vary depending on location, desired appearance of the dune, environmental impact, life expectancy and public safety. Should sand replenishment be required, the sand used in dune reconstruction should match the grain size of the existing dune to allow for the establishment and growth of vegetation.

If it is not possible to use the preferred or matching grain size of sand and the median grain size is too coarse, the dune will be designed so that the top 300mm of its surface consists of finer sand capable of retaining moisture and which is supportive of plant growth.

Foreign materials such as rubble, concrete and clay will not be used as the differences in the permeability and transport characteristics differ and this may cause more problems e.g. dune drainage, introducing weeds, etc. Further, such substances may pose a health and safety hazard to the public as well as detracting from the aesthetic appeal.

6.1.2 Position

The position of a reconstructed dune will be aligned with the original location of the degraded dune or in keeping with previous design criteria which will take into consideration any structures that may be in close proximity to the dune. A reconstructed dune will run approximately parallel with the beach berm.

6.1.3 Slope and Shape

Dune gradients will vary considerably at different sites. Gentle gradients are preferable; however steeper slopes may be unavoidable in areas of limited space. Reconstructed dunes will be shaped in a way that is consistent with climatic conditions. In wind-driven systems, such as those in Cape Town, dune profiles will be shaped in a way that provides as less resistance to the prevailing winds as possible.

6.1.4 Height and width

The height and width of rebuilding dunes will depend on a number of factors including:

- Height and width of the existing dunes;
- Availability of sand and;
- Availability of space, considering the existing dunes, infrastructure and the position of the HWM, and
- Historical aspects of the affected dune system.

6.1.5 Sand Sources

Sand will be used form a variety of sources, with emphasis being placed on collecting wind-blown sand that has accumulated on CCT infrastructure. This sand will only be used provided it is not contaminated with any other debris such as rubble or litter. Sand from other sites with similar grain size and chemical composition will also be considered, again provided that such sand is not contaminated. Sand may also be obtained from the beach berm and below HWM where it is available. This will only be undertaken under the provision that the removal of such sand will not have an impact on the broader beach or dune environment or have any other negative impacts.

6.1.6 Dune rebuilding using dune forming materials

Dune forming fences, wind nets or hedgerows can be helpful with dune rebuilding as they reduce wind velocity and therefore cause sand to be deposited in the vicinity of the fence. These materials may be used to:

- build a dune where no dune exists

- fill gaps or blow-outs in the crest line of existing dunes;
- create a higher or wider dune, making it a more effective barrier to wave run-up, wind and wind-blown sand, and salt spray originating from the beach;
- build a new dune ridge seaward of an existing dune, and
- Raise the beach profile.

Dune forming fences are mainly used on smaller isolated blowouts which are still surrounded by functional dunes and vegetation; however, they can also be used for larger scale dune formation and at sites where new material cannot be imported. Dune-forming fences may be used in sensitive areas where it is undesirable to use earthmoving equipment or where access is difficult.

Dune-forming materials may also be installed after earthmoving activities have achieved desired dune profile. A benefit of dune forming fences is that public access may be guided by the placement of material. In the event fences are required, natural materials (such as branches obtained from alien invasive removal programmes) will be used in the construction of the fences. This is primarily because this material breaks down over time and does not offer any source of value from a theft perspective. If it is not possible to use natural material or specific results are required in which natural materials cannot achieve, fences from porous materials (such as shade cloth) will be used. Wooden slats laced together as well as hessian may also be used in addition to shade cloth. Other designs will be considered depending on local circumstances and availability of materials. To be most effective, dune forming fences should be positioned at right angles to the prevailing wind.

6.1.7 Dune reconstruction using earth moving equipment

Earthmoving machinery is not always required for dune reconstruction but can be useful where dunes require significant amount of earth moving in a short period of time. Earthworks may be required to push the sand up from the beach or from areas where the sand has accumulated. A variety of mechanical devices are available and selection will depend on the tasks required and available operating space. These include the following:

- Bulldozer - Useful for moving large amounts of readily available, compacted sand in large open areas, or when large areas need to be levelled or reshaped and the distance the sand needs to be moved is short. Many bulldozers can also be fitted with a 'ripper' which can plough soil, making planting easier;
- Front-end loader – Can be used in tight spaces, moving small amounts of sand over moderate distances. They are valuable for accurately placing sand where required with minimal environmental disturbance and for effectively transplanting/loading primary vegetation and other basic raw materials onto tip trucks;
- Excavator - May be used to excavate sand from the source and progressively place the sand at the site of rehabilitation. Excavators have an extendable arm with a digging bucket, grasper or auger attachment. The digging bucket can move large quantities of sand in a short space of time and the grasper can be used to collect and spread large quantities of brush. It is possible to use an excavator to trim the slope of the dune to the required angle from either the crest or toe of the dune;
- Tractor – Loader – Backender: may be used to perform all of the above tasks, and

- Bobcat – May be used in narrow spaces for example to remove sand build-up from walkways and near buildings.

When earth-moving equipment is used precautions will be taken so as not to disturb existing areas of vegetation. All vehicles and equipment used on site will be operated by appropriately trained and/or licensed individuals in compliance with all safety measures as laid out in the Occupational Health & Safety Act (OHSA). Vehicles and machinery will be kept in good working order and will not be serviced and refuelled on site (see section 11 for further detail surrounding the conditions of use for heavy equipment).

6.1.8 Timing and reconstruction

Dune reconstruction should ideally be timed in accordance with favourable weather patterns and where necessary, carried out in stages to enable planting to commence almost immediately following re-profiling to minimise risk of erosion and the loss of sand through aeolian movement. If the reconstruction is completed too far in advance of planting, the likelihood of significant sand loss is likely to be high. The loss of sand due to poor synchronisation between re-profiling and planting will necessitate further dune reconstruction. The timing of dune reconstruction work will therefore take into account climatic conditions, planting season, the availability of planting materials, staffing and equipment availability.

6.2 Dune stabilization

Stabilisation of sand will in most cases be undertaken following dune reformation (rebuilding and reshaping). This will assist against wind erosion as well to allow vegetation to establish. Common techniques used to stabilise the dune surface include the use of plant material such as wind nets, hedgerows, mulch, brush matting, irrigation, and the placement of kelp. These approaches are also useful in improving moisture and salinity conditions for vegetation. Pioneer species may also be planted in conjunction with the use of plant material stabilisers, but will only be done if the moisture and salinity conditions are favourable.

6.2.1 Mulch/Woodchip

In areas where exposure to wind is minimal, surface stability can be obtained by using mulch. Mulch assists with retention of soil moisture and provides protection for seedlings from the harsh conditions associated with coastal environments. Suitable materials for mulch include grass cuttings, leaves, wood chips, straw and sawdust. Chipped waste from pruning and clearing operations will be considered as long as the material is not contaminated with undesirable seeds. Mulches have the advantage of being (1) cheap, (2) readily available, (3) easier to handle and transport than brush and does not offer any value from a thievery perspective. However, mulches are not effective on exposed areas with strong winds. Under these circumstances brush is preferred. Mulch used for dune rehabilitation should be coarse and heavy to lessen the likelihood of it blowing away when dried out. Mulch will not be harvested from surrounding areas of indigenous vegetation.

6.2.2 Wind netting

Wind netting may be used to trap sand at a pre-determined site. If erected at right angles to the predominant winds they function effectively as win-breaks, leading to the deposition of sand on the lee side of the wind nets. The trapping of sand through this method is useful in slowing down the movement of sand and ultimately the stabilisation of the system.

6.2.3 Brush matting

Brush matting involves placing a layer of branches over the bare sand surface. As the wind passes over this layer, wind velocities are reduced, allowing the sand surface to remain intact. Windblown sand drops through and is trapped beneath the brush. Brush matting is labour intensive as it requires the cutting, transporting and spreading of brush. It is also a technique which is restricted to areas where brush is available and does not bear seeds. However, the advantages outweigh the disadvantages, as outlined below:

- Dune vegetation establishes well and grows easily through brush matting. The sand-trapping qualities of brush matting are useful for burying seed that can be planted over the brushed area. It is incorporated into the soil profile as windblown sand is trapped and deposited on top of the seeds;
- Brush matting withstands strong winds while keeping the sand surface stable;
- With competent supervision, the brush can be obtained and spread by relatively unskilled staff;
- Seed or seedlings can be planted and fertiliser applied either before or after the brush is laid. Brush matting provides shelter for the developing seedlings, and
- As the brush eventually decays it adds organic matter to the sand, improving its nutrient status and moisture-holding capacity.

