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ABBREVIATIONS

amsl	Above mean sea level
CBA	Critical Biodiversity Area
CML	Coastal Management/Set-back Line
CMP	Coastal Management Programme
CPZ	Coastal Protection Zone
EIA	Environmental Impact Assessment
HWM	High-water mark
ICM Act	National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)
IDPs	Integrated Development Plans
LUMS	Land Use Management Schemes
MEC	Member of the Executive Council
NEMA	National Environmental Management Act (Act No. 107 of 1998)
PSDF	Western Cape Provincial Spatial Development Framework
SEMA	Specific Environmental Management Act
WCD	West Coast District
WCG	Western Cape Government's Department of Environmental Affairs & Development Planning

GLOSSARY

(dynamic) coastal processes	as defined by the ICM Act means all natural processes continually reshaping the shoreline and near shore seabed and includes — (a) wind action; (b) wave action; (c) currents; (d) tidal action; and (e) river flows.
coastal management	as defined by the ICM Act: (a) the regulation, management, protection, conservation and rehabilitation of the coastal environment; (b) the regulation and management of the use and development of the coastal zone and coastal resources; (c) monitoring and enforcing compliance with laws and policies that regulate human activities within the coastal zone; and (d) planning in connection with the activities referred to in paragraphs (a), (b) and (c).
coastal management / set-back line	means a line determined in accordance with section 25 of the ICM Act in order to demarcate an area within which development will be prohibited or controlled in order to achieve the objects of the Act or coastal management objectives.

coastal overlay zone	a zoning area which is applied over one or more previously established zoning areas within the applicable Town Planning Scheme, establishing additional or stricter standards and criteria for covered properties in addition to those of the underlying zoning area.
coastal planning scheme	as defined by the ICM Act a scheme that — (a) reserves defined areas within the coastal zone to be used exclusively or mainly for specified purposes; and (b) prohibits or restricts any use of these areas in conflict with the terms of the scheme.
coastal protection zone	as contemplated in sections 16 and 17 of the ICM Act, a zone established for enabling the use of land that is adjacent to coastal public property or that plays a significant role in a coastal ecosystem to be managed, regulated and/or restricted.
coastal public property	means coastal public property referred to in section 7 of the ICM Act.
coastal risk	risks specifically related to the coastline as informed by events such as coastal erosion, storm surges, sea level rise and storm wave run-up, as well as certain dynamic ecological processes such as active littoral zones (e.g. mobile dune systems).
coastal set-back line	see 'coastal management line' – ICM Act terminology likely to be changed to 'coastal management line'
development	as defined by the ICM Act in relation to a place, means any process initiated by a person to change the use, physical nature or appearance of that place, and includes— (a) the construction, erection, alteration, demolition or removal of a structure or building: (b) a process to rezone, subdivide or consolidate land; (c) changes to the existing or natural topography of the coastal zone; and (d) the destruction or removal of indigenous or protected vegetation.
estuary	as defined by the ICM Act means a body of surface water — (a) that is part of a water course that is permanently or periodically open to the sea; (b) in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the water course is open to the sea; or (c) in respect of which the salinity is measurably higher as a result of the influence of the sea.
existing development rights	executable rights for activities or development on properties, as allocated through zoning schemes and approvals in terms of applicable regulatory schemes.
high risk	risk with a 20 year return period – i.e. therefore with a 5 % chance of taking place in any given year during the ensuing 100 years.
LIDAR	a remote sensing technology that measures distance by illuminating a target with a laser and analysing the reflected light in order to produce high resolution topographical maps.

littoral active zone	as defined by the ICM Act means any land forming part of, or adjacent to, the seashore that is — (a) unstable and dynamic as a result of natural processes; and (b) characterised by dunes, beaches, sand bars and other landforms composed of unconsolidated sand, pebbles or other such material which is either un-vegetated or only partially vegetated.
low risk	risk with a 100 year return period – i.e. therefore with a 1% chance of taking place in any given year during the ensuing 100 years.
medium risk	risk with a 50 year return period – i.e. therefore with a 2% chance of taking place in any given year during the ensuing 100 years.
overlay zone	planning zones superimposed on a base property zoning to increase or decrease the level of regulation over development on the site.
public facilities	facilities developed and owned by government in the public interest, such as: - Buildings or structures or systems related to ablutions or public resorts - Buildings or structures or systems related to educational or cultural purposes - Buildings or structures or systems related to roads and utility services, including water, sewerage and electricity reticulation - Coastal defence structures and flood control structures - Public open space
public open space	a piece of land formally zoned as such in the applicable town planning scheme
sea level rise	a rise in mean sea level as a consequence of global climate change, and driven by the melting of glaciers, the expansion of ocean volume through temperature rise and changes to the amount of water stored on land.

1 INTRODUCTION

Nowhere will the impacts of continued economic development, population growth and changes to the climatic regime come more into focus than on the coastline. Despite climate change increasing the abrasive nature of wave action and storm events, the adjacent onshore areas will remain host to the majority of the Western Cape's population. The coastal zone also represents a particularly desirable location for settlement, industry, harvesting of natural resources as well as recreational activities. It places the sensitive, vulnerable, often highly dynamic and stressed ecosystems found along the coast right in the middle of a growing conflict between the need for human habitation and natural resource protection. As a consequence, coastal areas require specific attention in management and planning, in order to preserve coastal resources, protect coastal quality, and reduce coastal-related risks.

The Western Cape Government's Department of Environmental Affairs & Development Planning (WCG) proposes to delineate coastal set-back or 'management' lines[1] (CML) for the West Coast District (WCD) as one strategy through which responsible coastal management can be promoted. This project forms part of a larger initiative to determine such development controls for the entire Western Cape coastline, and mirrors similar efforts underway in the other coastal provinces of South Africa.

1.1 The West Coast

The WCD stretches between Grotto Bay in the south and Brand-se-Baai in the north. It consists of five local municipalities / authorities, namely the Saldanha Bay, Berg River, Swartland, Cederberg and Matzikama Municipalities. The WCD is the second municipal area where set-back lines are proposed to be designated by the Western Cape Provincial

[1] Proposed amendments to the ICM Act are likely to see 'coastal set-back lines' renamed to 'coastal management lines' in future. Refer to Section 1.3 for more detail.

Department of Environmental Affairs and Development Planning (DEA&DP), the first having been for the Overberg District.

The coastline of the WCD is approximately 366 km long, the longest coastline of all 13 district authorities in South Africa and thus also constitutes the largest part of the Western Cape provincial coastline at approximately 30.68%. Large tracts of the coast are owned by mining corporations and thus access to coastal resources is somewhat limited. The shoreline of the study area is diverse by virtue of its sheer size, with a number of different coastal habitats and ecosystems making up its length, subsequently, a number of different human activities and uses characterise this coastal area, with the nutrient-rich waters of the Atlantic Ocean sustaining a productive coastal ecosystem.

Whilst the region has only four major estuaries in the form of the Olifants, Bergrivier and Verlorenvlei Estuaries and the Langebaan Lagoon, the size and importance of these habitats renders their continued protection of critical importance. The existence of Estuary Management Plans for these systems is acknowledged and need to be taken into account. A number of coastal wetlands add further biodiversity value to the region, particularly in terms of breeding sites for fish and birds, as well as the provision of ecosystem goods and services.

In terms of coastal management initiatives prior to the commencement of the National Environmental Management: Integrated Coastal Management Act, 2008, the West Coast District Draft IDP of 2007/08 linked its municipal planning initiatives to the Coastcare and Sustainable Coastal Livelihoods initiatives as well as the C.A.P.E. estuaries programme with further strategic planning direction being derived from the Draft Coastal Zone Policy for the Western Cape (2004) and the development of Coastal Management Plans and Programmes.

With regards to coastal specific planning, the district municipality is also in possession of sub-regional plans for 'coastal areas', but these are outdated and are in process of being reviewed. Coastal development has been known to 'sprawl' within the district, suggesting that a focus on integrated and nodal coastal development needs to be implemented. The West Coast District Municipality is in the process of preparing for implementation of its municipal Coastal Management Programme.

1.2 Coastal management/set-back lines

The use of coastal management/set-back lines is particularly important in the face of the unfolding effects of climate change, as it involves both a quantification of risks and pro-active planning for future development. Although it cannot address historical decisions that have locked in development investment along potentially at-risk coastal areas, coastal management/set-back lines can influence how existing development is maintained over time and how new development will be allowed to proceed.

Delineation of coastal management/set-back lines must be undertaken in accordance, or in alignment with, a number of legislative tools. This includes the National Environmental Management: Integrated Coastal Management Act (Act No. 24 of 2008)(ICM Act), the National Environmental Management Act (Act No. 107 of 1998)(NEMA), NEMA Environmental Impact Assessment (EIA) Regulations, 2010, as well as the Western Cape Provincial Spatial Development Framework (PSDF). Furthermore, coastal management zones are proposed as a means to facilitate improved planning and management of sensitive and often vulnerable coastal areas. The process outcomes will therefore need to filter into municipal planning through Integrated Development Plans (IDPs) and Land Use Management Schemes (LUMS).

1.3 Prescriptions in the ICM Act

Coastal set-back lines, as currently detailed in the ICM Act, are prescribed boundaries that indicate the limit of development along ecologically sensitive or vulnerable areas, or an area where dynamic natural processes pose a hazard or risk to humans. According to the recent proposed amendments to the ICM Act, as detailed in the ICM Amendment Bill (Bill no 8 of 2013), the lines will be referred to as 'coastal management lines' in future to avoid confusion with EIA development set-back lines.

The ICM Act allows coastal management lines to demarcate areas where authorities can prohibit or restrict the construction, extension or repair of structures that are either wholly or partly seaward of the line. It is noted that management areas may even be situated outside the coastal zone. The ultimate intention of the coastal management line, as currently defined in the proposed amendments to the ICM Act, is to protect or preserve:

- coastal public property including coastal waters, land and natural resources
- coastal private property such as private residences and business properties
- public safety in the face of extreme climate and other natural events
- the coastal protection zone
- the aesthetics or 'sense-of-place' of the coastal zone

The establishment of coastal management lines is a provincial responsibility. The relevant Member of the Executive Council (MEC), however, may only declare such a management line(s) after consultation with Municipalities and interested and affected parties (I&APs). The MEC must communicate this by publishing regulations in the *Government Gazette*. It is noted that the proposed amendments to the ICM Act give MECs the power to establish or amend coastal management lines simply through means of a notice in the *Government Gazette*. Once determined, this line must be delineated on

the map(s) that forms part of municipal zoning schemes. This is done to ensure consistency and to properly inform the public about the position of the coastal management/set-back line in relation to existing cadastral boundaries.

