2/17/2017

The Tinley Manor South Banks Coastal Development: Coastal Impact Assessment

A project for Tongaat Hulett Developments

19 May 2017

COASTWISE CONSULTING

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1. INTRODUCTION

In early 2010, the Coastal Unit of Royal HaskoningDHV (then operating as SSI Engineers & Environmental Consultants) prepared a coastal assessment report for the Tinley Manor and Tugela landholdings of Tongaat Hulett to evaluate the environmental opportunities and constraints of these areas from a coastal development feasibility perspective. This study was assessment-driven and had little conceptual application; however, it represented a detailed and thorough study that covered a wide range of topics and issues that were pertinent to development in general within the coastal zone.

Subsequently, a follow-up development planning exercise for the Tinley Manor landholdings was undertaken. This report is described in more detail below, and was informed by the aforementioned coastal assessment report. Royal HaskoningDHV then initiated the required environmental impact assessment process for the proposed Tinley Manor South Banks Coastal Development in late 2011. Various specialist reports informed this on-going process, including an Estuarine Impact Assessment for the Umhlali Estuary, and provided the required context. Tongaat Hulett Developments also requested, at the initial base line stage of the assessment, that the various specialist reports be reviewed to identify any shortfalls or potential fatal flaws from a coastal management perspective. This was undertaken and informed all the updated reports and is therefore no longer included in this updated assessment (full re-write of this specialist report). This report has since been updated following the stakeholder engagement process.

2. DETAILS OF THE PROJECT TEAM

The initial assessment was undertaken collectively by Tandi Breetzke and Luke Moore with Tandi Breetzke undertaking the February 2017 update of the report. Tandi has since left Royal HaskoningDHV and formed her own consultancy, namely Coastwise Consulting.

Tandi has more 20 years of general and 13 years of specialised coastal management, governance and environmental experience. She is a member of IAIAsa and EAPASA, as well as a member of the WESSA affiliated coastal NGO, Coast Watch and a long-standing member of the South African Blue Flag Jury. Tandi's experience mirrors the South African coastal experience. Initially developing governmental policies, practices and procedures and now, as a consultant, in implementing integrated coastal management principles. As a government official, Tandi set international best-practice and now continues that trend by building on partnerships developed in government and winning top awards both internally and within the profession as a whole. Tandi jointly prepared a user-friendly guide to the ICM Act in public/private partnership with the National Department Environmental Affairs, won the IAIA 2010 Premier Award and was a finalist in the KZN Business Woman's Association Business Achievers Awards. She was previously employed by Royal HaskoningDHV where she was recognised as a leading professional. Tandi is now trading as Coastwise Consulting and is offering specialised consulting services.

Luke Moore was a senior environmental consultant specialised in coastal management and spatial planning working for Royal HaskoningDHV. Luke has since left Royal HaskoningDHV and is employed as an urban expert in spatial planning and coastal zone management by ICLEI. Luke's work experience encompasses a wide range of environmental planning and sustainability projects including coastal management programmes, development concept planning, coastal sensitivity and development feasibility assessments as well as coastal specialist comments. Luke is a registered member of the Society of South African Geographers (SSAG) and the IAIAsa. Luke holds a Bachelor of Arts degree in Geography and Environmental Science from Rhodes University as well as an Honours degree (*cum laude*) in Geography and Environmental Management from the University of KwaZulu-Natal.

3. SCOPE AND PURPOSE OF THE SPECIALIST REPORT

Given the detailed nature of the original coastal development feasibility study undertaken in 2010, an addendum to this original report (which has since been redrafted in its entirety by this report and updated in May 2017), which assessed the potential impacts of the proposed development, was deemed to satisfy the requirements of the required coastal impact assessment component of the application for environmental authorisation (reference DC29/0019/2011). This assessment deals with issues relating to *inter alia* integrated coastal management, risk in relation to coastal erosion, sea-level rise (SLR), potentially unstable coastal geology, coastal access as well as development feasibilities (Table 1). Issues relating to boardwalks as well as the location of sewer pump stations have been included in addition to other coastal specific requirements, as detailed in the rejection letter dated 8 June 2016.

Table 1: Summary tabled of coastal specific requirements and responses

	Comment/required amendment	Response
1	Update report based on revised layout (include comparative assessment of layouts)	Report updated taking cognisance of revised layout and comparative assessment provided (Table 4 and Figure 5)
2	Provide impact assessment around location of the sewer pump station on the boundary to the coastal dune forest (include the secondary containment facility in the extent of the station)	impact assessment provided
3	Final inclusion of the construction method around the boardwalks and the impact assessment, paths, widths, etc.	indicative requirements to inform construction method to be submitted by contracted and approved by Environmental Control Officer (ECO) provided
4	Proximity of resort to the coast as well as beach access	Detail in respect to proximity and access points provided
5	Proposed development in sensitive areas and no-go zones	Additional direction provided in respect to proposed activities in sensitive coastal environments and identification of no-go zones
6	Various amendments in the draft EMPr	Amendments included.
7	Clarification to be provided in respect to coastal management lines, set-back and limited development lines	Clarification provided in the report and clearly illustrated. It should be noted that specific distances between the proposed coastal setback line and limited development lines are modelled and are therefore not consistent. These are included in the amended layout and have fully informed the location of the proposed development.

Requirement amendments and responses following the stakeholder engagement process are included in table 2 below.

Table 2: Summary table of coastal specific comment requiring amendment in this report

	Comment	Response
1	Boardwalk construction methodology to be included	Narrative method statement included.
2	Exclude proposed beach enhancement (subject of alternate EIA and not part of this proposal) from impact rating related to beach amenity etc.	Linkages between the proposed Tinley South Coastal Development and the proposed Tinley beach Enhancement expanded upon impact rating reviewed.
3	Update on progress with KZN Coastal Management Line determination	Update on progress made included.

4. DESCRIPTION OF THE METHODOLOGY

The objective of this coastal impact assessment report is to incorporate a coastal specific assessment of the impacts of the proposed development identified as part of the subsequent development planning process. This includes:

- An evaluation of the potential impacts (direct, indirect, cumulative, positive and negative) associated with the proposed development concepts that constitute the development planning report for the Tinley Manor South Banks Coastal Development; and
- Recommendations and mitigation measures with respect to the impacts identified above.

5. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The Tinley Manor South Banks Coastal Development (hereafter referred to as 'the development') consists of a proposal by Tongaat Hulett Development to develop a currently commercially farmed 484 ha site, located within the KwaDukuza Municipality, into a mixed-use coastal development, which includes large residential, commercial, social, open space and a single resort component.

The proposed development is centred upon the site's exceptional natural and physical attributes which includes, *inter alia*, 3.5 km of river frontage on the uMhlali Estuary (Figure 1). The 484 ha site also includes approximately 2.5 km of shoreline, which abuts the Indian Ocean, and includes segments of coastal dune forest. The proposed development, which will require new road and service infrastructure including electricity, sewer reticulation and water supply, is proposed as detailed in Table 3.