During the rehabilitation of the dunes:

- Coastal vegetation will not be used as brush except when rehabilitation coincides with the clearing of areas for development or the construction of fire breaks;
- Care will be taken to avoid introducing seed from plants that are not locally endemic or indigenous;
- The butt end of the branch will face the prevailing wind direction;
- When laid the brush should cover at least 60-80% of the sand surface;
- If brush availability is limited, it will be laid in rows 2-3 meters apart beginning at the base of the dune nearest to the mobile sand source, and
- Brushwood will not be used if it presents a fire hazard, especially to nearby infrastructure.

6.2.4 Irrigation

Irrigation systems will only be used in certain circumstances (see section 6.4.4)

6.2.5 Kelp

Kelp is important for the integrity of coastal dunes as it has the ability to trap sand, raise beach profiles and encourages the establishment of pioneer plants. It also provides nutrients for dune vegetation during the decomposition process. Beach cast kelp, otherwise known as kelp 'wrack' also provides a physical barrier for dune systems from storm surges, particularly during the second high tide of a storm surge event.

Excessive removal of kelp from beaches can have significant implications for the integrity of beach and dune ecology. The CCT has in place a Beach Cleaning Protocol (Annexure B) which informs the operational management and removal of kelp from Cape Town's beaches. This policy aims to strike a delicate balance between leaving kelp on beaches due to the environmental and indirect social benefits, whilst minimising the negative social impacts associated with kelp, that being odour, flies and obstruction. Outside of kelp cleansing zones (Annexure C), beach cast kelp will be left in its natural configuration along Cape Town's beaches as opposed to physically placing kelp on dune systems. The natural distribution of kelp on beaches plays an important role in elevating beach profiles. Elevated beach profiles in turn mitigate exposure of dunes to coastal erosion.

6.3 Protective fencing

The main purpose of fencing is to prevent damage to the dunes from pedestrian and vehicular traffic when rehabilitation and maintenance is in progress. Physical delineation of the site is critical as it defines the area where the public must not enter.

Various types of fencing may be used, for example wooden posts, recycled plastic fencing, danger tape etc. Fencing may be temporary or permanent depending on the progress of dune rehabilitation and the pressures that may exist around rehabilitated dunes. At no time however will fences be constructed if they limit or restrict public access to the beach. Further, at no time will concrete footings be used to secure poles for fences.

6.3.1 Fence type and construction

- The fence type and construction will be dictated by local site characteristics and the availability of materials;
- Fences will be of simple construction, and easy to maintain and remove;
- Hazard tape may be used to as a temporary intervention in emergency situations, and
- Provided there are no ongoing pressures that may lead to the degradation of rehabilitated dunes, fences will be removed upon completion of rehabilitation

6.3.2 Fence position

- The seaward or frontal fence will be located near the toe of the foredune, above high-water levels;
- Fences will be roughly parallel to the dune toe;
- At remote sites with limited pressures, fences are unlikely to be used;
- The location of fences in hind dunes will vary according to constraints imposed by the landform, existing vegetation and the presence of developments such as car parks and roads, and
- All such areas will have signage, informing people of both restricted access and the need for rehabilitation through access control.

6.4 Re-vegetation of dunes

6.4.1. General planting principles

The most effective long-term method for dune stabilisation is through the planting of vegetation. Vegetation is the least expensive, most durable, most aesthetically appealing and only self-maintaining technique available. Vegetation on coastal dunes binds the sand as well as reduces wind velocity. Re-vegetation of dunes must be carried out as swiftly as possible following the reconstruction of the dune. The use of nursery-raised seedlings, in situ cuttings and seeding are the most common methods of establishing vegetation on the dunes. However, established plants from the immediate vicinity, rescued during the course of other operations, may also be used on occasion. The following conditions will be applicable when using vegetation to stabilise dune systems:

- Planting will occur as soon the dune is profiled and sand movement is stabilized;
- Locally indigenous species will be used which is consistent to the local vegetation characteristics (Annexure D);
- Successional planting will be established where possible and appropriate;
- All plants will be inspected to ensure that they are free from pests and diseases;
- All measures will be put in place to create a protected and sheltered environment for newly planted vegetation;
- The combination of high temperatures, low soil moisture and strong winds are the major causes behind poor establishment of dune vegetation. The timing of planting will be such that these conditions are avoided. Planting will take place within Cape Town's growing season, mainly between May and August;
- All necessary preparations (i.e. the addition of mulch or fertilizer) will be made to ensure the establishment of newly planted vegetation;
- Where necessary irrigation systems may be installed and used during Cape Town's dry season (summer months), and
- When seed mix is used all preparations (i.e. the installation of wind breaks and mulch) will be undertaken to ensure that seeds are given the best available chance of germinating.

6.4.2 Plants and seed mulch sourced from nurseries

In order for re-vegetation projects to be successful, the planting of tough, well-hardened native dune plants is essential. Plants can be raised in nurseries and when ready, planted on the dunes requiring re-vegetation. Alternatively seed mulch may also be used in cases where dense vegetation cover is required. The nurseries from which the plants and seed mix are sourced will need to meet various requirements:

- They should have a suitable supply of indigenous dune species native to the Western Cape;
- They should take precaution to ensure that plants and seeds are free from diseases by maintaining a disease free environment and treating disease/pest outbreaks;
- They should ensure that the components of the potting mix are free of disease-causing pathogens, and
- Follow-up monitoring will ensure that any alien plant species accidentally incorporated into the mix are timeously eradicated.

6.4.3 Compost and fertilizer

Plant tissues (e.g. leaves and stems) make up a significant proportion of the total nutrient pool of the otherwise nutrient poor coastal dune soils. Therefore, in areas where vegetation has been damaged or removed it will be necessary to use fertiliser or compost in order to increase the nutrient level to that which will allow for successful plant growth. While indigenous dune plants are often well adapted to surviving in nutrient poor soils, fertilisers and compost are useful when it comes to facilitating the growth of young plants. Fertilizing and composting also minimizes the time required to achieve stability against wind erosion. The following points will be taken into consideration when applying compost or fertilizer:

- Organic matter generated by garden refuse may be used as compost;
- Care will be exercised when using fertilizer products near sensitive areas (e.g. wetlands) in order to avoid contamination of these areas;
- Organic fertilizers should be used where possible and fertilizer should be applied in a uniform manner after planting;
- Eco-labelled and green certified products should be used e.g. FSC, Energy Star, Fair Trade etc;
- Fertilizers will not be applied to establish natural vegetation on the undisturbed coastal dunes;
- Fertilizing beyond initial planting is unnecessary and will not be conducted;
- Fertilizer should not be applied before heavy rain as it may be leached from the soil before uptake of plants;
- Fertilizers should be spread by hand ensuring that each area receives the appropriate amount;
- fertilizers containing phosphorus will be used cautiously, as phosphorous levels can build-up in the sand and encourage weed invasion;
- The nitrogen component of fertilizers tends to be very soluble and heavy rainfall can cause leaching from the relatively shallow root zone of young dune plants. This risk may be reduced by splitting up the fertilizer application and applying it when weather conditions are suitable, and
- Fertilizer containers should be properly sealed and stored in a safe place in between uses.

6.4.4 Irrigation systems

Irrigation may be required to assist with watering plants in the early stages of dune rehabilitation in order to evade moisture stress which is often responsible for the poor survival of seedlings. Typically, this is required in Cape Town during the hot and dry summer months. There is far greater flexibility with regard to the time of planting if seedlings can be watered during the critical establishment period. The following guidelines will be applicable in the use of irrigation systems:

- During periods of drought use of water for irrigation will be limited in accordance with the CCT's own water use restrictions;
- Correct irrigation sequences need to be applied; excessive irrigation will induce root rot as well as cause roots to grow too close to the surface. As a consequence, the dune may become less stable;
- All seeded or planted vegetated areas shall be irrigated at regular intervals. This should be monitored by the relevant beach for the duration of the rehabilitation period;
- All vegetated areas should receive 100% irrigation coverage;

- Care should be taken not to damage the soil structure or stability by use of excessive force of water;
- Water used for irrigation should be free from pollutants that would harm the plants;
- Plants with similar water requirements should be grouped together e.g. plants with low, moderate or high water needs;
- Weeds and by extrapolation alien plants should be removed as these compete with indigenous vegetation for water;
- Water loss through evaporation will be reduced by watering in the early morning or late afternoon, and
- The irrigation system and pressure must be regularly inspected to identify leaks.

6.5 Managing Access

6.5.1 Boardwalks

The purpose of these structures is to guide peoples' movement over dunes in an elevated manner to avoid trampling of vegetation and the subsequent formation of dune blow-outs. Boardwalks may be constructed using wood or recycled plastic; the latter being preferable as it requires less maintenance and has a longer lifespan. The following factors will be taken into account when constructing boardwalks within sensitive dune areas:

- Boardwalks will be repaired and maintained regularly;
- Existing access routes will be used where possible without the addition of unnecessary infrastructure;
- Unnecessary access routes will be de-commissioned and rehabilitated, with other improved access routes?
- Boardwalks will be positioned in a manner that does not detract from the aesthetic appeal of the coastal environment, and
- No concrete foundations will be used to support boardwalks; main support poles will instead be sunk to a depth that provides stability.