The coastal management/set-back line and accompanying management zones are proposed to give specific direction in respect to both the management of property with existing land use rights, and with the planning of proposed activities and land uses. Coastal governance institutional structures should ensure that future decision making is in line with the National Coastal Management Programme (NCMP), the Provincial Coastal Management Programme (PCMP), the District/Local Coastal Management Programme(s) and relevant proposed norms and standards and management strategies. If these are to be effective, the structures must assist decision makers in respect to the application of best practice coastal management principles, integrate and align regulatory and management prescriptions in order to reduce duplication and uncertainty, and mobilise limited resources in a way that stimulates sustainable interventions.

Coastal management/set-back lines may be established for various reasons and there may be more than one management/set-back line in any given area. For example, one line may relate to anticipated erosion, while another may be aimed at issues of aesthetics to control the height of buildings in a specific scenic landscape.

1.4 Project details

This project consists of three main components, namely the modelling of dynamic coastal processes, the determination of a coastal management/set-back line and finally the determination of management guidelines. These were developed through the course of ten project phases, as indicated in Figure 1.

Figure 1: Project phases

The first component, the technical modelling (phases 1 to 3) took place between February and August 2013, and involved the determination of a refined high water mark (HWM) from which future risks are projected for short (1:20 year), medium (1:50 year) and long (1:100 year) time horizons. Future risks were considered in terms of:

- natural coastal regression or accretion
- littoral active zones (mobile sand)
- projected sea level rise (SLR)
- storm-driven coastal inundation
- projections of storm-driven coastal erosion

These designated risk areas informed the demarcation of risk zones, as a way of highlighting natural coastal processes and risks.

The coastal management/set-back line or CML, final risk zones and associated management guidelines were based on the technical risk projections, but were informed by local knowledge obtained via local authority input and a stakeholder engagement process.

Four rounds of public consultation and engagement informed the project direction and outputs. An initial round of public consultation (phase 4), during which public comment was sourced on the projected risk zones and on how the information should be used to

inform the management of development along the coast, took place in July 2013. A second round of consultation allowed the public to review the methodology used for the delineation of the CML and zones on the one hand, and engaged local authorities specifically on the other. This took place between August 2013 and February 2014, and resulted in the delineation of a draft management/set-back line and coastal management overlay zones and controls, as informed by the projections of coastal risk and local understanding of spatial planning, development zoning and other factors influencing coastal development (phases 5-7).

The involvement of relevant authorities in the study area, namely the five Local Municipalities and the District Municipality, was deemed a critical part of the stakeholder engagement process. A high level of agreement and buy-in is necessary as municipalities will ultimately be responsible for the implementation of the development controls in the management zones.

A third public engagement (phase 8) was undertaken during April 2014. This engagement allowed the public to review the proposed coastal management/set-back line and associated overlay zones/controls and verify that the proposals were fair, practical, appropriate and responsive to the public comments raised during the first round of engagement.

Following the compilation of the final project report (this report), and revision of the project outcomes based on the stakeholder engagements, the public was once again offered an opportunity to comment on the outputs (phase 9). The final comments accompany the submission of the final deliverables to the Western Cape Government for consideration in ensuing implementation phases.

It is important to recognise that the projections of risk and associated coastal management measures are based on the best available information at the time, and that this information will change and improve over time. All controls and delineations referred to in this report consequently relate specifically to the risk projections compiled for the 2013/2014 coastal set-back line project on the basis of the best information available at the time. The project and its deliverables are specifically designed to allow for updating of both the risk projections and the designation of management features, as knowledge of coastal risk and the certainty of those risks improves.

In summary, by the end of the project the following will be available:

- an accurate delineation of the high water mark as per the ICM Act definition
- risk projections demarcating physical processes or hazards for the short, medium and long term (1:20, 1:50 and 1:100)
- a coastal management/set-back line
- various coastal management overlay zones and accompanying controls that can be used to manage development along the coast
- a boundary line demarcating the Coastal Protection Zone (CPZ)

2 IDENTIFICATION OF PHYSICAL PROCESSES

The determination of specific risk zones or areas where dynamic coastal processes are active along the West Coast is based on the application of a consistent delineation methodology applied along the study area. The process, as it unfolded, is described in more detail in Appendix A: "Coastal Processes and Risk Modelling".

The outcome of the risk modelling process is a set of risk projections for the coastline as related to events such as coastal erosion, storm surges, sea level rise and storm wave run-up, as well as dynamic ecological processes such as identified active littoral zones (e.g. mobile dune systems). Littoral active zones are identified based the presence of wind blown sand furrows indicating currently active sand belts on the most recent aerial photographs (2012/2013). The combined risks are then projected for short (1:20 year, or High Risk), medium (1:50 year, or Medium Risk) and long (1:100 year, or Low Risk) term time horizons (Figure 2).

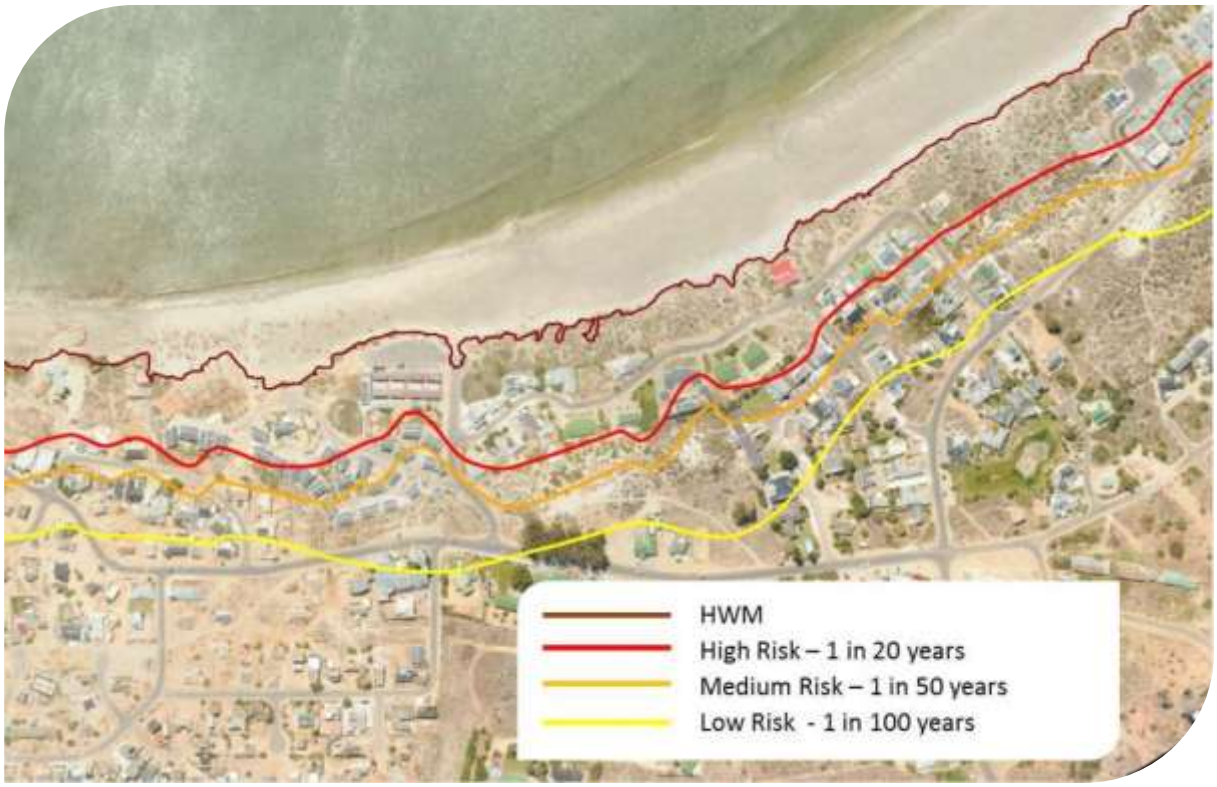

Figure 2: Example of modelled risk projections for the West Coast

The risk modelling is based on high resolution LIDAR data, aerial photography, as well as wind and wave data for the region. The modelling itself followed the method described by Mather *et al.* (2010) as refined for a similar preceding coastal management/set-back line project undertaken in the Overberg district. It does not account for extreme events such as freak ocean conditions (e.g. tsunamis) or man-made disasters (e.g. the failure of a dam wall upstream of an estuary).

Estuaries are particularly dynamic ecological systems that display characteristics of both terrestrial and marine systems. This makes estuaries extremely complex and sensitive, and consequently also challenging to manage. Nevertheless, degradation of estuaries often

results from increasing coastal development and the impact of human activities. In order to preserve the remaining ecological functioning, biodiversity, and sustainable use of these sensitive coastal resources, effective co-operative and integrated management is essential.

Since inundation in estuaries represents the primary risk, floodline determination that can anticipate flood events with different return periods will be valuable in understanding how flood dynamics will impact on existing and future development. Unfortunately, to generate the necessary information within the scope of a regional coastal set-backs demarcation project will be prohibitively expensive. Consequently an approach is adopted that will use a simple contour height line to inform set-back or management lines for estuaries, but with the option to defer to existing fine-scale management plans where such have been prepared. Additionally, some indication of recurring inundation can be gleaned from an assessment of the vegetation surrounding estuaries.

Estuary Management Plans have been prepared for the Olifants, Berg and Verlorenvlei estuaries, and the Langebaan Lagoon is partly covered by the West Coast National Park's Management Plan. Within these estuaries, the local fine-scale planning being undertaken by Municipalities, through the guidance and assistance of bodies such as estuary management forums or CapeNature, should dictate the set-back or management lines. In other estuaries, it is recommended that the 5m or 10m amsl contour be used as a reference line to determine or inform development set-back or management lines, until such time as an adopted Estuary Management Plan and zonation plan or detailed floodline determinations can indicate an appropriate coastal development set-back for individual estuaries.