Table 3: Breakdown of proposed land use zones

	LAND USE	DETAILS	TOTAL SITE AREA (ha)	% OF TOTAL AREA	TOTAL NO RESIDENTIAL UNITS
Residential	Special Residential	Special Residential 1500m^2	**24,56**	5%	**147**
	Special Residential	Special Residential 1000m^2	**23,72**	5%	**237**
	Special Residential	Special Residential 600 / 800m^2	**18,55**	4%	**260**
	Medium Density Residential	Planned Unit Development (25units/ha)	**44,78**	9%	**1 120**
	High Density Residential - Town Centre	Planned Unit Development (75 units/ha) with 10% commercial	**3,56**	1%	**267**
	High Density Residential	Planned Unit Development (75 units/ha)	**14,66**	3%	**1 222**
Resort	**Resort / Hospitality**	Hotel with Entertainment	**12,00**	2%	-
Commercial	Retail 1 (MU)	Mixed Retail, Office and Residential Node	**20,46**	4%	**1 279**
	Retail 2	Low Impact Retail and Entertainment Mixed Use for Beach Node	**5,36**	1%	-
Social	Education	FET College or School	**12,43**	3%	-
Open Space	Private Open Space	Parks within Residential Areas	**5,50**	1%	-
	Conservation	Wetlands, Estuary, Coastal Zones, Grasslands including buffers	**246,35**	51%	-

Utilities	Road	All roads	**52,31**	11%	-
	Grand Total		**484,23**	-	**4 531**

The proposed development capitalises on the undulating landscape, wetland areas and coastal vegetation as part of an eco-centric design concept, which includes both direct and indirect interactions with the Umhlali Estuary and shoreline, through the numerous drainage lines, wetland areas, coastal forests and vegetated dunes. The 2016 block layout is provided (Figure 2) as is the updated composite block layout plan, as amended, is provided (Figure 3) as is the updated overall engineering layout detailing environmental layers including wetland crossings (Figure 4).

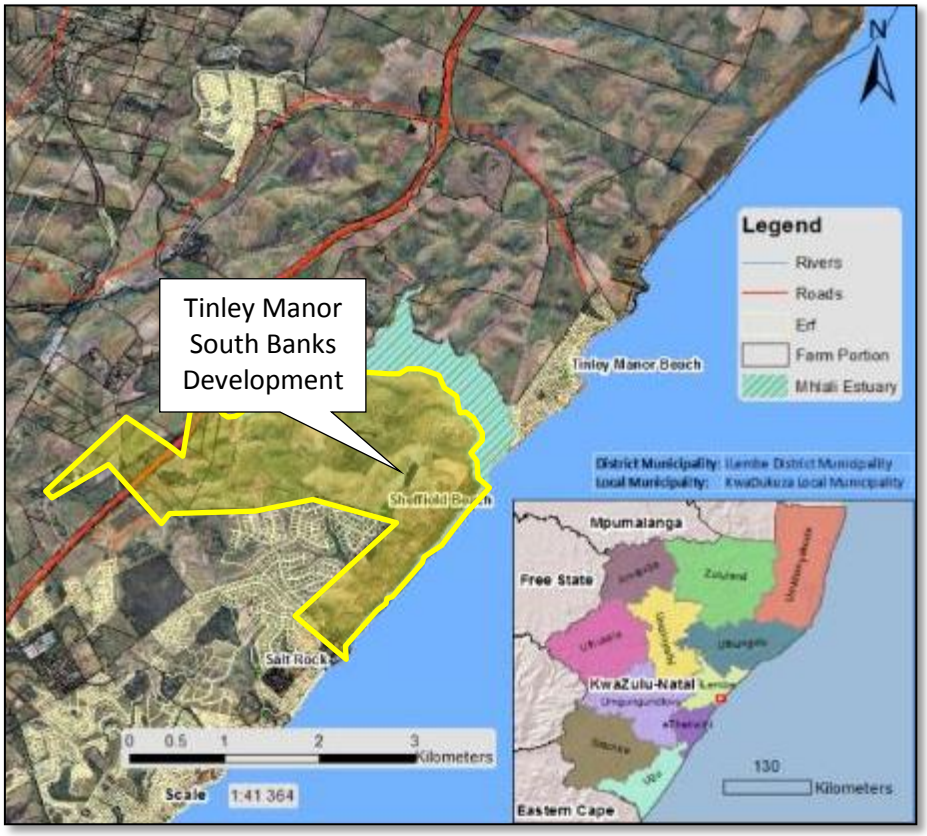

Figure 1. Location of the Tinley Manor South Banks Development site and the Umhlali Estuary