6.5.2 Signage

Informative signage will be installed to inform the public of any rehabilitation processes (and the importance of such processes) taking place and the purpose of any new structures which may have been erected.

Monitoring of the rehabilitation and maintenance process

As in any rehabilitation project, maintenance is a crucial aspect in achieving successful results. Maintenance of dune vegetation, dune profiles and ancillary infrastructure such as raised boardwalks for the duration of the dunes lifespan is essential for optimising the functionality and effectiveness of these systems. Dune vegetation requires intensive maintenance for a number of weeks following planting and must be inspected on a regular basis. Collaborative platforms will be utilised to facilitate communication between departments within the CCT, as well as between the CCT and any service providers that may be utilised for rehabilitation and maintenance of dune systems.

7.1 CCT Coastal Monitoring Programme

Monitoring will also form an important component of the CCT's dune and beach management programme. This will primarily be undertaken through the CCT's Coastal Monitoring Programme (Figure 3) and will include the following methods:

- Fixed point photography
- Aerial/drone imagery
- Beach and dune profile analysis

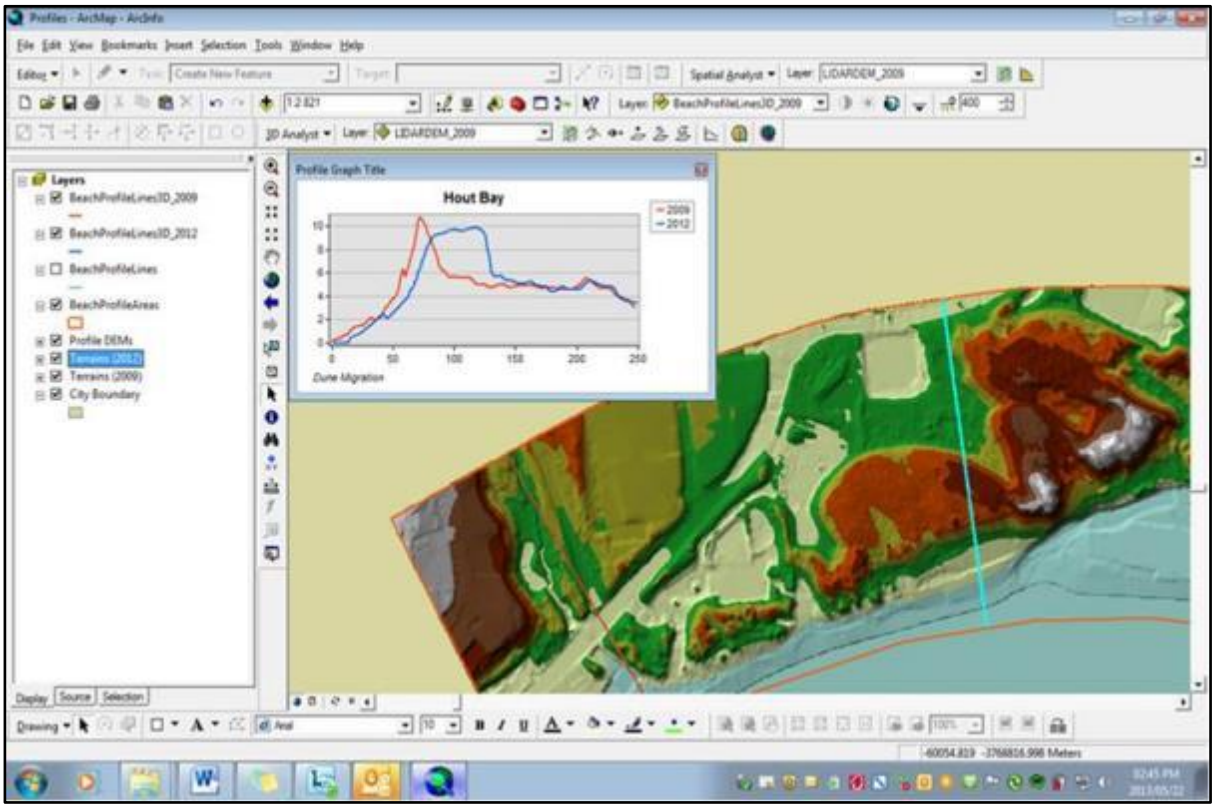


Figure 4: Screen grab of the CCT's coastal monitoring programme tracking change in dune profiles over time.

An additional component here is operational monitoring. This includes weekly measurements, daily inspections or irrigation systems, determination of sand accretion on public infrastructure etc. These operational monitoring requirements will be established and built into operational management plans for distinct coastal nodes. The intent of which is to provide guidance to operational level staff on the management and maintenance of coastal infrastructure and the retention of institutional memory to address staff turnover and the loss of knowledge.

The data generated by the CCT's coastal monitoring programme will provide the feedback required to determine maintenance requirements and will help to measure the effectiveness of the CCT's rehabilitation and maintenance efforts.

7.2 Search and rescue of nesting sea shore birds

The access route and area of operations will be inspected prior to activities commencing to ensure that there are no nesting birds e.g. plovers, oyster catchers on site. No nests or roosts will be moved or relocated. Areas in which nests are found will be cordoned off and avoided.

7.3 Alien plant clearing

An important aspect in establishing indigenous vegetation on dune cordons is the removal of alien vegetation. Alien invasive vegetation is problematic in many regards, namely: they often require more water than indigenous plants and therefore the local plants in the area are often left with an unsatisfactory water supply, they can act as fuel for veld fires and they are a major threat to biodiversity in catchment areas. There are also benefits to alien species. This benefit arises out of the ability of hardy species such as Rooikrans (*Acacia cyclops*) to stabilise sand dunes through their root systems in harsh environments and thereby prevent wind erosion and the migration of dunes onto infrastructure. This is particularly relevant in Cape Town with its strong and persistent winds. In respect of this, the removal of alien vegetation must be undertaken within a successional plan i.e. the removal of alien invasives cannot be removed without phasing in indigenous vegetation or any other means to stabilize the dune system; and through a series of consistent follow-up operations to ensure that alien plants do not re-coppice; or re-establish following dormancy of their seed bed. To do so would compound the problem of wind-blow sand within Cape Town. Some common undesirable species are identified below:

- *Acacia cyclops* (Rooikrans)
- *Acacia elata* (Pepper tree wattle)
- *Acacia implexa* (Screw pod wattle)
- *Acacia mearnsii* (Black wattle)
- *Acacia melanoxylon* (Blackwood)
- *Acacia longifolia* (Long-leafed wattle)
- *Acacia podalyriifolia* (Pearl acacia)
- *Acacia saligna* (Port Jackson)
- *Acacia stricta* (Hop wattle)
- *Acacia paradoxa* (Kangaroo wattle)
- *Acridostheres tristis* (Common Myna)
- *Ailanthus altissima* (Tree of heaven)

- *Anredera cordifolia* (Madeira vine)
- *Billardiera heterophylla* (Blue bell creeper)
- *Bryophyllum delagoense* (Chandelier plant)
- *Cardiospermum grandiflorum* (Balloon vine)
- *Campuloclinium macrocephalum* (Pom weed)
- *Centranthus ruber* (Devil's beard)
- *Cortaderia selloana* (Pampas grass)
- *Eucalyptus conferruminata* (Spider gum)
- *Genista monspessulana* (French broom)
- *Hakea drupacea* (Sweet hakea)
- *Hakeasericea* (Silky hakea)
- *Iris pseudacorus* (Yellow flag iris)
- *Leptospermum laevigatum* (Australian myrtle)
- *Lythrum salicaria* (Purple loosestrife)
- *Melaleuca hypericifolia* (Red flowering tea tree)
- Nymphaea Mexicana (Yellow water lily)
- *Parkiaspeciose* (Stinkbean)
- *Pennisetum setaceum* (Fountain grass)
- *Pereskia aculeata* (Barbados gooseberry)
- *Pinuspinaster* (Cluster pine)
- *Pittosporum undulatum* (Australian cheesewood, sweet pittosporum)
- *Polistes dominula* (European paper wasp)
- *Rivina Humilis* (Rivinia bloodberry)
- *Spartium junceum* (Spanish broom)
- *Verbesina encelioides* (Wild sunflower)

7.4 Herbicides

Use of herbicides in the removal of alien invasives will be avoided. The CCT will instead focus on labour intensive removal of alien invasives when clearing operations are required. Any application of herbicides for the removal of invasive species will be undertaken strictly in accordance with Departmental Affairs *Revised and Updated Policy on the Use of Herbicides and Mycoherbicides for the Control of Alien Vegetation* (2012). Due regard will also be given to the potential for dune destabilisation that may result from alien removal as per section 7.3.