3 DETERMINING COASTAL MANAGEMENT LINES AND COASTAL MANAGEMENT ZONES

During the course of this project, a proposed coastal management scheme was developed for the West Coast District that identifies a coastal management overlay zone consisting of three sub-zones related to the projected coastal risk horizons, as well as a coastal management line designating an area where no development, or no further development should take place.

This is a further refinement of the coastal management lines methodology applied in the 2012 Overberg District pilot project, and takes into consideration the need for national (National Coastal Committee discussions, i.e. Working Group 8 forum) and local alignment (similar work by the City of Cape Town). The lessons learnt from the application of the coastal setback line methodology in the Overberg District and the City of Cape Town setback line process have informed the refined methodology.

3.1 Different approaches for determining coastal management lines

The approach taken in determining the coastal management/set-back line(s) and coastal management zones for the West Coast District is necessarily informed by a coastal set-back lines methodology previously developed for the Western Cape Province, implementation thereof in the Overberg District, and current work being undertaken by the City of Cape Town.

3.1.1 Provincial methodology for the delineation of coastal set-back lines

As indicated above, this study represents the second full-scale set of coastal management/set-back lines determined by the WCG. It is preceded by a study conducted during 2010 at Milnerton and Langebaan to devise a standard methodology for the delineation of coastal set-backs in the province (DEADP, 2010), as well as the determination of coastal set-backs along the coastline of the Overberg District (WCG, 2012).

The 2010 Western Cape Coastal Development Set-back Lines Methodology project differentiated between a coastal 'erosion' set-back and a development set-back, yet described a methodology for the determination of a coastal processes/hazard line and a management line that conflates the erosion and development set-backs. In terms of the WCG's initial Coastal Development Set-back Lines Methodology two coastal set-back lines were therefore envisaged:

- A **physical process / hazard line**. This line proposed to define the limit of the coastal area seaward of which any development is likely to experience unacceptable risk of erosion, flooding by wave action and/or unacceptable maintenance of wind-blown sand accumulations.
- A management **(limited/controlled development) 'set-back' line**. This line proposed to define areas where some limited and/or controlled development could occur

that accommodates requirements of biodiversity, heritage and other aspects not related directly to coastal processes. This line was situated on or landward of the hazard/coastal processes line.

Conceptually, this designated a hazard zone adjacent to the water's edge as a 'no development zone', a managed development area immediately outside the risk zone, and lastly, a zone of minimum regulation beyond that (Figure 3):

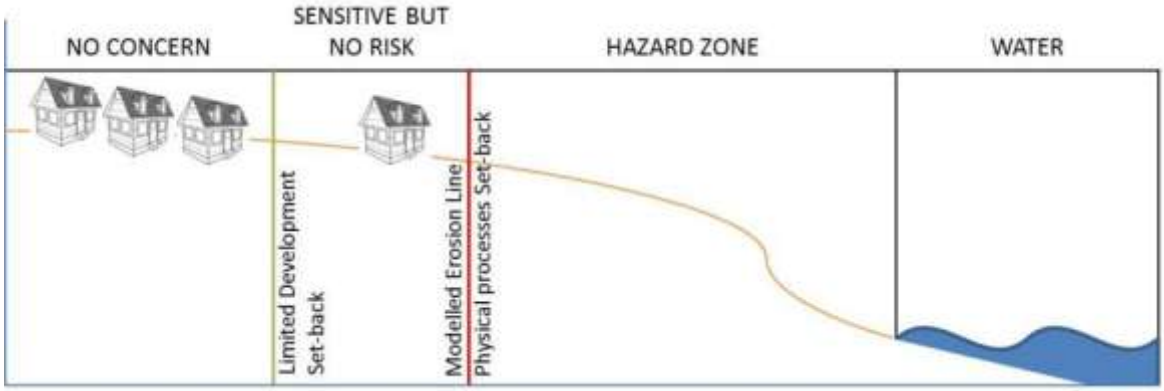

Figure 3: Conceptual structure of coastal management lines

3.1.2 Overberg District (as a pilot study)

The reality of existing legal coastal development in the Overberg District meant that coastal set-back lines had to make provision for existing developments and development planning that already extended into the hazard zone. Decisions regarding development in this zone are particularly difficult as they affect existing or assumed property rights as well as development precedents, and are relative to planning horizons. For example, a partly developed residential area within the hazard zone is unlikely to be removed or relocated, and approval for infill development is unlikely to be refused.

By implication, the conceptualization of a hazard zone, determined on the basis of a coastal erosion and coastal inundation threat, needed to be refined to accommodate existing development. A management response was required that differentiated between a modelled long-term erosion hazard and pragmatic development control. The solution recommended by the Overberg Coastal Set-backs project involved delineating realistic management coastal set-back line(s) in addition to the modelled maximum risk line. The management lines would then translate long term (e.g. 100 year) natural processes modelling into guidance that relates to pragmatic planning horizons (e.g. 50 year structural life expectancy).

The project culminated in the designation of three conceptual lines or zones:

- A broad Coastal Protection Zone extending to the landward boundary of sensitive coastal features in addition to the maximum modelled coastal risk zone, within which limited management control was required.
- A Physical Processes Zone which demarcated the output of the rigorous scientific modelling process used to project future coastal risk.

- An Overberg Coastal Set-back Line which designated a narrow band of high risk area along the shoreline within which strict management controls are to be applied.

As compared to the theoretical concept described in the Provincial Methodology, the revised concept can be schematically represented as is shown in Figure 4.

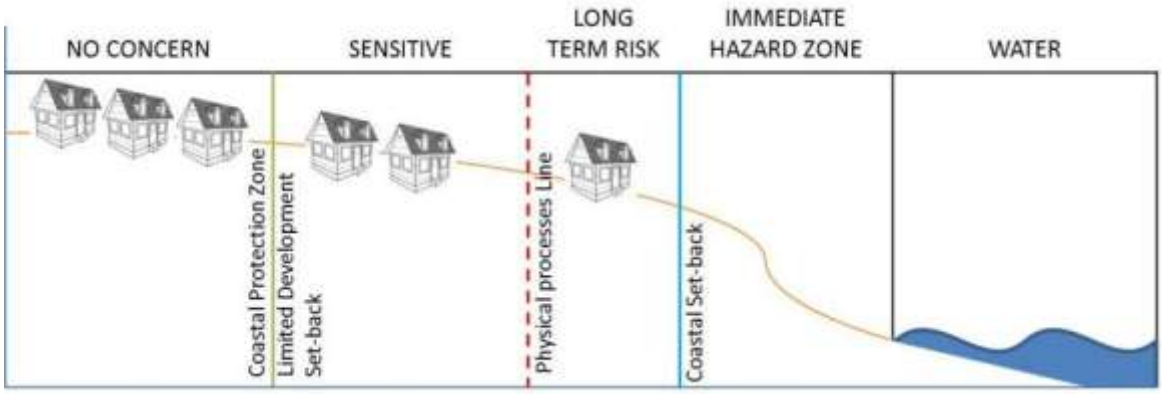

Figure 4: Overberg District Coastal Set-Back Lines concept

The management zones were determined by using the modelled physical processes line in conjunction with local planning knowledge and realistic determinants of the capacity for regulatory control, to delineate final management zones which could possibly be closer to the water's edge than what is prescribed by physical processes modelling. The proposed management zones therefore relied not only on the modelling results but also on the interpretation thereof in terms of realistic planning horizons, and were delineated in consultation with affected local municipalities.

3.1.3 City of Cape Town

In the City of Cape Town, a general approach is being taken that will determine two management lines, the Coastal Protection Zone (as per the definition from the ICM Act), and a set-back line seaward of existing development or properties with existing development rights. The two coastal zones determined by these lines (i.e. between the HWM and Coastal Edge Line, and between the Coastal Edge Line and the CPZ) are then proposed to be managed in a manner appropriate to the level of existing or desired development through means of zoning schemes. The locations of the two management lines are informed by the profiling of different points along the coastline which considered risk from storm damage, possible inundation under storm surge scenarios, biophysical processes and public access issues.

General zoning schemes are proposed to be used as a base management system of land-use decisions to control commercial, residential, industrial, and agricultural construction, with coast-specific 'overlay zones' that are superimposed on the baseline plan to increase or decrease the level of regulation. Each coastal management overlay zone is assigned specific regulatory requirements based on land use that include resilient building designs, set-backs and ecological buffers.

3.2 Key recommendations emanating from the Overberg District pilot project

3.2.1 Realistic development controls

In practice it was found that the application of coastal set-back lines, as conceptualised by the Western Cape Province's Coastal Development Set-back Lines Methodology, was not fully compatible with the diversity and dynamics of long sections of coastline or with the current level of development encroachment into the conceived 'hazard zone'. In particular, it was found that in assuming that the 'no development' zone should equate to land seaward of the modelled coastal erosion set-back line, the provincial Set-back Lines Methodology failed to fully accommodate the reality that development and developed areas had already encroached beyond the physical processes / erosion line.

The most practical solution recommended placing more emphasis on the use of local knowledge and planning considerations to determine development restrictions rather than a rigid line based solely on mathematical modelling. This can be achieved by using the modelled physical processes line in conjunction with local planning knowledge, as well as realistic determinants of the capacity for regulatory control, to delineate a final high control zone which may be narrower than what is prescribed by physical processes modelling.

3.2.2 Link proposed activities to realistic planning horizons

An additional recommendation related to considering the nature of proposed development activities in relation to the planning horizon applied in decision making. For this purpose, modelling was recommended to be undertaken for three proposed sea level rise scenarios, namely – low (20 years or 200mm), medium (50 years or 500mm) and high (100 years or 1000mm). Decisions regarding land use and development could then be based on either the proposed value of the proposed development or activity, or the nature of the proposed activity. This proposal was originally included in the report outlining the Provincial Set-back Line Methodology (Table 1 below).

Application of this time horizon-based modelling would, for example, require that a proposed application for the development of a sewage treatment works (high value infrastructure, medium to long term life span) would take the 1000mm physical processes line into consideration, while a proposed application for the development of a boardwalk (low value infrastructure, short term life span), would take a 200mm line into consideration.