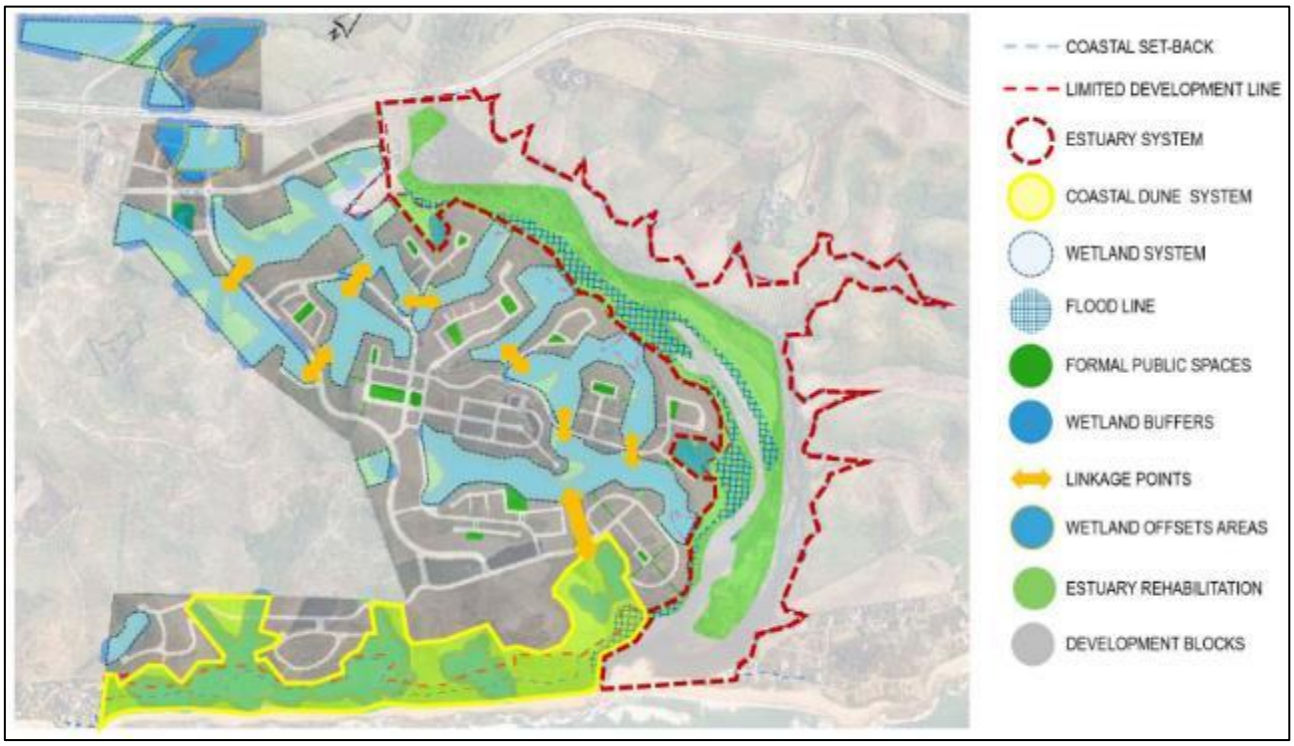

Figure 2: 2016 Development Block Layout

Figure 3: Composite Tinley Manor South Banks block layout plan, 2017

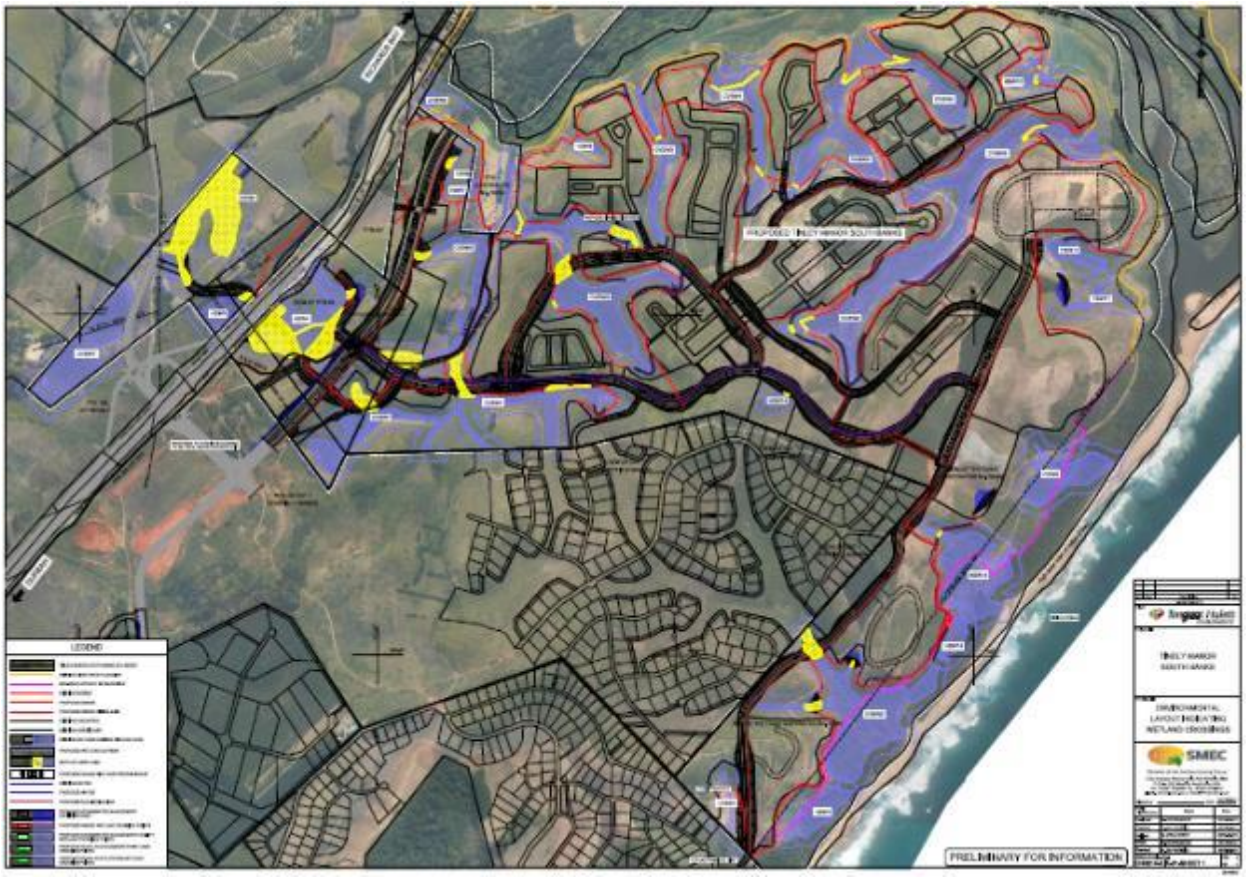

Figure 4: Tinley Manor South Banks Overall Engineering layout, 2017

6. CHANGES IN THE LAYOUT FROM THE FINAL EIAR TO THE AMENDED EIAR

Changes to the layout included in the final EIAR are detailed as follows and presented spatially in Figure 5 below and discussed in more detail in Table 4:

- Road reserve for all major roads widened slightly along the length of the road, all polygons were 'shaved' to reflect the new road reserve ①;
- The road in the south-east corner was amended to facilitate a connection to the neighbouring settlement ②;
- The main access road north-south reclassified as a Class 3 road, therefore no access permitted to adjacent sites, Retail 1 site extended south to accommodate access off main east-west spine ③;
- Indicative future link options to neighbouring settlements ④;
- Lower coast road widened and realigned ⑤;
- Some minor amendments to block outline based on detailed design explorations ⑥;
- Yields amended to reflect more detailed work undertaken during the course of 2016 – the number of units therefore increases from 4,336 to 4,532;
- Due to uncertainty regarding use of the Seaton Delaval reservoir, the Tafeni Reservoir is now proposed to service this development. The required upgrades will be submitted in a separate EIA process;
- Due to alignment changes a 600mm diameter steel bulk water main line to the Tafeni reservoir will follow the alignment of the P228 and is proposed to be constructed within the road reserve. *The bulk water main does not form part of this application;*
- Education site inland of N2 now called Community site ⑦;
- An irrigation network and dam is added to the application ⑧;
- The number of Sewer pump stations required was reduced from 4 to 3 with the proposed sewer network layout being slightly amended as a result ⑨; and

- A new stormwater management facilities layout providing for alternative solutions in order to minimize wetland losses and to include a number of swales.

Table 4: Description of the changes to the layout and their applicability to the coastal zone

DOCUMENTED CHANGES	APPLICABILITY
LAND USE PLANNING:	
Road reserve for all major roads widened slightly along the length of the road, all polygons were 'shaved' to reflect the new road reserve ①	Not specifically applicable to the coastal zone.
The road in the south-east corner amended to facilitate a connection to the neighbouring settlement ②	This amendment will encourage accessibility along the coast as well as access to the coast.
The main access road north-south reclassified as a Class 3 road, therefore no access permitted to adjacent sites, Retail 1 site extended south to accommodate access off main east-west spine ③	Not specifically applicable to the coastal zone.
Indicative future link options to neighbouring settlements ④	Not specifically applicable to the coastal zone.
Lower coast road widened and realigned ⑤	This amendment will encourage accessibility along the coast as well as access to the coast.
Some minor amendments to block outline based on detailed design explorations ⑥	These amendments are all located landward of identified coastal risk.
Yields amended to reflect more detailed work undertaken during the course of 2016 – the number of units therefore increases from 4,336 to 4,532	The increase in the number of units could imply potential additional solid waste and stormwater run-off but all potential impacts are adequately mitigated.
ENGINEERING STRUCTURES:	
Bulk Water Line - The bulk waterline alignment changed from the Seaton Delaval Reservoir to the Tafeni reservoir. bulk water main will follow the alignment of the P228 and be constructed within the road reserve. The bulk water main does not form part of this application.	Not specifically applicable to the coastal zone.
Sewer - The number of sewer pump stations required was reduced from four to three pump stations. Subsequently, slight changes in the sewer network layout were made. ⑨	The impact of the location of one of the sewer pump stations in proximity to the coastal zone assessed and mitigation measures proposed.
Irrigation - An irrigation network and dam have been added to the application ⑧	Not specifically applicable to the coastal zone.
Stormwater Management Facilities (SWF) - The stormwater management facilities layout was changed completely. Alternative solutions had to be found in order to minimise wetland losses. A number of swales have been included in the Storm Water Management Plan.	
Road Layout - Slight modifications to the road layout (as also captured in the block layout). This includes: ▪ Possible cross connections into Seaton Delaval ④ ▪ Road reserve for possible extension of Colwyn drive to allow another access point ② ▪ Realignment of the beach road (this provides the 3rd possible access to Seaton Delaval) ⑤ ▪ Widening of road reserves to align with Traffic Impact Assessment ① ▪ Provision of wide enough road reserve for the KwaDukuza District Municipality future planned North South Link Road ①	Amendments will encourage accessibility both to and along the coast as well as support physical access to the coast.