Beach re-profiling

Beaches are highly dynamic spaces. Within Cape Town, beach profiles generally tend to be raised on the west coast due to prevailing south easterly and relatively calm seas in the summer whilst in winter beach profiles tend to drop due to exposure to higher seas and subsequent erosion. The opposite is true for Cape Town's False Bay coastline.

Beaches are highly dynamic spaces. Within Cape Town, beach profiles generally tend to be raised on the west coast due to prevailing south easterly and relatively calm seas in the summer whilst in winter beach profiles tend to drop due to exposure to higher seas and subsequent erosion. The opposite is true for Cape Town's False Bay coastline. The dynamic nature of Cape Town's beaches in conjunction with heavily altered and 'fixed' coastlines necessitates that beach levels are managed. Beach revetments, built to protect coastal infrastructure, were built with the intention to facilitate the efficient management of sand levels on the seaward side of beach walls and revetments.

8.1 Purpose

The intention of beach which is to prevent beach levels from building up to such an extent that sand does not 'spill over' and smother public infrastructure such as roads, walkways and parking facilities. Lowering of upper beach levels also enables greater areas of the beach to become wet during high tides thus limiting the potential for aeolian transport of sand.

The CCT, and the various councils prior to the CCT's formation in 2000, have for many decades (as far back as the 1960's), mechanically flattened beach profiles through mechanical scraping to a pre-determined level and the re-distribution of sand to a more even profile within the intertidal zone. Beaches requiring re-profiling include the following:

- Fish Hoek
- Muizenberg
- Strand
- Gordon's Bay
- Hout Bay

This method and process, and considering the highly altered environment in which these beaches occur, has no impact on beach ecology, and is beneficial from a public access perspective in that coastal infrastructure remains accessible and open at all times. Further, such an approach is more cost effective as opposed to removing sand from CCT infrastructure after the fact where such sand often becomes contaminated by litter and taken to land-fills. This sand, as a consequence, is lost to the system. The following operational protocols will be complied with when re-profiling the listed beaches:

- Re-profiling will not take place during windy or unfavourable conditions;
- Re-profiling will be undertaken at low tide to facilitate redistribution of sand below the HWM;
- Re-profiling will not be undertaken during peak periods of beach use;
- Excesses sand will be levelled out within the intertidal zone, and
- Re-profiling will take place on an 'if and when required' basis determined by the CCT's coastal branch.

Estuary Mouth Maintenance Management Plans

The CCT has documented the various maintenance and management interventions that are required in the following seven estuary / river outlets in it's so called "Maintenance Management Plans (MMPs):

- Diep
- Silvermine
- Disa
- Lourens
- Sir Lowry's Pass
- Eerste
- Zandvlei

9.1 Purpose

The purpose of these MMP's, is to guide the CCT's maintenance activities, which mainly cover typical stormwater management activities, within sensitive estuarine environments and to identify suitable mitigation measures that will minimize negative environmental impacts of these activities. The MMPs also make provision for maintenance interventions which departments such as ERM, W&S, Parks, Sport, Recreation & Amenities, and Electricity may also need to undertake on municipal infrastructure within the estuarine area.

While these MMPs contain internal working guidelines and outline best practise for a range of municipal interventions, they also serve to preserve the City's institutional memory. The MMPs were authorised in terms of an amendment of the City's existing Environmental Authorisation of the Stormwater Maintenance and Management Programme in terms of the National Environmental Management Act (Act No. 107 of 1998) (EIA Ref No. 16/3/1/3/1/A7/4/2031/12).

The Estuary MMPs include a delineation of the estuary extent; a summary of available information on conservation importance, health status and sensitivity of each estuary; a description of the required maintenance activities. An identification of the presence of Heritage Resources was also undertaken within each estuarine area. It should be noted that the coastal zone, river mouths / estuaries and coastal zones may have fossils and/or remnants of previous settlements / communities. Site visits to each of the seven estuaries were undertaken during which a variety of maintenance activities were discussed with CCT officials and estuarine ecologists. These MMPs were compiled based on information supplied by CCT officials, observations made during the site visits, available information in the scientific literature and other reports (e.g. estuary management plans), and the consultant's previous experience and specialist knowledge. Finally, the MMPs should be read together with the Environmental Management Programme and Technical Assessment Report (GIBB, 2014) which were compiled as part of the original Basic Assessment Report and EIA application for the authorisation for maintenance and management interventions in the City's surface stormwater systems. Chapter 13 of that EMPr deals specifically with estuaries and river mouths.

MMPs for the Zandvlei and Rietvlei have been completed as a separate process as part of the City's reserve management plans. All Estuary MMPs are available upon request

General site maintenance

A good housekeeping and a clean site policy will be applied by the CCT during dune and beach management interventions. The site maintenance guidelines below will apply to any maintenance and rehabilitation in respect of dunes and beaches.

10.1 Access routes

Machinery used to access areas requiring work will be undertaken through formal access routes. If no formal access routes are available, access to the site will be undertaken in a sensitive manner, or thorough already disturbed areas. Upon completion of work, access routes will be rehabilitated. The movement of any personnel or equipment outside of the designated working areas as it relates to dune rehabilitation and maintenance will not be permitted.

10.2 No go areas

Prior to commencing work, 'no go areas' will be determined and demarcated at project sites for areas that are ecologically sensitive and are at risk of being damaged during rehabilitation and maintenance work. Officials from the CCT's coastal branch will be on site during planned maintenance activities to ensure that these areas are not impacted upon.

10.3 Storage of equipment

No storage areas will be established on the beach or within sensitive dune areas. All equipment and tools that are used will be removed at the end of each working day. Equipment that may need to be stored for whatever reason (including breakdowns and overnight storage due to lengthy operations) will be stored in pre-determined and secured sites.

10.4 Public safety, compliance and ECOs

It is the CCT's responsibility to make sure that the public is kept safe from planned maintenance and rehabilitation operations. This is especially the case considering that these operations will be taking place on the beaches and dune systems, which are designated as areas of public open space. The CCT will post Environmental Control Officers (ECOs) on the ground during maintenance operations to advise and caution beach users. The ECOs will also ensure that operations for undertaking dune and beach rehabilitation will be undertaken in strict accordance with this MMP.

10.5 Pollution and foreign substances

Operations conducted towards dune and beach management will require the use of machinery and equipment. Thus there is the potential risk of pollution in the form of leakages. The following sections determine measures that will be put in place to mitigate against spills:

10.5.1 Fuel and fuel spills

No re-fuelling of machinery will take place on the beach. All re-fuelling will take place at the designated equipment storage site. A drip tray for each item of equipment will be provided and used during operation and re-fuelling. If leakage of oil or fuel does take place on site and any area is contaminated, the effected sub-straight will be removed from site immediately and disposed of waste at a registered landfill.

All non-road going vehicles (i.e. heavy tracked machinery) will be re-fuelled at the designated site by means of mobile re-fuelling equipment. The surface under the refuelling area shall be protected against spills prior to any re-fuelling activities. Appropriate absorbent material (SpillSorb or similar product) shall be readily available on site to absorb, break down or encapsulate a minor fuel or oil spillage. The CCT will make provision for a minimum of 200l of fuel or oil spillage.

10.5.2 Generators

In the event that generators are required, the following conditions will apply:

- Generators will have catch receptacles (drip trays) for leaks and for when re-fueling takes place;
- Generators are to be placed so as not to disturb or cause a nuisance to people or fauna. This is not only applicable to noise, but also exhaust fumes.

10.5.3 Foreign substances

No foreign substances (i.e. landfill) will be taken onto the beach and used in the process of re-profiling. In the event that additional sand is required either for raising the beach profile or for dune maintenance and rehabilitation processes, such sand will be sourced according to the specifications detailed in section 6.1.1. and 6.1.5.

10.5.4 Oil spills

SpillSorb will be on site at all times to mop up and remove spills from vehicle machinery.

Stakeholder Notification and Reporting Process

11.1 Stakeholder notification

A week prior to commencement of activities in respect of this management plan, the CCT will erect signage indicating the City's intent to commence with activities as it relates to dune rehabilitation. Information to be displayed on the sign will include the following:

- Nature of the work to be undertaken;
- Expected commencement and completion date, and
- Contact numbers for further information.

11.2 Post-reporting and compliance monitoring

Following from the completion of work undertaken, a compliance monitoring report will be completed by the Coastal Management branch. All compliance reports will be archived and will be made available to DEA&DP should they be required for audit purposes. The compliance monitoring report as per Annexure E will detail the following:

- Date of commencement and completion of work;
- Materials used, estimated quantities of sand removed and replaced;
- Whether there was any non-compliance with the MMP, and

- Any additional information.