Table 1: Planned sea level rise values based on value and risk of failure of infrastructure (Based on DEADP, 2010):

Value of Infrastructure	Life of Infrastructure	Impacts of Failure of the Infrastructure	Planned amount of sea level rise
Low **(up to R2 million)** Recreational facilities, car parks, board walks, temp beach facilities	Short term Less than 20 years	Low Minor inconvenience, alternative facilities in close proximity, short rebuild times	0.2m
Medium **(R2 million to R20 million)** Tidal pools, piers, recreational facilities, sewerage pump stations	Short to Medium Term Between 20 and 50 years	Medium Local impacts, loss of infrastructure and property	0.6m
High **(R20 million to R200 million)** Beachfronts, small craft harbours, Residential homes, sewerage treatment works	Medium to Long Term Between 50 and 100 years	High Regional impacts, loss of significant infrastructure and property	1.0m
Very High **(Greater than R200 million)** Ports, desalination plants, nuclear power stations	Long term In excess of 100 years	Very High Major disruption to the regional and national economy, failure of key national infrastructure	2.0m

3.2.3 Use of physical processes modelling

For the reasons outlined above, the scientifically modelled physical processes line (or lines, should multiple planning horizons be modelled), should not become the legally promulgated Coastal set-back Line. Physical processes modelling, whether in the form of single or multiple planning horizons, must simply inform regulatory zones as well as future decision making in the Coastal Zone in current and future development areas.

Keeping the physical processes modelling and demarcation separate from set-back lines and the associated zones allows for adjustment of the modelling results as knowledge of long term trends in coastal erosion and accretion rates, climate change and sea level rise projection improves over time. Such adjustments can then be interpreted from a pragmatic perspective leading to regular stepwise realignments of coastal set-back lines rather than constant changes.

It was recommended that development decision-making and spatial planning take cognisance of the modelled physical processes lines in order to ensure that public liability

for damage to property and infrastructure was limited, and to ensure the protection of an adequate coastal buffer. Such a buffer is important in terms of protection against coastal erosion and accretion as well as sand movement, and in order to improve the resilience of coastal ecosystems. Decisions would therefore need to consider the need and desirability of developments along the coast in relation to the projected future impacts from dynamic coastal processes.

The scientifically modelled physical processes line (or lines) can and should, however, be considered to be the 'coastal set-back line' in rural or undeveloped areas and become a legally promulgated set-back. Rural or undeveloped areas were considered to be those areas where there has not been significant encroachment into the identified hazard zone by formal development. The absence of substantive capital investment and vested interests meant that the entire hazard zone could still be protected from inappropriate or high risk development.

3.2.4 The nature of regulatory controls

The use of coastal set-back line regulations, as provided for in the ICM Act, was contemplated for the Overberg District. As such, a set of regulations was drafted that defined compatible and incompatible developments and activities in the different set-back areas. The regulations were intended for official promulgation through gazetting by the Provincial Minister responsible for environmental matters.

It was found though that the nature of such strict regulatory control was less than palatable to the general public and especially to property owners and developers along the coast. Regulations are absolute – in terms of not offering space for negotiation, mitigation and discretion – and are consequently viewed as a top-down form of governance. The regulations would also create multiple layers of authority control, which could lead to conflicting decision-making and overlapping mandates. Formal regulations from a Provincial level of governance were therefore abandoned for the time being in favour of more practical and locally customisable form of development control.

4 COASTAL MANAGEMENT/SET-BACK LINE, RISK BASED OVERLAY ZONES AND COASTAL PROTECTION ZONE FOR THE WEST COAST DISTRICT

4.1 COASTAL MANAGEMENT/SET-BACK LINE AND OVERLAY ZONES FOR THE WEST COAST DISTRICT

4.1.1 Proposed coastal management scheme

The use of coastal management or set-back lines and coastal management zones need to reflect management principles or criteria suggested by affected authorities as well as the public stakeholders participating in the stakeholder consultation process facilitated by the WCG.

These principles are:

- Legal development with existing rights (including zoning) must be allowed to proceed as long as public (i.e. government) liability and the quality of the coastline are not compromised.
- Management controls must allow for private acceptance of liability.
- Controls must allow for discretion in decision-making by authorities based on appropriate motivations and information.
- Provision must be made for areas where the local municipalities propose growth, as long as the development proposals are responsive towards coastal risk and ICM Act principles.
- Coastal defences, if constructed, must be constructed and managed in an integrated manner and in accordance with legislative requirements.
- Delineation must avoid the uncertainties surrounding the position of the HWM.
- Management control must recognise that 'land use' and physical activities are distinct.

The need for a graduated management approach is therefore evident, especially considering the recommendations flowing from implementation in the Overberg District. As a result, this project proposes a management scheme consisting of a coastal management/set-back line and coastal management 'overlay zones'.

4.1.2 Coastal management /set-back line

A coastal management/set-back line, as envisaged by the ICM Act and its proposed amendments, is informed by the projections of risk generated in the first phase of the study, as well as the location and extent of existing development and existing executable development rights. The coastal management/set-back line is intended as a clear guideline for the management of development within risk areas, and the protection of coastal public property. The West Coast Coastal Management/Set-back Line therefore differentiates between areas along the coastline with existing development rights and/or

part of future municipal development, and those areas that should be left undeveloped due to a high risk from dynamic coastal processes or as coastal public property.

To determine the coastal management/set-back line, coastal features are considered alongside coastal risk zones, based on observed and available information:

- Environmental buffers required inland from the HWM to maintain a functional coastal ecosystem under future sea level rise scenarios.
- Social buffers required along the coast, for example, allowance for public beach access through and along the coastal frontage, areas which have cultural significance and will need to be preserved from development, or heritage resources and historically sensitive locations that require specific management.
- Economic requirements for the coast, for example, allowance for new beach facilities that will need to be placed closer than normal development to serve the public. Economic demands often require a trade-off against environmental aspects at a particular site.

The resultant zone is conceptualised as the area below the coastal management/set-back line. It includes all sensitive areas along the coast, both in terms of biophysical sensitivity and socio-economic value (Figure 5).

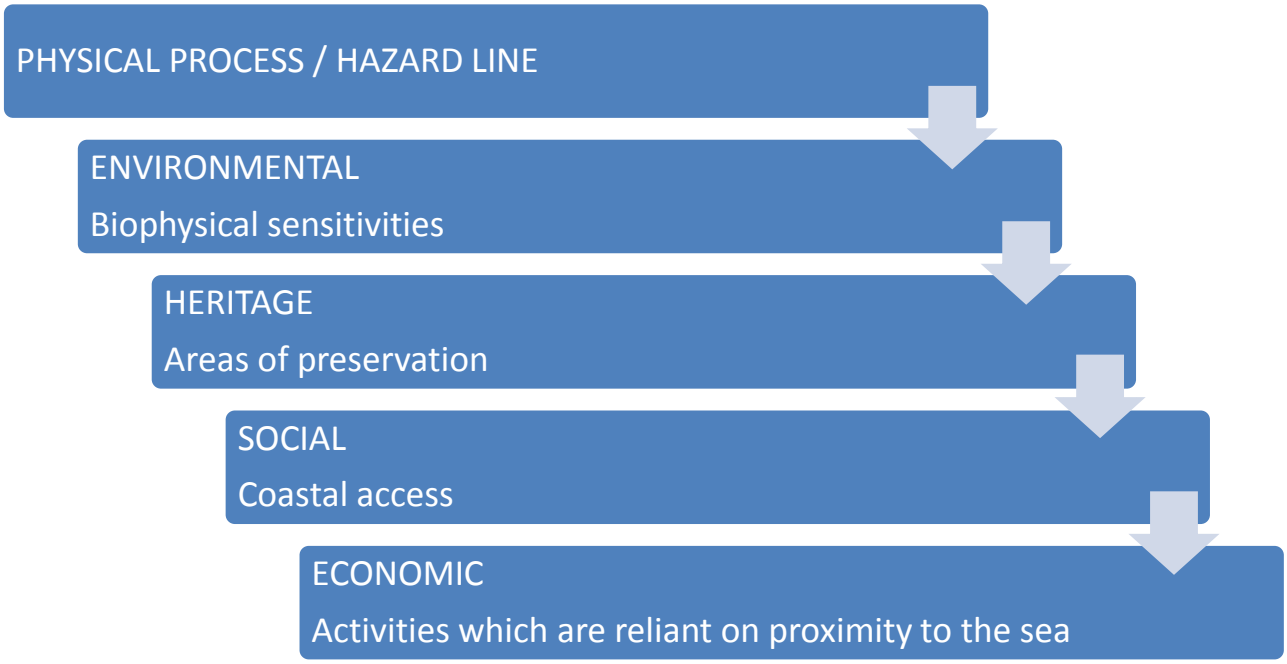

Figure 5: Aspects to consider in determining the coastal management/set-back line

Specific heritage resources taken into consideration in the delineation of the coastal management/set-back line are listed in Table 2. Also provided is a note on how the resource is being taken into account in the demarcation of the various management layers being applied to the coastal zone.

Table 2: Heritage resources considered for the delineation of the coastal management/set-back line (CML)

Name	Description	Location	Action/comment
Bokkerivier, Bokbaai	Historic buildings on beachfront	Bokbaai	Falls outside the Risk Zones Not included in CML – retain CML on 1:100yr risk line
Yzerfontein Middle Stone Age site	A rich Middle Stone Age site with archaeological and palaeontological resources found near Yzerfontein Harbour	West of Yzerfontein harbour	Will be within CML once Admiralty Reserve is included as sensitive area
Geelbek Restaurant, WCNP (and VOC beacon)	Historic buildings	West Coast NP	CML not applied in Protected Areas, so no specific CML drawn. Development remains subject to the reserve's management plan
Oosterwal, WCNP	Historic buildings	West Coast NP	CML not applied in Protected Areas, so no specific CML drawn. Development remains subject to the reserve's management plan
Saldanha Fishermen Cottages	Oval shaped historic cottages	Above Saldanha town harbour	Behind harbour development, so not linked to CML-protected shoreline.
Vredenburg peninsula fossil sites	Extensive marine and terrestrial fossil deposits along the coastline	Peninsula directly West of Vredenburg	More detail is required for the information to be included in the CML
Paternoster shell midden	Shell midden	Eastern end of Paternoster	Has coastal significance, so include within the CML
Historic fishermen cottages St Helena Bay	Historic buildings	St Helenabay harbour	Not sufficiently defined to be included in the CML

Name	Description	Location	Action/comment
Langrietvlei	Historic buildings	Berg River Estuary (inland)	Within 5m amsl, so will be within CML
Mussel Point Midden & Baboon Point	Archaeological and rock art sites	Baboon Point, Elands Bay	CML to run landward of proclaimed Baboon Point heritage area Further heritage assessments required before CML is amended to include Mussel Point sites
Doorspring / Soopjeshoogte	Shell middens x3	Soopjeshoogte Private Nature Reserve, north of Lamberts Bay	Not a concern. The heritage impact assessment from 1994 for the northern part of the development recommended that development proceed.