Figure 5: Annotated changes to the composite block layout plan

Further amendment to the block layout plan has been made in response to EIA commenting period in May 2017 to include the cul-de-sac adjacent to Colwyn Drive and the location of floating jetties associated with the proposed boardwalk.

It is noted that the overall concept continues to propose, as previously, the optimal development of the site without compromising its environmental character and function. The updated design continues to capitalise on the undulating landscape, wetland areas and coastal vegetation as part of an eco-centric design concept, which includes both direct and indirect interactions with the Umhlali Estuary, through the numerous drainage lines, wetland areas, estuary and the shoreline. The single resort node proposed, currently at conceptual stage only, is located adjacent to the coast approximately 200 m inland. Pedestrian access from this node to the beach is proposed via boardwalks, with such boardwalks being elevated when crossing sensitive dune areas. Possible construction methods, impact assessment and mitigation measures are provided. It should be noted that any changes to the natural topography of the dunes should be avoided and their dynamic nature must be taken into consideration. The location of the resort node, access and boardwalks (conceptual only) in relation to the coast is shown in Figure 6.

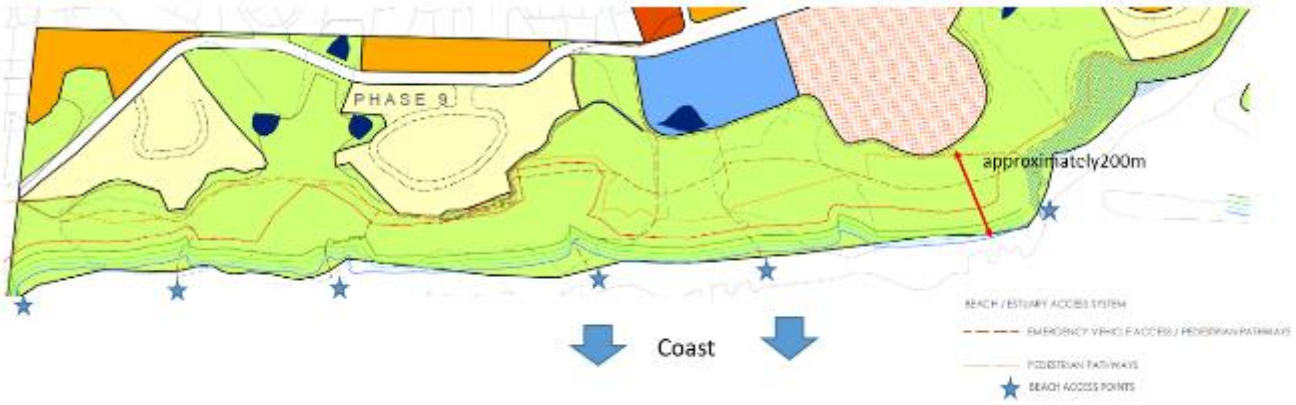

Figure 6: Location of Resort node, coastal access and boardwalk alignment in relation to the coast

7. POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

7.1.Legal Requirements

7.1.1. National Environmental Management Act

According to the National Environmental Management Act (Act 107 0f 1998) (as amended) (NEMA), environmental authorisation must be obtained from the relevant competent authority, in this case the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA), for the proposed development and associated listed activities[1] through an Environmental Impact Assessment (EIA) process. The purpose of an EIA is to determine whether there are any fundamental negative impacts which may result from the proposed development activity and which cannot be effectively mitigated. The report is then submitted to the competent authority to inform their decision to grant/not grant approval for the project, as well as specific conditions to mitigate negative impacts, should authorisation be granted.

7.1.2. Integrated Coastal Management Act

The Integrated Coastal Management Act of 2008 (Act No. 24 of 2008 as amended) (ICM Act) emanate from the White Paper for Sustainable Coastal Development in South Africa, 2000, and propose to inter alia, establish a system of integrated coastal and estuarine management. The enactment and subsequent enforcement of this landmark legislation firmly establishes integrated coastal management as the preferred vehicle for the promotion of sustainable coastal development in South Africa. This is promoted through directives in terms of the conservation and maintenance of the natural attributes of the coastal environment concomitant with development that is sustainable as well as socially and economically justifiable. It defines the rights and responsibilities of all coastal stakeholders, including those of organs of State, and gives effect to South Africa's international responsibilities in respect to coastal pollution. The ICM Act aims to facilitate the implementation of the principles and guidelines presented by the White Paper and has a number of objectives including:

- The provision of a legal and administrative framework to promote cooperative, coordinated and integrated coastal management;
- The protection of the natural coastal environment as a national heritage;
- The management of coastal resources in the interests of the whole community;

[1] Listing Notice 1 Activities (GNR. 544 of 2010), Listing Notice 2 Activities (GNR. 545 of 2010) and Listing Notice 3 Activities (GNR 546 of 2010)

- The promotion of equitable access to the resources and benefits provided by the coast; and
- The fulfilment of South Africa's obligations under international law.

The ICM Act requires that activities that are potentially harmful to the coastal zone are considered as part of the NEMA EIA processes. The competent authority needs to consider, amongst others:

- If coastal public property, coastal access land or the coastal protection zone will be affected by the proposed action;
- Estuarine management plans, Coastal Management Programmes, coastal management lines and coastal management objectives;
- The socio-economic impact if that activity or action is authorised or not authorised;
- The likely effect of dynamic coastal processes (such as wave, current and wind action, erosion, accretion, sea-level rise, storm surges and flooding) on the activity; and
- Whether the development of activity is likely to cause irreversible or long-lasting adverse effects on the coastal environment that cannot be properly mitigated; will prejudice the achievement of any coastal management objective; or will not be in the interests of the community as a whole.

7.2. Current Impacts

Whilst the area under study is currently undeveloped, historical land use and practices have resulted in a number of negative environmental impacts and almost complete land transformation (Table 5). The Impact Assessment section must be viewed against the backdrop of these pre-existing impacts.