The following table provides a list of CCT officials, their departments and contact numbers, as relevant to dune and beach management as provided for in this MMP:

Table 1: City of Cape Town Contacts

NAME	DEPARTMENT	DESIGNATION	E-MAIL	TEL
Gregg Oelofse	Coastal Management	Manager: Coastal Management	Gregg.Oelofse@capetown.gov.za	0214872239
Darryl Colenbrander	Coastal Management	Head: Coastal Policy Development and Management Programmes	Darryl.Colenbrander@capetown.gov.za	0214872355
Howard Gold	Coastal Management	Head: Coastal Management	Howard.Gold@capetown.gov.za	021 710 80476
Edward Knott	Coastal Management	Coastal Coordinator	Edward.Knott@capetown.gov.za	0214001165
Natalie Newman:	Coastal Management	Senior Environmental Professional	Natalie.Newman@capetown.gov.za	021 4442613
Helen Jordaan	Coastal Management	Professional Officer: Beach Amenities Coordinator	Helen.Jordaan@capetown.gov.za	0214004638
Yolokazi Galada	Coastal Management	Professional Officer: Beach Amenities Coordinator	Yolokazi.Galada@capetown.gov.za	0214004638
Tamara Josephs	Coastal Management	Professional Officer: Beach Amenities Coordinator	Tamara.Josephs@capetown.gov.za	0214004638
Yaqeen Botes	Coastal Management	Clerk	Yaqeen.Botes@capetown.gov.za	0214004638

Conclusion

Littoral active zones are constantly being reshaped by the sea and the wind. Within the context of urban environments this requires ongoing maintenance of dune and beach systems. Regular inspections of dune and beach conditions and management interventions must be carried to ensure that coastal systems remain functional and intact, and in a manner which improves the socio-economic values of Cape Town's coastline.

References

A Barrie Low & J Deon van Eerden, Vula Environmental Services, 2013. Management and Rehabilitation for the Hout Bay Dunes.

A Barrie Low & J Deon van Eerden, Vula Environmental Services, 2016. Management and Rehabilitation Plans for the Tableview Beachfront Dunes.

Coastal, Storm water and Catchment Management, 2011. Environmental Management Plan for Dune Rehabilitation in Durban (Draft).

Department of Environmental Affairs, SRP Report, (2013). Dune Rehabilitation - Western Cape and KZN.

Department of Environmental Affairs (2012) *Revised and updated policy on the use of herbicides and mycoherbicides for the control of alien vegetation*, Cape Town.

EThekwini Municipality, Environmental Management Branch, 2002. Revegetation Specification for Civil Engineering Construction Projects.

Integrated Coastal Management (ICM) Act No. 24 of 2008, National Environmental Management Act (NEMA) No. 107 of 1998.

Annexure A: Priority locations for dune and beach maintenance and rehabilitation

Area	GPS[1]	Issue	Intervention[2]	Status
Van Riebeeckstrand	18° 26' 28.792" E 33° 42' 20.525" S	Encroachment by pvt sector into vegetated dune systems.	Rehabilitation through removal of garden species, structures and planting of indigenous dune vegetation.	As and when required
Melkbosstrand	18° 26' 39.609" E 33° 43' 3.939" S	Encroachment by pvt sector into vegetated dune systems.	Rehabilitation through removal of garden species, structures and planting of indigenous dune vegetation.	As and when required
Big Bay	18° 27' 24.961" E 33° 47' 35.757" S	Artificial dune cordon receding due to erosion.	Requires managed realignment of vegetated dune and beach re-profiling.	To be undertaken
Table View and Dolphin Beach	18° 28' 27.717" E 33° 49' 7.749" S	Deteriorating dune systems compounding wind-blown sand problems and failing infrastructure abutting these systems.	Requires re-profiling, re-planting and ongoing maintenance.	To be undertaken.
Table Bay Nature Reserve	18° 29' 5.384" E 33° 50' 20.693" S	Alien invasive infestation.	Removal of alien vegetation.	Ongoing
Sunset Beach	18° 29' 21.849" E 33° 51' 19.464" S	Encroachment by pvt sector into vegetated dune systems.	Rehabilitation through removal of garden species and structures and planting of indigenous dune vegetation.	As and when required
Milnerton area	18° 28' 53.205" E 33° 53' 36.833" S	Artificial dune system being exposed to coastal erosion.	Requires managed realignment of vegetated dune and beach re-profiling.	To be undertaken
Hout Bay	18° 21' 12.737" E 33° 53' 36.833" S	Deteriorating dune systems compounding wind-blown sand problems leading to smothered infrastructure. The Hout Bay dunes form what was originally a sediment by-pass system to Sandy Bay. Build-up of sand against public infrastructure as a result of raised beach profiles.	Wide-scale rehabilitation and maintenance of Hout Bay dune and beach areas. Beach re-profiling.	To be undertaken
Kommetjie	18° 20' 13.699" E 34° 7' 48.026" S	Dune encroachment into private properties and public infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	As and when required.
Glencairn	18° 25' 52.997" E 34° 9' 34.108" S	Deteriorating dune vegetation and subsequent mobilisation of sand smothering infrastructure such as road and rail network.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Fish Hoek	18° 26' 5.71" E 34° 8' 9.124" S	Deteriorating dune vegetation and subsequent mobilisation of sand smothering adjacent chalets and infrastructure. Build-up of beach area leading to 'over spilling' of sand onto adjacent public infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling of the beach area.	Ongoing
Sunrise Beach	18° 28' 52.048" E 34° 6' 14.314" S	Deteriorating dune vegetation and subsequent mobilisation of sand smothering adjacent	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing

[1] These coordinates provide an indication of the general area.
[2] This table refers only to those interventions that are the responsibility of the CCT, which includes undertaking rehabilitation on behalf of private landowners.

		infrastructure such as parking facilities.		
Strandfontein	18° 33' 28.819" E 34° 5' 11.626" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Blue Waters	18° 34' 47.921" E 34° 4' 52." S	Mobile dune systems due to strong and persistent South Easterlies – smoothing coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Mnandi/Kapteinsklip	18° 37' 20.179" E 34° 4' 28.032" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Monwabisi	18° 41' 18.007" E 34° 4' 19.842" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Macassar	18° 45' 1.002" E 34° 4' 37.096" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Strand	18° 48' 59.698" E 34° 6' 15.175" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure. Build-up of beach area leading to 'over spilling' of sand onto adjacent public infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and beach re-profiling.	Ongoing.
Fleur Park /Hendon Park	18° 51' 45.223" E 34° 9' 14.043" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing
Gordon's Bay	18° 52' 4.254" E 34° 9' 30.422" S	Elevated beach profiles and over-spilling of sand onto public infrastructure.	Beach re-profiling.	Ongoing
Kogelbaai	18° 50' 52.972" E 34° 13' 55.028" S	Mobile dune systems due to strong and persistent South Easterlies – smothering coastal infrastructure.	Dune rehabilitation and maintenance requiring stabilisation, re-vegetation and re-profiling.	Ongoing

Annexure B: City of Cape Town Coastal Cleaning Protocol

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

COASTAL CLEANING PROTOCOL
FOR THE
CITY OF CAPE TOWN

MAY 2015

Prepared by the Environmental Resource Management Department

Making progress possible. Together.

1. Introduction

Beach cleaning is an activity that plays a vital role in maintaining a high standard of coastal space that contributes to the social and economic value of the coast. However, kelp wrack and other natural marine debris play a significant role in the natural coastal processes taking place on our coast where wind driven systems and sand movement are predominant features. As such, uncontrolled, unregulated and unplanned beach cleaning has the potential to significantly negatively impact on the coast's natural dynamic systems and thereby contribute to the deterioration of the City's coastline.

Accordingly, the City of Cape Town has developed a Beach Cleaning Protocol that meets socio-economic needs while protecting natural coastal processes and dynamics. This Beach Cleaning Protocol is an internal City policy that directs all City line functions in their operations. In addition, all external organisations funded by various means to contribute to beach cleanliness in Cape Town, will be required to adhere to the City Beach Cleaning Protocol.

2. Definition and Intent

Beach Cleaning is defined as a service activity provided by the City of Cape Town that removes waste material from City beaches and rocky shores between the low water mark and the first fixed infrastructure on City owned boundaries.

The intention of the protocol is to provide the City of Cape Town and its communities with a clean beach and coastal environment to the highest standards free of waste material while protecting the natural coastal processes and dynamics.