Demarcation of the actual coastal management/set-back line is different for developed and undeveloped areas, and is a combination of the two around estuaries.

In **rural areas**, the coastal management/set-back line follows the landward boundary of the long term risk projections. Where necessary, a separate line can be drawn around existing development and development rights within the risk zone in order to protect the development rights within a 'development island'.

As the intention is not to use the coastal management/set-back line to impact on existing development rights, the line is drawn seaward of properties abutting the shoreline with existing development or development rights in **'urban' or 'developed' areas**. These are areas where clustered development is present, and where the density is significantly higher than in rural or undeveloped areas where single residential units on farm properties dominate the land use pattern. Due to considerations related to practical implementation, the coastal management/set-back line is aligned with defined property boundaries or distinct landmarks. This allows an exact demarcation to take place, and reduces the likelihood of subsequent arguments over its location. An example of the demarcation of the coastal management/set-back line along the property boundaries in urban areas is shown in Figure 6.

Figure 6: Example of the location of the coastal management/set-back line in urban areas

Different types of development, or locations of properties relative to the water's edge, will have different implications for the location of the coastal management/set-back line. These are specifically addressed in Table 3:

Table 3: Location specific delineation of the coastal management/set-back line

Issue	Location of Coastal Management/Set-back Line
Properties extending into the water	Line remains on seaward side of the property
Development seaward of sensitive coastal features or within a risk zone	Line to be drawn around the development to create a development 'island'
New public facilities that have reason to be close to the water's edge (see definition of public facilities)	The line can be drawn on the landward side of the facilities and development must be in alignment with the principles of ICM Act

Issue	Location of Coastal Management/Set-back Line
Protected Areas and state-owned land	Coastal management/set-back line omitted on request from the management authority if sufficient development controls are present, otherwise delineated as normal. Where coastal public property exists between the protected area and the water, locate line on seaward boundary of the protected area boundary Retain projections of coastal risk to inform activities and development

The coastal management/set-back line also extends along **estuaries**, and in developed areas along the banks of the estuary is aligned with the lower (water side) boundary of properties with existing development or development rights. In rural areas, the coastal management/set-back line runs along the 5m amsl contour around estuaries (Figure 7).

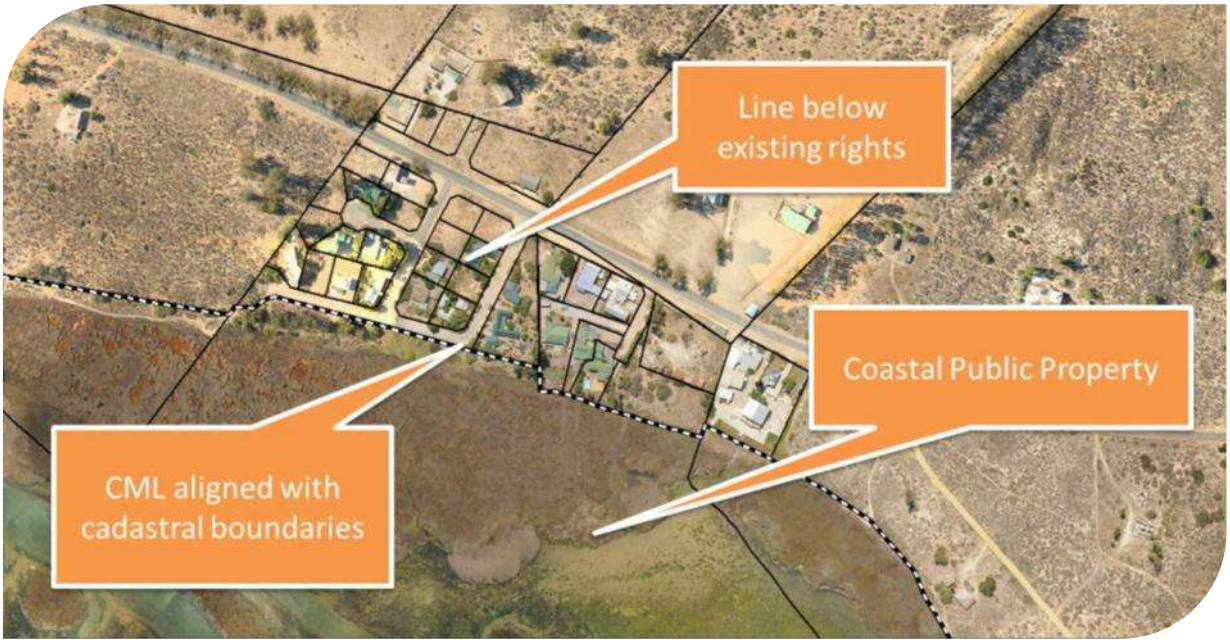

Figure 7: Example of the location of the coastal management/set-back line in urban parts of estuaries

4.1.3 Coastal management overlay zones

As piloted in the City of Cape Town's municipal area, the use of Overlay Zones are being considered as a universal mechanism for administration of coastal management/set-back lines within the ambit of town planning regulation and management in the Western Cape.

Coastal management overlay zones are collectively envisaged as the area close to the sea within which development should be managed in order to preserve coastal quality

and protect property and lives. Development in these zones is possible under certain circumstances and after appropriate environmental and risk assessments have been undertaken. Restrictions in this area can be applied strictly and consistently, since it is informed by information on the level of risk gleaned from scientifically modelled coastal processes or hazard zones.

The overlay zones will be used within the ambit of existing town planning schemes on all properties and development subject to town planning scheme regulation. Exceptions do exist, but are limited to public (e.g. government, harbours and defence force) development that is governed by other relevant management controls such as management plans for protected areas or management and maintenance plans for harbours.

Three Coastal Management Overlay Zones are proposed for **urban areas** of the West Coast District:

High risk zone	**- 20 year horizon**	**- 0m amsl to high risk line**
Medium risk zone	**- 50 year horizon**	**- High risk line to medium risk line**
Low risk zone	**- 100 year horizon**	**- Medium risk line to low risk line**

The overlay zones therefore refer to areas designated by risk modelling as subject to short term (1:20 year), medium term (1:50 year) or long term (1:100 year) risk emanating from coastal processes such as coastal erosion, storm surges, sea level rise and storm wave run-up (Figure 8).

Figure 8: Example of the application of risk zone overlays as part of the local municipal zoning scheme

In **rural areas**, the risk grading from low to high is not necessary, and hence only a default 'risk' zone is indicated as the entire area between the 0m amsl and landward boundary of the low risk (long term risk) zone. This risk zone is expanded in places where littoral active zones are present, as these contribute to the risk of exposure to possible future coastal erosion. This is shown in Figure 9.

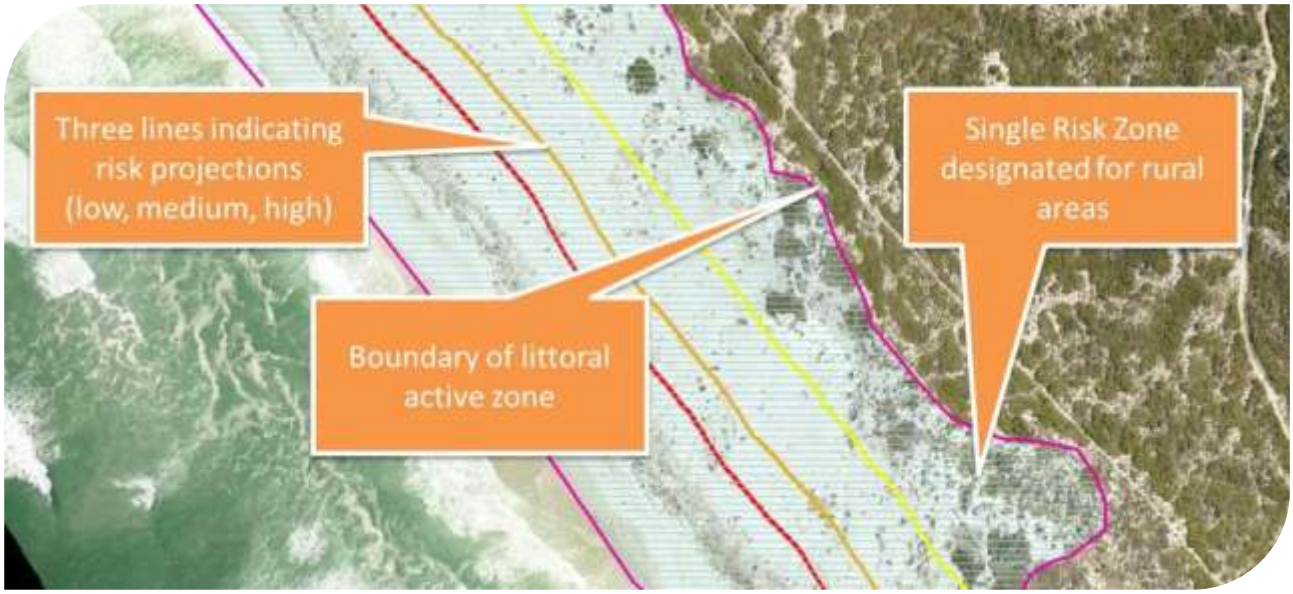

Figure 9: Example of the single risk zone designated for rural or undeveloped areas

With regards to **estuaries**, the risk-based zoning needs to be amended in order to accommodate the limited availability of information on localised estuarine dynamics. Consequently, it is proposed that a similar approach be taken as for rural areas, i.e. a single risk zone. This risk zone is, however, determined on the basis of inundation levels rather than wave impact risk. Consequently, the risk zone is considered to be the area below the 10m amsl contour around estuaries.