Table 5. Human-induced threats to the proposed development area

THREATS	DESCRIPTION
1. Habitat loss	Extensive commercial sugarcane plantations with only fragmented natural habitat remnants.
2. Sense of place	Natural coastal grassland and forest largely replaced by commercial sugarcane.
3. Loss of wetlands	Wetlands particularly affected through agricultural practices ('herringbone' drains).
4. Eutrophication & chemical contamination	Increased nutrient loading to terrestrial and aquatic resources from agricultural activities has long-term negative impacts.
5. Introduced species	Disturbance of natural areas via sugarcane agriculture increases the probability of the occurrence of invasive alien species (IAPs).
6. Coastal access	Limited incursions onto sensitive beach and estuary environment for pedestrian access.

7.3. Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to it nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- ***Nature:*** A brief written statement of the environmental aspect being impacted upon by a particular action or activity;
- ***Extent:*** The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- ***Duration:*** Indicates what the lifetime of the impact will be;
- ***Intensity:*** Describes whether an impact is destructive or benign;
- ***Probability:*** Describes the likelihood of an impact actually occurring; and

- ***Cumulative:*** In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Table 6: Criteria to be used for the rating of impacts

Criteria	Description			
EXTENT	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site
DURATION	**Permanent (4)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (3)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (2)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase
INTENSITY	**Very High (4)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**High (3)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Moderate (2)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (1)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILITY OF OCCURRENCE	**Definite (4)** Impact will certainly occur	**Highly Probable (3)** Most likely that the impact will occur	**Possible (2)** The impact may occur	**Improbable (1)** Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 7: Criteria for the rating of classified impacts

	Class	Description
+	Any value	**Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.**
–	Low impact (4 -6 points)	**A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.**
	Medium impact (7 -9 points)	**Mitigation is possible with additional design and construction inputs.**
	High impact (10 -12 points)	**The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.**
	Very high impact (12 - 14 points)	**Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.**
Status		**Denotes the perceived effect of the impact on the affected area.**
Positive (+)		**Beneficial impact.**
Negative (-)		**Deleterious or adverse impact.**
Neutral (/)		**Impact is neither beneficial nor adverse.**
It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.		

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

7.4. Impact Assessment

This section considers potential impacts that could affect the study area because of the proposed development. It is noted that this assessment is applicable to the development component that is specifically coastal in nature, i.e. the eastern boundary that borders the Indian Ocean and the area immediately inland of the vegetated dune cordon.

It is necessary to assess the potential impacts of the proposed development in order to minimise environmental degradation of natural elements of the system and to formulate and implement appropriate mitigation measures. With proactive and adaptive management, the impacts can be avoided or will be greatly reduced in terms of their extent, duration and overall significance. In this section, the potential impacts are assessed and rated in terms of their potential direct, indirect and cumulative effects. Mitigation measures to minimise the potential negative impacts are provided thereafter.

It is noted that this coastal impact assessment has been amended on numerous occasions and has now been updated to reflect amendments made specifically as a result of the rejection of the application dated 8 June 2016 and the change in layout. All effort will be made below to adequately reflect this process adequately.

7.4.1. Climate Change Vulnerability

The coastal location of the proposed development means that it is inherently exposed to risks associated with natural and dynamic coastal processes. This is exacerbated by the study area's proximity to the Mhlali River estuary which adds the additional risk factor of terrestrial flooding. These factors have far-reaching and significant impacts for the sustainability of any development proposed in the coastal area, and were taken into account both during the feasibility assessment and at the earliest stages of the development planning concept by means of the delineation of a hazard line and limited development line.

The coastal hazard line was determined by initially calculating the wave run up position along the coast based on a chosen offshore wave height and return period using an offshore 1:10 year wave height of 7,1 m combined with three scenarios of anticipated sea level rise, namely 300 mm, 600 mm and 1000 m. For this step a sea level rise scenario of 1m was adopted. The next two steps entailed a slip failure analysis and the addition of a calculated 20 m allowance of shoreline retreat to reflect a typical short term storm erosion buffer. Step four determined the long term erosional trends of the shoreline, which is this instance was zero considering this stretch of shoreline is relatively stable. The limited development line was thereafter calculated considering the environmental assets along the coast and included all important coastal habitats landwards of the coastal hazard line.

This approach was aligned with national and provincial thinking at the time in respect to the application of the then proposed coastal set-back line or now, coastal management line methodology and best-practice risk aversion within the coastal zone in a South African context. An additional known risk factor within the KwaZulu-Natal coastal zone taken into consideration is the potential for geologically unstable areas to 'slip' or fail due to, *inter alia,* an advancing high-water mark because of coastal erosion. This has the potential to further negatively impact the sustainability of developments proposed in the coastal zone.

The provincial lead agent for coastal management in KwaZulu-Natal is currently leading a pilot study to determine coastal management lines (CML) for the KZN province, using the Tinley Manor area and it surrounds as one of the case studies. It is anticipated that this process will be guided by both the National Guideline (soon to be finalised) as well as a similar process being undertaken in the Western Cape province. In that instance risk is modelled and delineated as short term risk (1:20 year storm event and a 20cm prediction of sea level rise); medium term risk (1:50 year storm event and a 50cm prediction of sea level

rise); and long term risk (1:100 year storm event, a 100cm prediction of sea level rise and any additional littoral active zones). The draft CML is thereafter informed by these projections of risk, spatial information on ecological or other sensitivities adjacent to the coast, as well as the location and extent of existing development and existing executable development rights. It should be noted that in the Western Cape, distinction is made between developed area versus undeveloped areas with the CML following followed the landward boundary of the modelled long term risk projections or areas identified as sensitive from a coastal perspective. These sensitive areas include Critical Biodiversity Areas (CBA) and Ecological Support Areas (ESA) related to coastal processes, as well as large wetland areas functionally part of the coastal zone as illustrated in Figure 7.

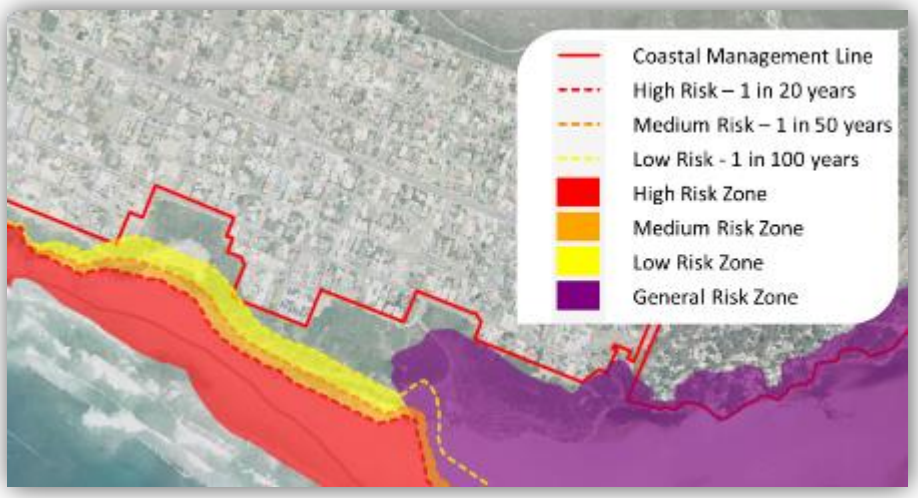

Figure 7: Example of Western Cape Coastal Management Line delineation process showing risk zones (taking cognisance of critical biodiversity areas adjacent the estuary and modelled risk adjacent the coastal zone) and draft coastal management line (Western Cape Government, 2015)

For ease of reference the 3 anticipated sea level rise scenarios are included and can be used as a proxy for risk, until the above pilot process is completed as is detailed below. It is also anticipated that the CML will follow the limited development line, as included in the initial feasibility assessment. As such, the proposed development footprint, in addition to all services has taken cognisance of this delineation and is appropriately setback.