3. General Principles

The City's Beach Cleaning Protocol is informed by the following guiding principles:

- All beaches and rocky shores will be primarily managed as ecological systems vulnerable to human induced changes and activities.
- The City's coastline is one of our greatest economic, environmental and social assets and as such should, to the best of our abilities, be kept free of waste material.
- Our coastline is utilised in many different ways with distinct high intensity recreational nodal points across the City, as well as extensive natural coastal areas utilised on a far lower intensity. This use pattern of the coastline must inform the Beach Cleaning Protocol and direct City efforts.
- Maintaining a waste free coastal environment is a shared responsibility between the City, its citizens, user groups as well as external organisations. This principle of shared responsibility must at all times be communicated and re-enforced to all coastal users.

4. Waste Categories

The following definitions of waste will apply to the Beach Cleaning Protocol:

- Human induced/resultant waste: This includes all litter and domestic waste (plastics, paper, cigarette butts, cans, cardboards, bottles, organic waste etc) and commercial waste products
- Domestic animal waste: dog and other domestic animal excrement

The following is NOT defined or considered as waste, but is central to the Beach Cleaning Protocol:

- Kelp Wrack
- Red Bait
- Shells and shell fragments

The following coastal waste is excluded from this protocol as it is specifically addressed in separate Council Policies and protocols

- Marine Animal Carcasses (will be dealt with as per the City's Large Marine Animal Stranding Policy)
- Oil, toxic and hazardous waste (Will be dealt with as per the Disaster Management Policy)

5. Roles and Responsibilities

This Coastal Cleaning Protocol applies to all City line functions undertaking cleaning and waste removal actions on the City's beaches or rocky shore lines. Specific reference is made to the lead service delivery department, Solid Waste Management, although the protocol remains applicable to Sport, Recreation and Amenities, Environmental Resource Management, City Parks, Disaster Risk Management and Transport, Roads and Stormwater.

All City partner organisations, independent organisations, individuals as well as externally funded organisations undertaking beach cleaning work (for example CoastCare) within the jurisdiction and boundaries of the City of Cape Town, will be required to adhere in full to this Beach Cleaning Protocol or permission for their work will be removed.

6. Governance

The City of Cape Town will apply the following governance principles in relation to the Beach Cleaning Protocol to ensure optimum opportunity for beach cleaning operations while minimising risk of injury to person or persons:

- The City retains the rights to close affected beaches to public access in the event of significant waste removal operations
- City law enforcement agencies will have the authority to prevent public access to the affected area where needed and may remove general public and unauthorised individuals from the area
- The City will ensure ongoing communication through the media in this regard

7. Beach Cleaning Protocols

7.1. General Protocols

- All beaches will be managed as ecological systems;

- Under no circumstances will human waste be buried on the coast/beach. Natural waste may under exceptional circumstances be buried on the coast/beach with permission from the Manager: Area Cleaning and the City of Cape Town's Coastal Coordinators.
- All marine mammal carcasses must be managed in accordance with the Large Marine Animal Strandings Policy for the City of Cape Town;
    - In the event of a whale or dolphin carcass Disaster Management Call Centre must be contacted to initiate the Large Marine Animal Strandings Policy
    - All animal carcasses will be removed to the appropriate landfill site unless requested for dissection by National Government's Oceans and Coasts Department.
- No litter bins, dustbins and cleansing containers will be located on beaches or rocky shores but at the back of beaches and rocky shores

7.2. **Kelp Wrack and Red Bait**

- For all areas demarcated as Kelp Cleaning Areas (Annexure A) all kelp wrack and Redbait shall be removed from the coast and taken to the appropriate landfill site;
- No kelp may be removed from the coast at any time by private individuals or organisations unless in possession of a permit issued by National Government
- All tidal pools to be kept free of kelp
- No kelp or redbait is to be removed from any other area on the coast. Where extreme storm events result in abnormal amounts of kelp wrack being deposited, removal of kelp wrack to a landfill site from "Natural Coastal Areas" may be requested by the relevant Beach Manager (in consultation with the Coastal Coordinators. Completion of these ad hoc requests will be at the discretion of the Area Cleaning Manager.
- Frequency of kelp and redbait removal from the demarcated areas will be done according to the Cleaning Schedule. This Cleaning Schedule will be determined by the Area Cleaning Manager and communicated in writing to the relevant Sport, Recreation and Amenities as well as the Environmental Area Managers for their records.
- The Kelp Cleaning Schedule will be frequent during summer months (1st October to 30th April) and reduced to as needed during winter (May to September).
- Kelp and redbait may be stockpiled prior to removal to the landfill site. All stockpiling will be done at the locations indicated on the maps. No kelp or redbait may be stockpiled for longer than three days;
- On the request of the relevant Beach Manager, collected kelp will be distributed to reasonable locations and central points for the use in dune rehabilitation. This kelp will NOT be litter picked by Area Cleaning prior to distribution for dune rehabilitation,
- Once distributed for dune rehabilitation, the Beach Manager will be responsible for removing the kelp to the landfill site if NOT used for dune rehabilitation as intended.

7.3. **Deep Sand Cleaning**

- For all areas demarcated as Deep Cleaning Areas (in the attached aerial photographs), deep sand cleaning may occur in the defined nodal area (as mapped);
- The frequency of deep sand cleaning will be restricted to the following:
    - Deep sand cleaning may only take place between the 1st October and 30th April
    - Each deep sand cleaning beach will be deep cleaned at least twice during this period and a maximum of three times at the discretion of the Solid Waste Department
    - No Deep Sand Cleansing will take place during windy conditions,
- The Deep Sand Cleaning machine may only enter and exit the beach at the formalised access point.

7.4 **Litter picking and waste removal**

- All coastal areas will be litter picked according to the annual cleansing schedule which, where appropriate, will be determined by the Manager: Area Cleaning. A copy of the schedule, or ad hoc or seasonal work, will be supplied to Sports, Recreation and Amenities as well as the Environmental Area Managers for their records.
- On request by the relevant Sport, Recreation and Amenities or Environmental Manager, major waste material in the form of large drift wood, concrete blocks, metal poles etc that may emerge on the beaches or be washed ashore, shall be removed by Area Cleaning at their discretion.
- No private organisations may conduct beach cleaning activities without approval by the Council's Solid Waste Management Department.

7.4. **Shells and Shell Fragments**

In compliance with national legislation, the City and its partners will not remove any shells or shell fragments from the beach as part of its cleaning activities.

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

KELP REMOVAL ZONES
FOR THE
CITY OF CAPE TOWN

MAY 2015

Prepared by the Environmental Resource Management Department

Making progress possible. Together.

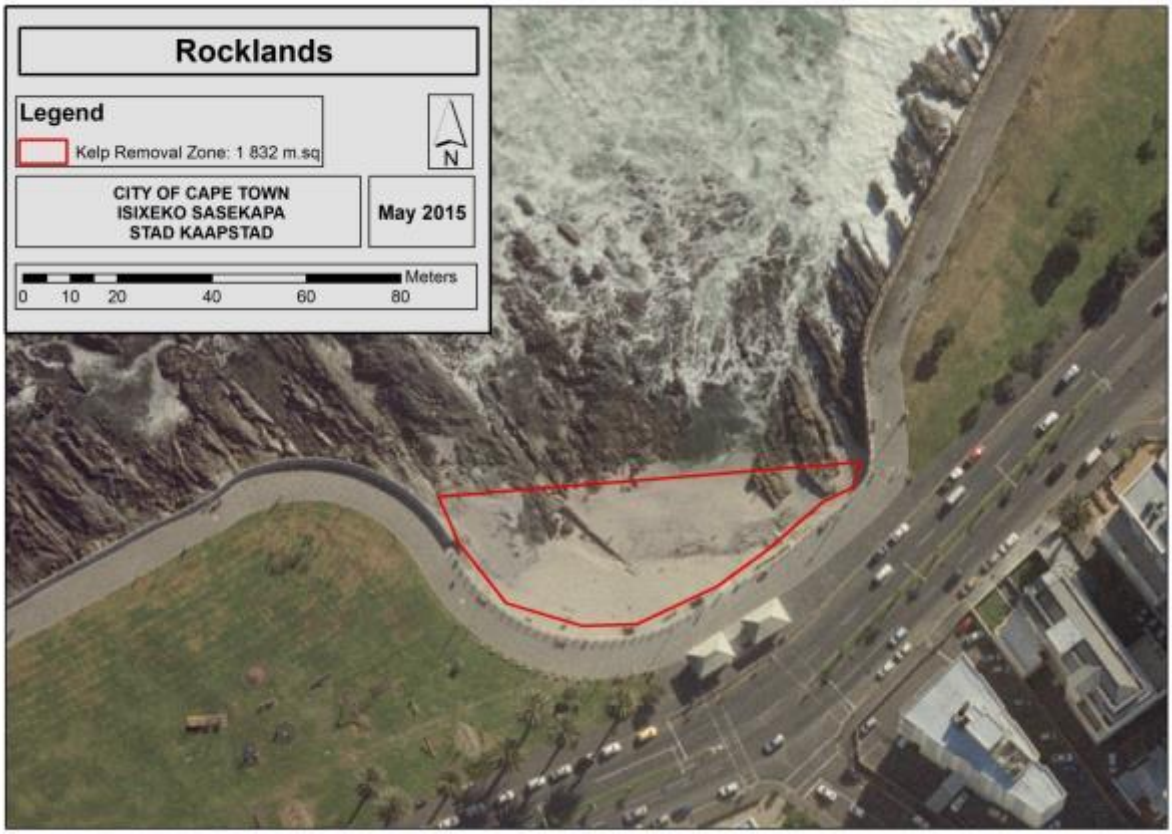
Beach	Extent of Kelp Removal Zone	Frequency of Kelp Removal	Solid Waste: Area Manager	Contact Details
Melkbosstrand	Between the parking lot on 7th Avenue, and the ablution facilities on the corner of 11th Avenue and Beach Road.	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Big Bay-Small Bay	Entire beach area between the northern-most 'Eden on the Bay' access point in Big Bay, and the beach area opposite the parking area on Stadler Road, Bloubergstrand.	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Milnerton	Area directly opposite the Milnerton Beach car park, between the golf course and Woodbridge Island.	Seasonal	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Three Anchor Bay	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Rocklands	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Queen's Beach	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Saunders	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Clifton	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Camps Bay	Entire beach	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Llundudno	NO REMOVAL		Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Hout Bay West	Opposite the gravel parking area, extending from the concrete pier for approximately ¾ of the length of the parking area (± 50m from the river).	Throughout the year	Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Hout Bay East	NO REMOVAL		Xolisile Mama	Xolisile.Mama@capetown.gov.za 021 392 5114 0846006131
Fish Hoek	Beach area adjacent to Jager Walk until (but not including)	Throughout the year	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057