As a test case, actual floodlines were generated for the Berg River estuary as part of the project. The floodlines showed that for the most part, there was alignment of the 5m contour and 1:100 year floodline for this area. By implication, the approximation of risk according to the 5m and 10m contours, in the absence of more detailed information, is considered an acceptable approach.

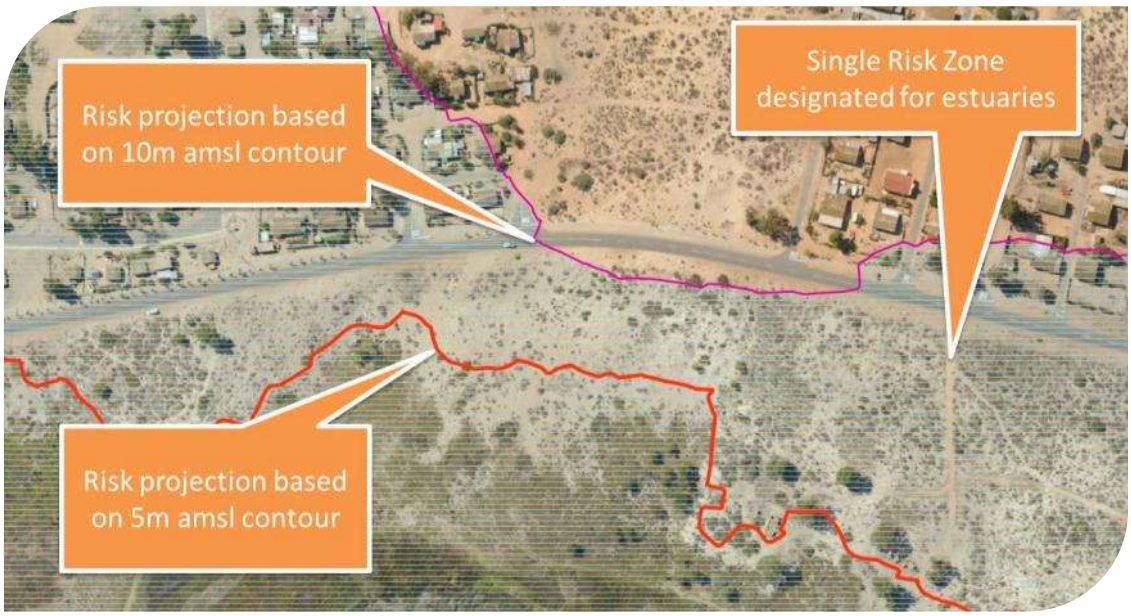

Figure 10: Example of the Risk Zone designated for estuaries

4.1.4 Combined coastal management/set-back line and overlay zones

Combined, the coastal management/set-back line and coastal management overlay zones depict a management scheme along the shore that guides where development should and shouldn't take place (coastal management/set-back line) and how it needs to be undertaken in order to protect property, lives and the integrity of the coast (overlay zones).

Figure 11 below shows an example of what the final combined management scheme looks like in a **developed or urban area**. With the coastal management/set-back line in place, development can be prevented from encroaching onto coastal public property, whilst the risk based overlay zones will determine the nature of development in close proximity to the shoreline.

Figure 11: Example of the combined coastal management/set-back line and overlay zones (urban or developed area)

In **rural areas**, the coastal management/set-back line follows the landward boundary of the single rural areas risk zone.

The same differentiation between rural and urban areas is applied in **estuaries**. Whereas in urban areas the coastal management/set-back line follows the water-side boundary of properties with existing development or executable development rights, in rural areas the line follows the 5m amsl contour around the estuary. It should be noted that in contrast to general rural areas, while the coastal management/set-back line and risk zones generally overlap completely, in estuaries the coastal management/set-back line will follow the 5m amsl contour and the estuary risk zone the 10m amsl contour.

In cases where the generalised estuary risk zone (below 10m amsl) overlaps with the differentiated risk zones on the open coastline, such as is the case at Laaiplek, both sets of risks are applied to the area. This means that both types of risk – wave action related erosion *and* inundation risk in the estuary - will need to be taken into consideration for development proposals and coastal management.

Figure 12: Designation of the risk zone and CML in the urban parts of estuaries

In both rural and urban coastal areas, there are cases where existing development lies seaward of the coastal management/set-back line, or effectively within the area where no further development/encroachment should be allowed. To prevent an unfair limitation of the rights to develop, a boundary is drawn around existing legal development or properties with existing executable development rights, which creates a limited 'island' of developable area within a larger area of restriction. Figure 13 shows the concept graphically.

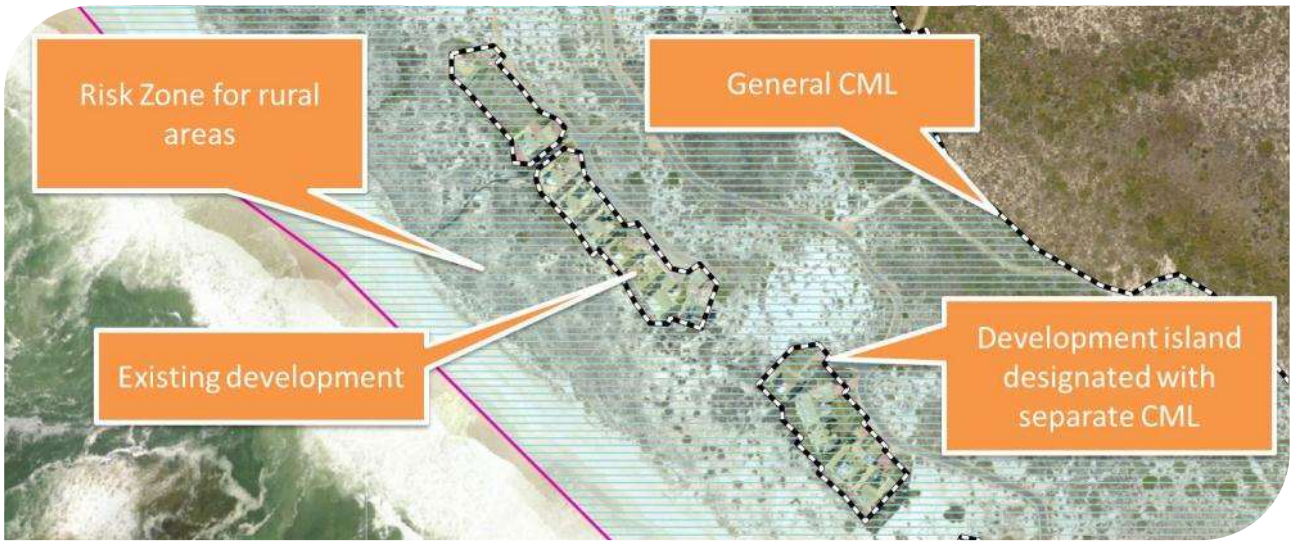

Figure 13: Example of development islands within the general area of restriction

4.2 COASTAL PROTECTION ZONE

The ICM Act makes provision for the demarcation of a zone adjacent to coastal public property that "*plays a significant role in a coastal ecosystem*". The demarcation allows the area to be managed, regulated or restricted in a way that differs from non-coastal areas, in order to[2]:

a) protect the ecological integrity, natural character and the economic, social and aesthetic value of coastal public property;
b) avoid increasing the effect or severity of natural hazards in the coastal zone;
c) protect people, property and economic activities from risks arising from dynamic coastal processes, including the risk of sea-level rise;
d) maintain the natural functioning of the littoral active zone;
e) maintain the productive capacity of the coastal zone by protecting the ecological integrity of the coastal environment; and
f) make land near the seashore available to organs of state and other authorised persons for:
    i) performing rescue operations; or
    ii) temporarily depositing objects and materials washed up by the sea or tidal waters.

The ICM Act defines a default CPZ which, in essence, consists of a continuous strip of land, starting from the HWM and extending 100 metres inland in developed urban areas zoned as residential, commercial, or public open space, or 1 000 metres inland in areas that remain undeveloped or that are commonly referred to as rural areas. It also includes certain sensitive or at-risk land such as estuaries, littoral active zones and protected areas. These default boundaries may only be changed through a formal process of adjustment by the relevant Provincial MEC or National Minister.

In areas where considerable development has occurred and where there is no longer any functional natural environment or social, economic or heritage aspects that need special consideration, the CPZ can therefore be relocated closer to the HWM or behind developments at direct risk from active dynamic coastal processes. For the purposes of this project, a minimum width of 100m was retained as a conservative buffer. Where a functional natural environment exists, for example a declared nature reserve, the inland boundary of the natural environment should, however, still be recognised as forming part of the CPZ.

[2] Section 17 of the ICM Act

The investigations and risk projections of this project allows for a concurrent recommendation on refinement of the CPZ in the West Coast District. Consequently, it is recommended that except for completely developed areas, where the CPZ follows the coastal management/set-back line, the CPZ in the West Coast District consists of the following elements:

- the long term (100yr) risk projection
- littoral active zones
- properties that should form part of the Coastal Public Property, such as the Admiralty Reserve
- harbour areas if they remain enclosed by sensitive natural areas
- all ecologically sensitive areas directly linked to the shoreline
- areas or features of social, economic and heritage value specifically linked to the coast
- the designated coastal risk zone (i.e. 10m amsl) in estuaries

4.3 SUMMARY OF THE DELINEATION CRITERIA FOR THE CML AND CPZ

Table 4 below provides a summary of the criteria used to inform a consistent delineation of both the CML and CPZ for the West Coast District. It differentiates between rural (undeveloped) and urban (developed) areas, and specifies specific criteria for estuaries.