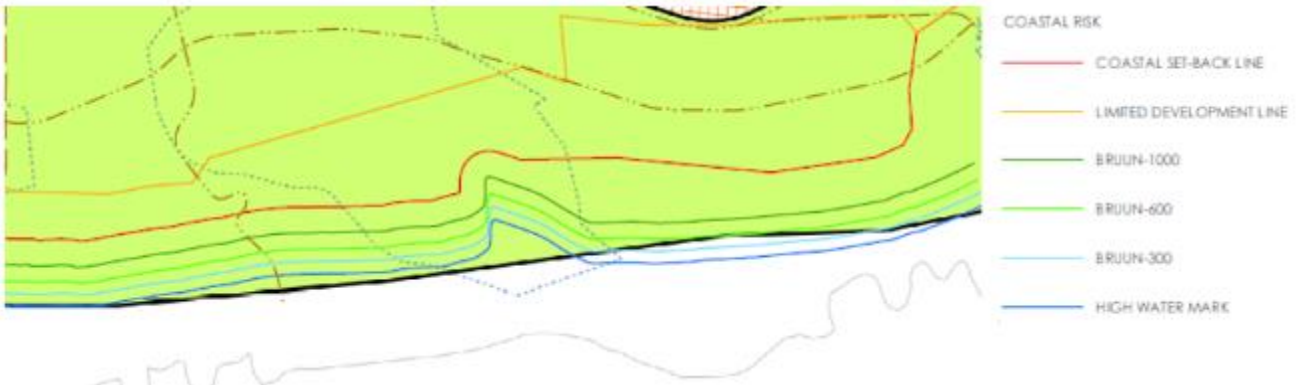

Figure 8: Three sea level rise scenarios deemed to be used as a proxy for the anticipated risk zones in respect to the proposed development of the Tinley South Coastal Development (The Markewicz Redman partnership, 2017)

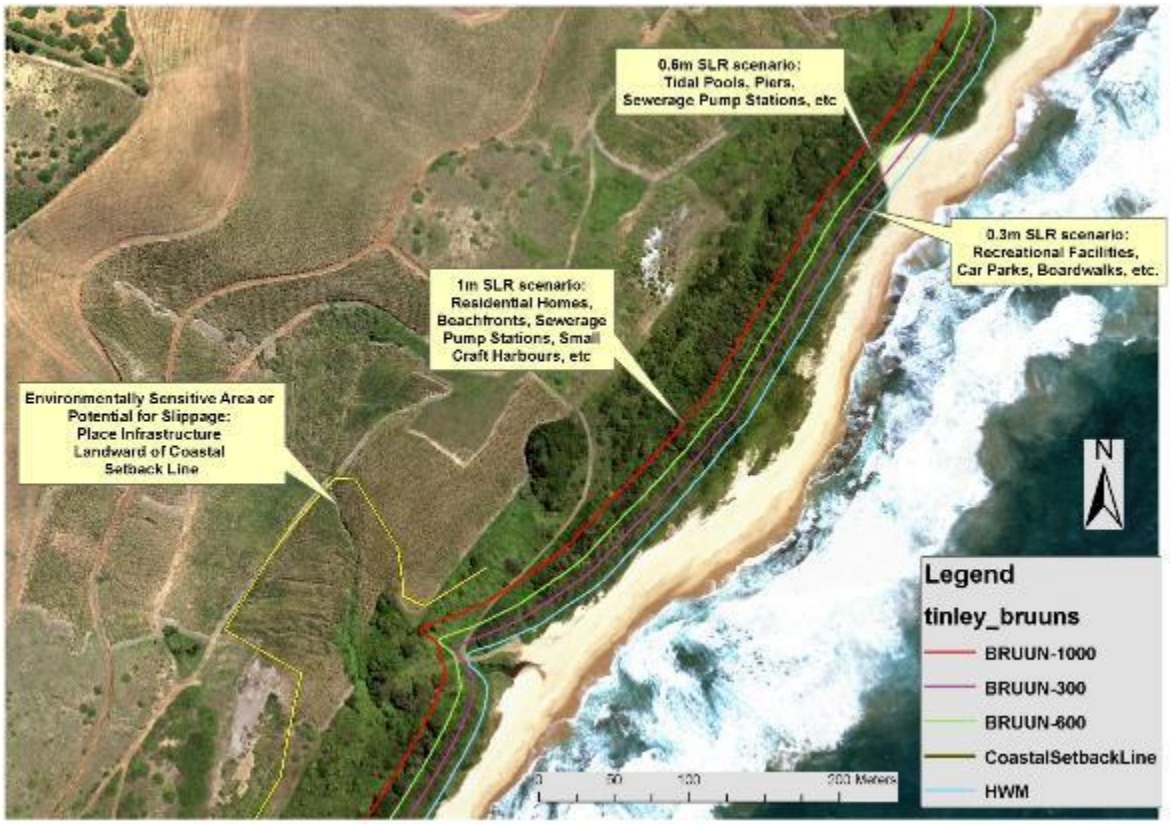

Figure 9: Three sea level rise scenarios as well as areas potentially identified for slippage and incorporated within the proposed limited development line (Mather and Swart, 2010)

It is noted that no development is proposed within coastal public property, as illustrated in Figure 10, which in this instance is the coastal area seaward of the High-Water Mark.

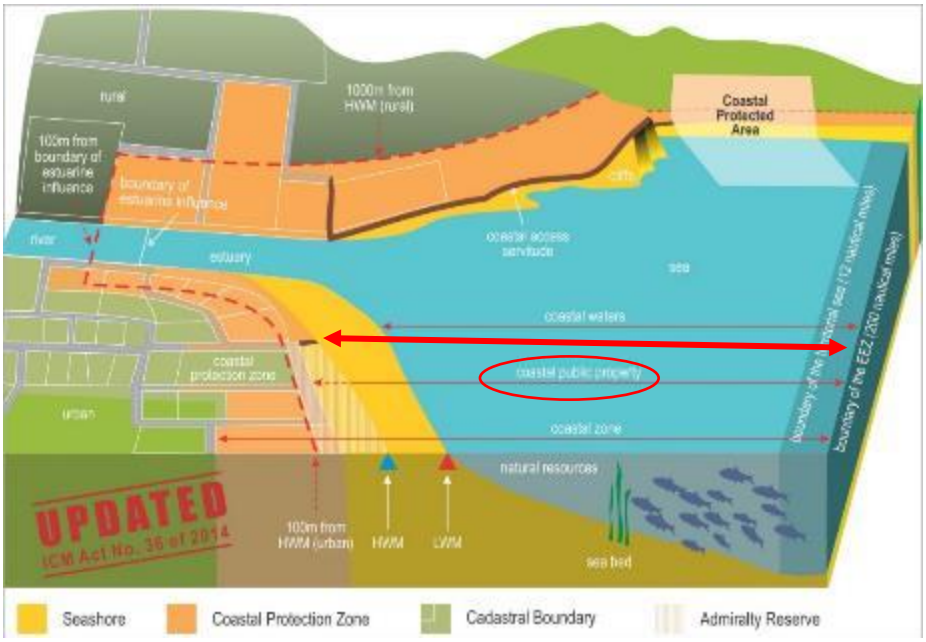

Figure 10: Coastal Zones as per the Integrated Coastal Management Act highlighting the boundaries of Coastal Public Property