	the area opposite the gravel parking area.			
Danger Beach	Entire beach	Seasonal	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
St James	Entire beach and tidal pool	Throughout the year	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Muizenberg	Area between Surfer's Corner and the Muizenberg Pavilion.	Throughout the year	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Sunrise Beach	NO REMOVAL		Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Strandfontein	Beach area between the tidal pool and the tarred access road.	Seasonal	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Strandfontein Coastal Resort	Beach area directly opposite the paved pavilion at Blue Waters beach.	Seasonal	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Mnandi West	NO REMOVAL		Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Mnandi East	Beach area between the car park and the enclosed recreational area.	Throughout the year	Peter Jaggers	Peter.Jaggers@capetown.gov.za 021 842 3222 0842200057
Monwabisi	Entire enclosed beach area to the east of the tidal pool.	Throughout the year	Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031
Macassar	NO REMOVAL		Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031
Strand North	NO REMOVAL		Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031
Strand South	NO REMOVAL		Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031
Gordon's Bay	Area opposite the parking lot on Beach Road, Gordon's Bay.	Throughout the year	Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031
Bikini Beach	NO REMOVAL		Sidima Godlo	SidimaCowell.Godlo@capetown.gov.za 021 842 0979 0799195031

Area of kelp removal:	Between the parking lot on 7th Avenue, and the ablution facilities on the corner of 11th Avenue and Beach Road.
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	**Entire beach area between the northern-most 'Eden on the Bay' access point in Big Bay, and the beach area opposite the parking area on Stadler Road, Bloubergstrand.**
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year

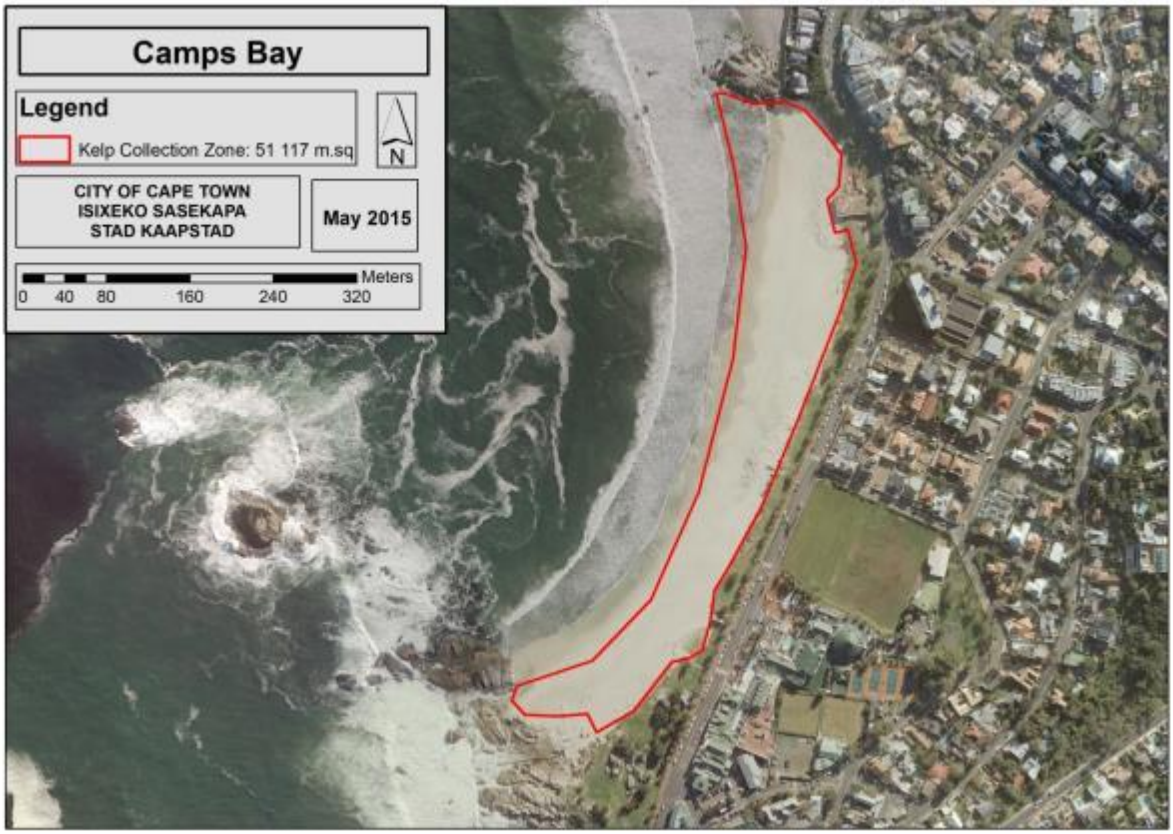


Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year



Area of kelp removal:	Entire beach
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Opposite the gravel parking area, extending from the concrete pier for approximately ¾ of the length of the parking area (± 50m from the river).
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Beach area adjacent to Jager Walk until (but not including) the area opposite the gravel parking area.
Frequency of kelp removal:	Throughout the year

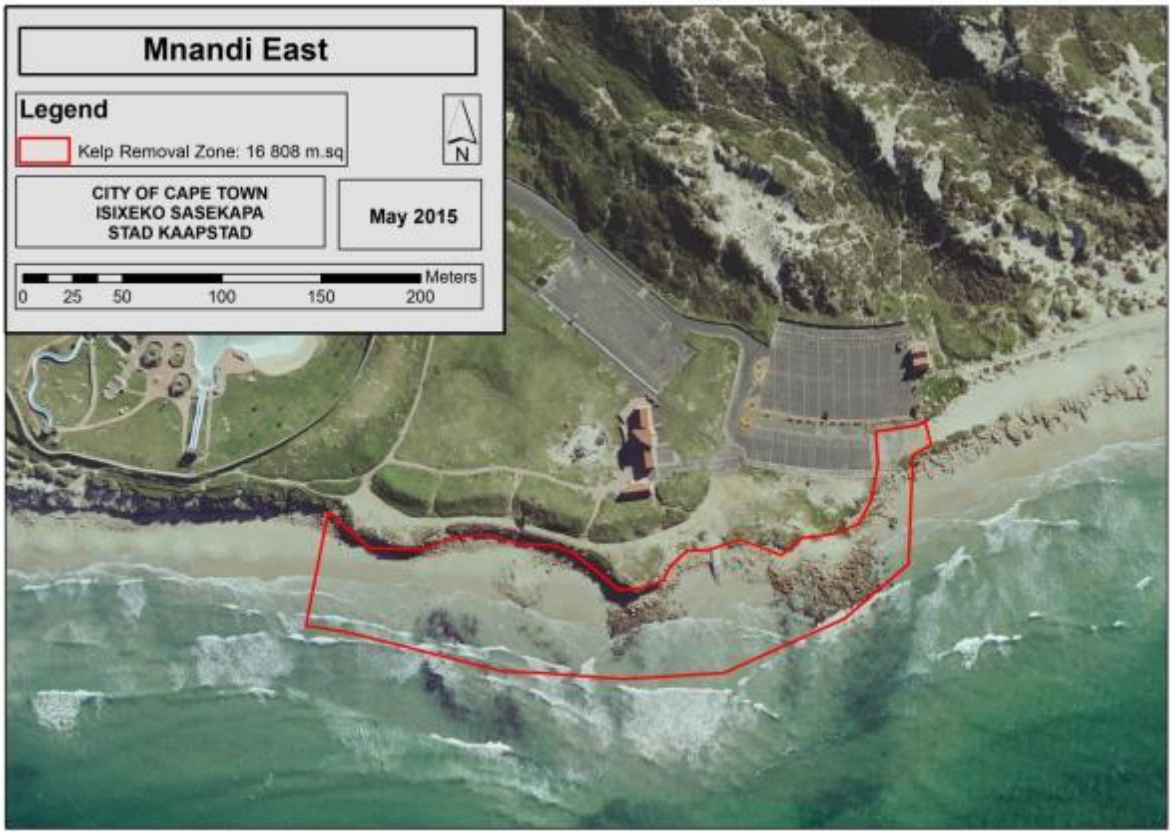
Area of kelp removal:	Entire beach
Frequency of kelp removal:	Seasonal