Table 4: Criteria for the delineation of the CML and CPZ

	CML Urban Areas (developed or earmarked for development)	CML Rural Areas (undeveloped)	CPZ
Purpose	ICM Act interpreted for developed areas: • protect public amenity value • reduce public liability • reduce risk to human life • inform planned retreat • prevent intensification of development in risk zones, but allow infill where appropriately • prevent encroachment that will impact on the integrity of the shoreline ecology	ICM Act interpreted for undeveloped areas: • prevent encroachment that will impact on the integrity of the shoreline ecology • prevent densification of rural areas • maintain coastal quality	Define a broad area within which coastal concerns are to be taken into account in decision-making: • protect the economic, social and aesthetic value of coastal public property • avoid increasing the effect or severity of natural hazards in the coastal zone and protect people, property and economic activities from risks • maintain the natural functioning of the littoral active zone • maintain the productive capacity of the coastal zone by protecting the ecological integrity
Delineation criteria	Follow the 1:100yr risk projection, except: • Where property boundaries exist seaward of the risk line: then move it to the seaward property boundary. • Where littoral active zones, public open space, sensitive biodiversity (aquatic and terrestrial critical biodiversity areas (CBAs), protected areas) and/or undeveloped coastal public property, where agreed to by the local municipality, remain connected to the coastline: then follow the landward	Follow the 1:100yr risk projection for rural (undeveloped) areas, except: • Where littoral active zones, public open space, sensitive biodiversity (aquatic and terrestrial CBAs, protected areas) and/or undeveloped coastal public property, where agreed to by the local municipality, remain connected to the coastline: then follow the landward boundary of the demarcated sensitive area.	Follow the CML, but include: • Public property that runs parallel to the coast (e.g. Admiralty Reserve) • Undeveloped areas surrounding harbours • Protected areas • Any areas or features of social, economic and heritage value specifically linked to the coast not included in the CML • A minimum width of 1km in

	CML Urban Areas (developed or earmarked for development)	CML Rural Areas (undeveloped)	CPZ
	boundary of the demarcated sensitive area. • Where heritage features are present: follow the landward boundary of the demarcated heritage area. • Where clusters of development are surrounded by undeveloped space within the 1:00yr risk zone: then create a development island with a CML drawn around it. • Where public amenities or government owned infrastructure is present: then move it to seaward property boundary or water's edge. • On request from protected area Management Authorities, the CML can be omitted if sufficient development control is already present.	• Where heritage features are present: then follow the landward boundary of the demarcated heritage area. • Where clusters of development are surrounded by undeveloped space within the 1:00yr risk zone: then create a development island with a CML drawn around it. • On request from protected area Management Authorities, the CML can be omitted if sufficient development control is already present.	undeveloped areas • A minimum width of 100m in developed areas
Estuaries	Follow the 5m amsl contour, except: • Where property boundaries exist below the risk line: then move it to the lowest property boundary. • Where clusters of development are isolated from other developed areas within the risk zone: then create a development island with a CML drawn around it. • Where estuary-specific risk projections are available: then follow the low risk projection.	Follow the 10m amsl contour, except: • Where clusters of development are isolated from other developed areas within the risk zone: then create a development island with a CML drawn around it. • Where estuary-specific risk projections are available: then follow the low risk projection.	Follow the 10m amsl contour, or outer boundary of sensitive areas intersecting the 10m line.

5 COASTAL MANAGEMENT CONTROLS FOR THE WEST COAST DISTRICT

With the coastal management/set-back line, overlay zones and associated coastal protection zone established, it becomes important to define what the zones mean and the implications they will have. If the intention of these lines / zones is to protect existing property, infrastructure and ecology, and ensure that only responsible development takes place in high risk areas (where current existing development rights are in place), then various management tools need to ensure this intention is put into action.

While progress has been made on the topic, there is still much ground that needs to be covered to ensure integration of coastal sensitivities into all applicable planning tools for consideration in future growth and development of coastal regions. This demands integration of tools embedded in the ICM Act, EIA Regulations, local level spatial planning and resources management. With coastal property in high demand and coastal cities growing rapidly, the determination of appropriate control measures for different layers of management is an important aspect that needs to be implemented with great expediency and via a process that is streamlined and effective.

The sub-sections that follow aim to outline existing management control tools and schemes, as well as how these tools may be further developed. Suggestions on additional tools and uses of existing tools are also made. However, it is acknowledged that there is no singular solution, and that adaptive management principles will need to be applied and continuous improvement will need to be strived for in order to make this process successful.

5.1 Specific development controls

Specific development controls are the most basic form of regulation and can be imposed relative to the different projections of coastal risk, in order to reduce risks to public and private property or human life. Accordingly, such controls should satisfy one or more of the following intentions:

- reduce public liability
- reduce risk to human life

- prevent intensification of development in risk zone, but allow exercising of existing rights
- maintain coastal quality
- prevent encroachment that will impact on the integrity of the shoreline ecology
- inform planned retreat
- prevent densification of rural areas

While it is recognised that the identification of such controls should only follow once clear determinations of development zoning and management control structures have been finalised, examples of such controls are suggested in Table 5 as a means to facilitate discussion and contributions on what would be deemed relevant and meaningful for the West Coast District. Measures applicable to a specific context can be taken up by Local Authorities as by-laws, building controls, or similar.

Table 5: Suggested specific development controls

All areas	Urban	Rural
• consolidated access points / paths to limit points of weakness in natural systems • limit extension of existing footprints and volumes of structures already in the risk zones • municipal infrastructure outside overlay zone, unless related to public amenity	• structures set back from front boundary / minimise rear (landward) space • piled or buried seawall (a form of 'sleeping defence') – the founding levels are to be determined by structural engineer • collective/integrated response by adjacent properties or developments to optimise resources and prevent spill over effect • structures elevated on pilings, posts, piers or column foundations – with the floor of lowest area to be above pre-determined risk level • dune rehabilitation to reinstate or strengthen natural barriers • permeable lower floors of structures – i.e. have openings to allow for the entry and exist of flood waters – to allow interior and exterior hydrostatic pressures to equalise • relocate mechanical and electrical plants to higher floors • reduce hardened surfaces – e.g. grassed blocks instead of impermeable paving – to reduce flow velocities and increase natural infiltration • manage stormwater on site through retention and controlled release • barriers that are permeable seawards but not landwards	• no development in high risk zone • utility services to be outside the risk area or protected from failing during extreme events

All areas	Urban	Rural
	• stop seepage into beach zone / coastal buffer / dune system that saturates and weakens natural defences • structures in the risk zones require engineers' approval in respect of erosion risk and the ability to withstand wave forces • no basements • protect access to the beach for earth moving machinery • defences to comply with relevant legislation • indigenous gardens or no gardens allowed in order to preserve and consolidate natural defences • flood and erosion proof design and location of septic/conservancy tanks and sewer links • septic/conservancy tanks on landward side of structures • limit size of structure / site coverage relative to flood and erosion exposure and potential impact on coastal public property and public interest in case of failure • protect the structure from falling over and creating secondary effects	

5.2 Building controls

Each municipality has the responsibility for checking and approving building plans for structures within their area of jurisdiction, as well as inspecting building work during construction to ensure compliance with the approved plans and related regulations.

Before approving building plans, municipal building control offices consider various factors, including the environmental impact and the environmental health consequences of the proposed development. It would therefore be a logical step to include the procedures for approval of building plans as a mechanism to enforce the development controls derived through means of coastal risk studies such as this.

5.3 Use of overlay zones within the town planning framework

The management of land and land use practices according to classification or zonation of land is nothing new to South Africa (Van der Stoep, 2013). In fact, it is on this principle that all town and regional planning is based. The addition of coastal management overlay zones should therefore be a natural addition to this practice. If appropriate management guidelines can be determined for zones of varying sensitivity, then the

corresponding spatial extents of these zones should be overlain in any spatial planning framework and associated mapping, such as SDFs and IDPs, to facilitate land use planning.

5.4 Coastal Protection By-law

An example of the application of municipal by-laws as a mechanism for the promotion of integrated coastal management is found in the City of Cape Town's Draft Coastal Protection By-law. This by-law is proposed to apply to the area between the HWM and Cape Town's coastal management line (the Coastal Edge Line), and aims to limit the threat to human life, property and ecology. As such, it acts as a tool within which to ensure appropriate land use practices and hold offending parties accountable for their actions.

The intention of the by-law is to regulate activities within sensitive and dynamic coastal zones. This is done in order to protect existing coastal property and avoid inappropriate future development. This by-law also aims to protect the ecological integrity of the area for its value as a natural ecosystem and the value it adds as a buffer to coastal property. In particular, it specifies a list of prohibited activities, a list of permissible activities as well as provisions for regulation and enforcement of the prescriptions.

5.5 Coastal planning schemes in terms of the NEM:ICM Act

The ICM Act makes specific provision for the determining of coastal planning schemes. A coastal planning scheme is defined as:

"*…a scheme that -*

> *(a) reserves defined areas within the coastal zone to be used exclusively or mainly for specified purposes; and*
>
> *(b) prohibits or restricts any use of these areas in conflict with the terms of the scheme;"*

This provision could potentially be used to give the determination of coastal risk zones or a 'Restriction Zone' legal status in terms of the ICM Act, over and above the legal provisions for municipal planning schemes and development regulation, in order to aid in coastal management.

5.5.1 Planning schemes for areas within the coastal zone

Section 56 of the ICM Act focuses on planning scheme requirements. The following are listed as requirements:

(1) A coastal planning scheme is a scheme that facilitates the attainment of coastal management objectives by—

> (a) defining areas within the coastal zone or coastal management area which may—

(i) be used exclusively or mainly for specified purposes or activities; or

(ii) not be used for specified purposes or activities; and

(b) prohibiting or restricting activities or uses of areas that do not comply with the rules of the scheme.

(5) A coastal planning scheme may only be established with the consent of—

(a) the Minister, if the scheme applies to an area that extends into the sea further than 500 metres from the high-water mark or affects the protection or use of marine living resources; or

(b) the Minister of Transport, if the scheme[3]—

(i) affects the navigation of vessels on the sea; or

(ii) restricts vessels entering or leaving a harbour.

(6) A coastal planning scheme may not create any rights to use land or coastal waters.

All of these considerations should be integrated into affected planning and / or management tools.

5.5.2 Coastal planning and land use schemes of municipalities

Section 57 further defines coastal planning and land use schemes within the responsibility of municipalities:

(1) Subject to section 56(5), a coastal planning scheme of a municipality may form, and be enforced as part of, any land use scheme adopted by the municipality.

(2) (a) A municipality may not adopt a land use scheme that is inconsistent with a coastal planning scheme established in terms of this Act.

(b) If there is a conflict between a municipal land use scheme established after the commencement of this Act and a coastal planning scheme made in terms of this Act, the coastal planning scheme shall prevail.