The KZN Coastal Management Line pilot study, mentioned above, has since progressed with a meeting held on the 9th of May 2017 where appointed coastal engineers reported back on the refined process sea level rise modelling process. It is noted that this was because of refined bathymetry being made available by Tongaat Hulett Developments, this process has been able to progress with modelling refined for the Tinley Manor area. Outputs reported on related specifically to Tinley Manor included wave modelling (climate); wave extraction points; bathymetry; simulated sea level rise scenarios; as well as wave run up ranges.

Short-term storm erosion estimates were made as follows:

- Baseline Scenario: Average erosion distance = 0 m
- SLR Scenario 1: Average erosion distance = 0 m
- SLR Scenario 2: Average erosion distance = 20 m
- SLR Scenario 3: Average erosion = 35 m

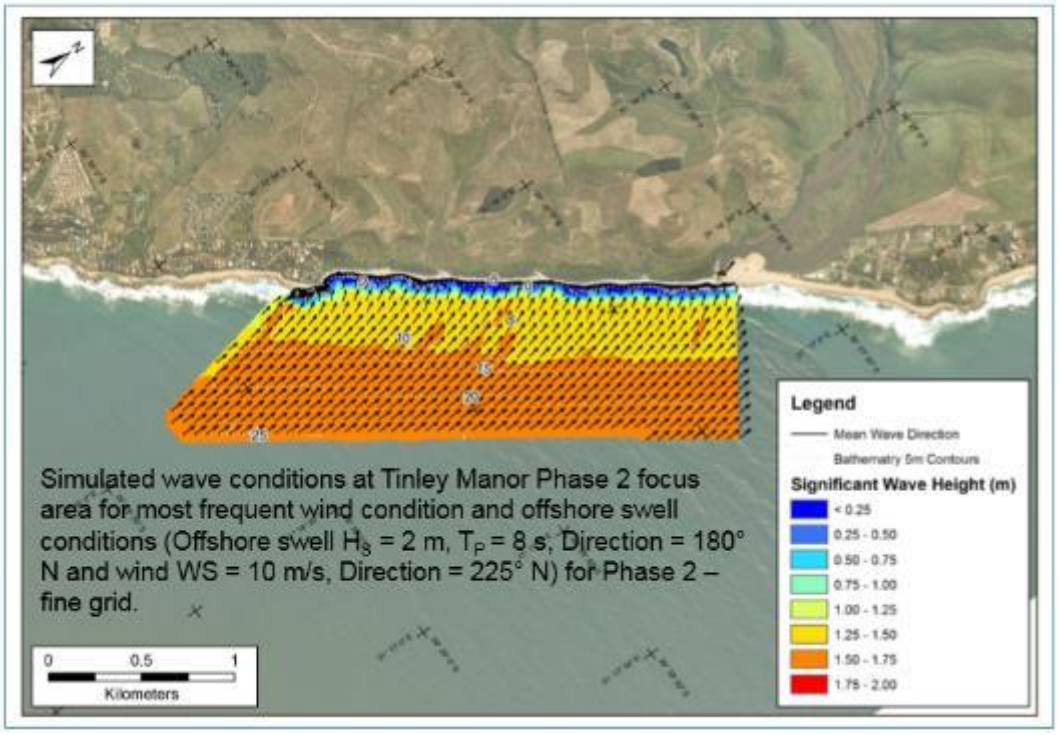

Figure 11: Wave modelling – climate (Advisan 9 May 2017 presentation)

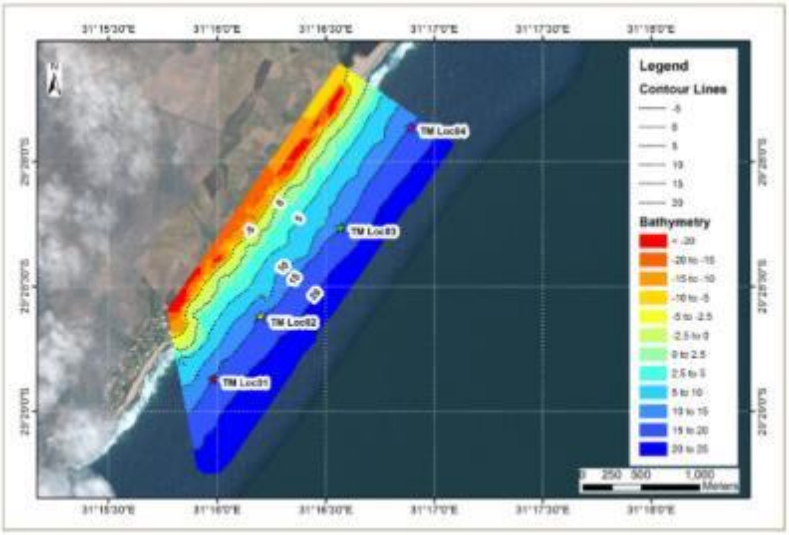

Figure 12: Wave extraction points and bathymetry (Advisan 9 May 2017 presentation)

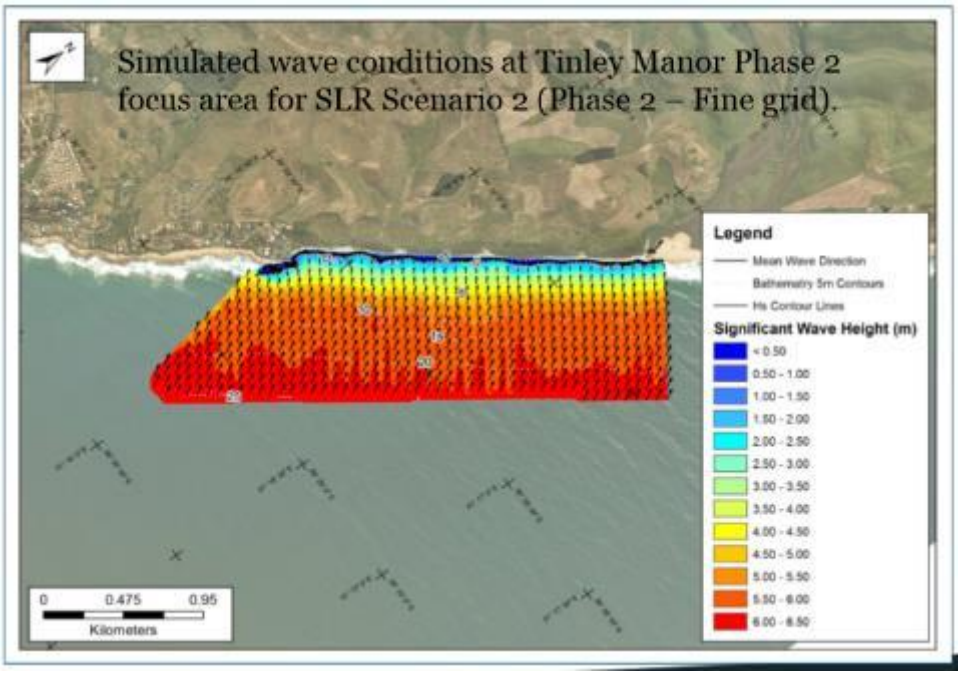

Figure 13: Wave modelling: Sea level Rise scenarios (Advisan 9 May 2017 presentation)