Area of kelp removal:	Entire beach and tidal pool
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Area between Surfer's Corner and the Muizenberg Pavilion.
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Beach area between the tidal pool and the tarred access road.
Frequency of kelp removal:	Seasonal

Area of kelp removal:	Beach area directly opposite the paved pavilion at Blue Waters beach.
Frequency of kelp removal:	Seasonal



Area of kelp removal:	Beach area between the car park and the enclosed recreational area.
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Entire enclosed beach area to the east of the tidal pool
Frequency of kelp removal:	Throughout the year

Area of kelp removal:	Area opposite the parking lot on Beach Road, Gordon's Bay.
Frequency of kelp removal:	Throughout the year

Annexure D: Indigenous dune plant species to the Cape Town area

Species	Common name
Afrolimon perigrinum	Strandroos
Albuca maxima	Soldier-in-the-box
Amellus asteroides	
Annesorhiza macrocarpa	Wilde-anyswortel
Anthospermum aethiopicum	Jakkalstert
Arctotheca calendula	Cape weed
Arctotheca populifolia	Sea pumpkin
Aspalathus hispida	Witertjiebos
Asparagus asparagoides	Breëblaarklimop
Asparagus capensis	Katdoring
Asparagus fasciculatus	Asparagus Fern
Asparagus rubicundus	Swarthaakdoring
Babiana tubulosa	Witbobbejaantjie
Capnophyllum africanum	
Carpobrotus edulis	Hottentot fig
Cassine peragua	Bastersaffraan
Chrysanthemoides incana	Grysbietou
Chrysanthemoides monilifera	Brother berry
Chrysanthemoides monilifera	Brother berry
Chrysocoma cf. coma-aurea	Golden heads
Chionanthus foveolatus	Fine-leaved ironwood
Cineraria geifolia	Cineraria
Cissampelos capensis	Davidjies
Cladoraphis cyperoides	Steekriet
Cliffortia obcordata	
Clutia daphnoides	Vaalbossie
Cotula turbinata	Batchelor buttons
Cotyledon orbiculata	Pig's ear
Crassula cf. glomerata	Brakvygie
Crassula dichotoma	Geelcrassula

Crassula subulata	
Crassula tomentosa	
Cynanchum africanum	Monkey rope
Cyphia cf. crenata	Kleinbokkies
Cysticapnos vesicaria	Klappertjie
Dasispermum suffruticosum	Duineseldery
Didelta carnosa	Kusslaaibos
Didymodoxa capensis	
Dimorphotheca pluvialis	Ox-eye daisy
Drosanthemum marinum	Krakervy
Ehrharta cf. calycina	Common ehrharta
Ehrharta villosa	Pypgras
Eriocephalus racemosus	Kapkoppie
Euclea racemosa	Bush guarri
Euphorbia burmannii	Steenbokmelkbos
Euphorbia caput-medusae	Medusa's head
Euphorbia caput-medusae	Medusa's head
Euphorbia mauritanica	Beesmelkbos
Exomis microphylla	Brakbossie
Felicia tenella	Astertjie
Ferraria crispa	Spinnekopblom
Ficinia ramosissima	
Galium tomentosum	Kleefgras
Gazania pectinata	Kaapserooigousblom
Gladiolus cunonius	Suikerkannetjie
Grielum grandiflorum	Platdoring
Haemanthus cf. coccineus	April fool
Hebenstretia cordata	Kusslakblom
Hebenstretia repens	Witslakblom
Helichrysum cf. revolutum	Kooigoed
Helichrysum cochleariforme	Gold-and-silver
Helichrysum crispum	Hottentotskooigoed
Helichrysum niveum	Sewejaartjie
Helichrysum patulum	Hottentot's bedding
Helichrysum retortum	Kuskooigoed

Helichrysum revolutum	Kooigoed
Heliophila africana	Bloubekkie
Hemimeris sabulosa	Sandgeelgesiggie
Hermannia pinnata	Kwasblaarkruippoproos
Indigofera heterophylla	Coral flower
Ischyrolepis eleocharis	Katstert
Isolepis antarctica	Sedges
Jordaaniella dubia	Helderkruipvygie
Kedrostis nana	Bryony
Lessertia tomentosa	Sutherlandia
Lycium cf. ferocissimum	Slangbessie
Lyperia lychnidea	Soettraanblommetjie
Lyperia tristis	Traanblommetjie
Manulea thyrsiflora	Woolly manulea
Manulea tomentosa	Duinevingertjies
Mesembryanthemum crystallinum	Ice plant
Metalasia muricata	Blombos
Microloma sagittatum	Bokhoring
Moraea fugax	Hottentotsbrood
Morella cordifolia	Candle berry
Muraltia (Nylandtia) spinosa	Skilpadbessie
Nemesia affinis	Weeskindertjie(s)
Nylandtia spinosa	Skilpadbessie
Olea exasperata	Slanghout
Oncosiphon suffruticosum	Stinkkruidbossie
Ornithoglossum viride	Eendjies
Osyris compressa	Pruimbas
Otholobium bracteolatum	Skaapbostee
Othonna coronopifolia	Sandbobbejaankool
Othonna filicaulis	Bobbejaankoolklimop
Oxalis pes-caprae	Sorrel
Passerina cf. paleacea	Gonnabos
Passerina ericoides	Kusgonnabas
Passerina corymbosa	Gonnabas

Pelargonium capitatum	Rose-scented pelargonium
Pelargonium gibbosum	Dikbeenmalva
Pelargonium gibbosum	Dikbeenmalva
Pentaschistis pallida	Haasgras
Pharnaceum lanatum	Wolhaarsneeuwvygie
Phylica ericoides	hardebos
Phragmites australis	Fluitjiesriet
Psoralea repens	Duine-ertjie
Pterocelastrus tricuspidatus	Cherrywood
Putterlickia pyracantha	Basterpendoring
Restio (Ischyrolepis) eleocharis	Duinekatstert
Rhus crenata	(dune) Crow-berry
Rhus glauca	Blue kuni-bush
Rhus laevigata	Dune taaibos
Rhus lucida	Wild currant
Robsonodendron maritimum	Duinesybas
Roepera flexuosum	Spekbossie
Roepera morgsana	Slaaibos
Ruschia indecora	
Ruschia macowanii	Bosvygie
Salvia africana-lutea	Wild sage
Senecio cf. arenarius	Hongerblom
Senecio elegans	Wild cineraria
Senecio littoreus	Hongerblom
Senecio maritimus	Strandhongerblom
Seriphium (Stoebe) plumosum	Slangbos
Sideroxylon inerme	White milkwood
Silene crassifolia	Crassifolia flower
Silene undulata	Wild tobacco
Solanum africanum	Melkellie
Tetragonia decumbens	Kinkelbossie
Tetragonia fruticosa	Kinkelbos(sie)
Thamnochortus spicigerus	Duineriet
Thesium aggregatum	Roothugs

Thinopyrum distichum	Coastal wheat grass
Trachyandra cf. divaricata	Duinekool
Trachyandra cf. revoluta	Cape Spinach
Trachyandra ciliata	Wildeblomkool
Trachyandra divaricata	Duinekool
Trichogyne repens	Witnaaldebossie
Viscum capense	Mistletoe
Wahlenbergia androsacea	Hare-bell
Zaluzianskya villosa	Drumsticks
Zantedeschia aethiopica	Arum lily

Annexure E: Compliance Monitoring Report

1.	Date of commencement and completion of work?
2.	Materials used, quantities of sand removed, replaced, etc.?
3.	Any issues experienced?
4.	Was there any non-compliance with the MMP?
5.	Any additional information?