5.6 Other potentially applicable acts

Under the NEMA there are a suite of Specific Environmental Management Acts, often referred to as SEMAs, which could potentially contain triggers for an environmental

[3] It should be noted that this section is to be amended as: "*(b) the relevant Minister [of Transport] responsible for navigation of vessels on the sea or vessels entering or leaving a harbour, if the scheme [-(i)] affects [the navigation of vessels on the sea;] or [(ii)]restricts such vessels [entering or leaving a harbour]*"

assessment or environmental permit. Some of these include the NEM: Biodiversity Act, NEM: Waste Management Act, and NEM: Protected Areas Act. Currently, in the absence of specific regulations on assessments published under the SEMAs, any trigger for environmental control reverts to the process for EIA authorisations. An example may be an activity planned within the proximity of an estuary. This would be considered as a trigger for an application for an Environmental Impact Assessment Authorisation because of proximity to sensitive coastal features (i.e. within 100m of the high water mark).

6 STAKEHOLDER ENGAGEMENT

Public engagement was an on-going process throughout the project. The engagement was conducted for several reasons, the most pertinent of which was to ensure that instead of coastal management/set-back lines and the associated management zones being presented to the public as a *fait accompli*, public engagement was being undertaken to facilitate a participatory determination of coastal management/set-back lines and associated guidelines.

Four distinct rounds of stakeholder engagement were undertaken:

Table 6: Stakeholder engagement process

Stakeholder Engagement #1a (initial project notification)	Notification (e.g. adverts, media releases and posters) Authority notification Compilation and distribution of background information document Compilation and maintenance of a stakeholder database
Stakeholder Engagement #1b (public meetings)	Notification (e.g. adverts, media releases and emails) Public review of draft hazard lines Compilation and distribution of background information document 11 public workshops Authorities consultation Compilation and maintenance of an Issues & Response table
Stakeholder Engagement #2	Notification (e.g. adverts, media releases and emails) Public review of draft report

Stakeholder Engagement #3	Notification (e.g. adverts, media releases and emails) Public review of draft report and draft management/set-back lines Authorities consultation 9 public workshops Direct engagement with various stakeholders
Stakeholder Engagement #4	Public review of final report and final management/set-back lines

During stakeholder engagement 1, the public were presented with scientifically defendable risk projections once the initial coastal hazard modelling was completed, prior to the delineation of the coastal management/set-back line. Comments and suggestions were sourced on how the risk projections could be used to manage development around the risk zone, which were incorporated into the determination of the coastal management/set-back line wherever possible.

In January 2014, a draft CML delineation report was released for public input. The comments received, and outcomes of engagements with Municipalities, were used to delineate a draft coastal management/set-back line, draft coastal risk zones, as well as a draft CPZ. An updated report as well as the draft lines were subsequently released for further public review and comment during April 2014. At the same time a round of public workshops were held, at which members of the public could engage with the project team directly to clarify any aspects and comment on the proposals.

Comments from the engagements informed refinements to the proposed CML, overlay zones and CPZ, and these were released for public review and comment along with a final draft project report during June 2014. The final comments are submitted to the Western Cape Government Coastal Management Unit as an accompaniment to the final report.

7 WAY FORWARD

7.1 Promulgation and implementation

The ICM Act, and the general approach adopted for the Western Cape, requires Municipalities to give effect to the coastal management/set-back line(s) and risk zonations by incorporating the lines in their local spatial planning and mapping. By implication, the overlay zones need to be added to the respective Town Planning Scheme, and the different management lines included in the Spatial Development Framework. Individual development controls need to be added to the management scheme in accordance with the level of risk and required level of control over development expansion.

The process of incorporating coastal management/set-back lines into local level zoning schemes will be facilitated by the Provincial initiative of establishing a Standard Zoning Scheme Bylaw (SZSB), which will be made available to municipalities for "adoption" as a Zoning Scheme Bylaw. This comes as a response to the recent enactment of the Spatial Planning and Land Use Act, Act 16 of 2013, which requires of all municipalities to adopt a single zoning scheme for their areas of jurisdiction within 5 years of the Act's commencement.

Prior to implementation at municipal level, however, the WCG needs to formally adopt the CML and CPZ in accordance with the prescriptions of the ICM Act.

In terms of Section 25(1) of the ICM Act, the MEC can declare coastal management/set-back line(s) after consultation with Municipalities and interested and affected parties, through publishing it as regulations in the Government Gazette. Once determined, the lines and risk zones must be delineated on the map or maps that form part of the municipal zoning scheme. This is done so that the public may determine the position of the set-back line and risk overlay zones in relation to existing cadastral boundaries (Celliers, *et al.* 2009).

The process for adoption and future adjustment of the CPZ is, however, not a simple process and the Act requires authorities to consider the concerns and representations of interested and affected parties as well as the interests of any local community affected by the boundary or amendment to a boundary. The applicable authority needs to

consider any coastal specific planning (applicable coastal management programme) prior to amending boundaries and such amendments then need to be reflected on municipal zoning schemes. Thereafter the relevant Registrar of Deeds needs to be notified in writing and provided with a description of the land involved. The notification must be accompanied by a diagram signed by a surveyor who is approved in terms of the Land Survey Act. The relevant Registrar of Deeds is then required to make note of such determination, adjustment or demarcation.

Authorities can also consider the option of incorporating some of the areas identified as high risk areas into protected areas. Formal proclamation as protected areas under the NEM: Protected Areas Act would increase awareness of the eminent risks, and make it harder to place new infrastructure in harm's way.

7.2 Further studies and refinements

The scale at which this and similar projects are undertaken means that some data gaps or uncertainties remain unresolved. Although measures were put in place to minimise the effect that such uncertainties had on the overall project, a need remains for further refinement over time.

Some of the core assumptions made in this project involved projections of climate change (in particular, sea level rise) for the West Coast. Although there is no doubt that climate change is taking place, projections for specific locations are still not very accurate due to the inherent complexities of climate, weather and marine systems. Internationally accepted estimates of sea level rise were therefore employed. In a similar vein, projections of storm wave height increase used for other long-term risk studies on the West Coast were also used in this study as a way to build consistency between similar studies.

By implication, the projections of future risk can be refined in future as more accurate predictions of the nature and extent of climate change in Southern Africa become available. It is expected though that future refinement will not drastically alter the current projections, but simply reduce the need for 'buffering' to compensate for uncertainty.

Improved accuracy is also possible should higher resolution studies be done for specific locations. The resolution of this study does take coastal form and topography into consideration, but cannot compensate for local dynamics such as stormwater runoff from the shore, human intervention in sediment transport, or geological resistance to erosion. It is therefore conceivable that studies on particular properties could point out detail like submerged or sand-covered rock layers that are not evident from aerial photography but which would substantially alter the rates of erosion. Similarly, in some locations, concentration of human activity could lead to destabilisation of dune vegetation, accelerating the rate of erosion.

As a consequence of the above, it is recommended that this work be revisited and improved over time in three ways -

Firstly, regular updates of the risk modelling need to verify the projections of erosion trends, in order to adjust the locations of any management/set-back lines and overlay zones

where significant change becomes evident. One of the ways in which this can be made particularly functional, is by putting in place uniform, statistically robust, long term monitoring programs on coastal erosion to inform the long term erosion trend variable in the modelling.

Secondly, more in-depth studies need to be undertaken in locations where complex marine and hydrological interactions are taking place. Saldanha Bay, in particular, needs a dedicated study on the local sediment transport and erosion trends. The interaction between an open bay, estuary and significant human intervention needs to be fully understood before an accurate estimation of erosion or accretion trends can be made. Any other areas along the coast where human-made structures like groins or sea defences have been put in place would also benefit from dedicated finer-scale modelling.

Thirdly, specific studies on individual properties could be recommended before any final decisions are made regarding proposed development or restrictions thereof. This is necessary in order to confirm the projected rates of erosion and to tailor the proposed development designs to the risks emanating from sea level rise, erosion, wave action, inundation etc.

8 CONCLUSION

Application and implementation of the coastal management/set-back line, in conjunction with the risk-based overlay zones, is envisaged as part of an overall coastal management scheme that will satisfy the principles of the ICM Act, as shown below in Table 7.

In order for the proposed coastal management/set-back line and risk-based overlay zones to function effectively as part of the overall integrated coastal management on the West Coast, an alignment of resources and intent needs to be achieved. Responsibility is shared between the Provincial and Local Authorities, with the municipality playing a pivotal role as the ultimate implementers and enforcers of the proposed spatial and developmental controls. However, as the authority ultimately responsible for the coordination of coastal management in the Western Cape, the WCG shares the responsibility albeit in the form of oversight and in a strategic coordination and advisory capacity.

All planning and decision-making related to coastal management/set-back lines and risk zonations must ultimately recognise the need to limit and fairly allocate the liabilities related to development in the coastal zone. Municipalities are responsible for decision-making and they need to take into account the best information that is currently available. However, risk is a shared responsibility and the private sector along with Municipality and other government departments need to ensure that information available translates into sustainable development. Consequently, in order to reduce conflicts over responsibilities and appropriation of blame, it is of utmost importance that the information and knowledge generated by this and similar studies be applied with the necessary level of consistency and alignment.

Table 7: ICM Act principles and the coastal management/set-back lines project

Principle	Application
National asset	Undeveloped and sensitive areas will be protected as part of a national coastal resource.
Economic development	Opportunities for development of coastal resources will be protected from risk, and informed decisions can be made in terms of long term sustainability.
Social equity	Stakeholder engagement is used to inform planning of the management schemes, and inter-generational (long term) impacts are considered.
Ecological integrity	Sensitive, vulnerable and dynamic coastal ecological systems are highlighted and protected.

Principle	Application
Holism	Interrelationships between global changes, coastal dynamics, ecological processes and human presence are considered and responded to.
Risk aversion and precaution	Risk projections allow for a precautionary approach to new coastal development.
Accountability and responsibility	Informed decision-making and fair allocation of risk liability can be based on the knowledge generated.
Duty of care	Coastal authorities and the public stakeholders are jointly informed by, and made responsible for the incorporation of risk projections into development planning.
Integration and participation	Cooperation and engagement between parties form a key part of the demarcation of the coastal management/set-back lines and associated management schemes.
Co-operative governance	All three tiers of government and various Provincial stakeholders are involved in the project, and jointly work towards a final implementation scheme that will be to the benefit of all parties.

9 REFERENCES

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APPENDIX A: COASTAL PROCESSES AND RISK MODELLING