Table 8: Wave runup ranges and long term ranges (Advisan 9 May 2017 presentation)

Modelling Scenario #	Sandy Beach	Rocky Beach
	Mather wave run-up (m)	EurOtop wave run-up (m)
Baseline	1.4 – 2.3	0.3 – 2.3
Scenario 1	2.7 – 4.2	0.5 – 3.2
Scenario 2	4.0 – 6.4	0.7 – 4.6
Scenario 3	6.4 – 10.0	1.1 – 7.6

Modelling Scenario #	Shoreline retreat (m)
Baseline	0
Scenario 1	1.7 – 3.3
Scenario 2	4.8 – 9.6
Scenario 3	14.6 – 29.1

It should be noted that Dr Andrew Mather, representing eThekwini Municipality in the pilot exercise, but also the coastal engineer who undertook the Tongaat Hulett Developments Setback Line modelling, believed such estimates to be too conservative. This is of particular relevance when considering the long-term shoreline evolution (Figure 14) provided by Advisan and the comment made that this coastline was predominantly stable as was evidenced from as far back as 1937.

The level 3 scenario depicted in red in Figure 15 and Figure 16 is therefore considered to be too conservative and will be reviewed.

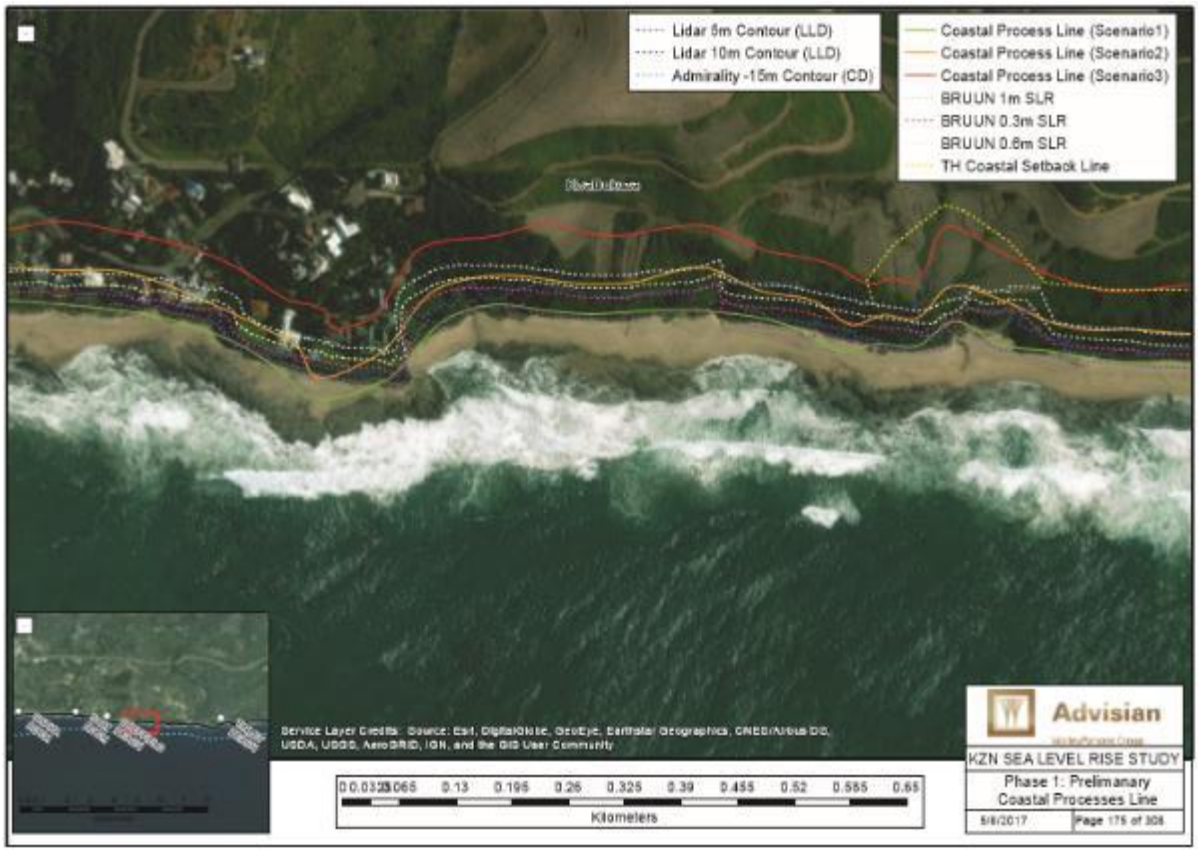

Figure 14: long term shoreline evolution (Advisan 9 May 2017 presentation)

Figure 15: Sea level Rise modelling (Dr Andrew Mather dotted lines, 3 Advisan scenarios and Tongaat Hulett Developments Setback Line)

Mitigation:

Adherence to the aforementioned limited development line (i.e. setting back any proposed development from the coast) and the maintenance (and potentially rehabilitation/re-establishment) of natural coastal vegetation/coastal forests should prove adequate mitigation against the impacts of dynamic coastal processes and vulnerability to climate change. It is noted that the sea-level rise modelling exercise that informed the delineation of the hazard line and limited development line included the identification of areas with unstable geology that are prone to slippage/failure.

Implementation:

Mitigation measures proposed above have been taken into consideration and the layout plan adjusted to set-back from identified coastal risk.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without	Negative	Regional	Long term	High	Probable	-11	High
		2	3	3	3		
With	Positive	Local	Long term	Low	Improbable	+6	Positive
		1	3	1	1		

Figure 16: Sea level Rise modelling (Dr Andrew Mather dotted lines, 3 Advisan scenarios and Tongaat Hulett Developments Setback Line)

7.4.2. Pollution

Solid waste will be generated by day-to-day construction as well as operational activities and may include, but will possibly not be limited to, concrete rubble and bricks, material off-cuts and other surplus construction and other materials. If not properly managed and contained, these items may find their way

into drainage lines, wetlands, and other remaining natural areas and eventually into the coastal zone where they will not only pollute, but also impede flow and the ecological functioning of these habitats. Unwanted vegetation off-cuts, including large tree stumps, will also pose a threat to such habitats through physical damage, if not handled correctly, or through decomposition, which has the potential to result in nutrient enrichment.

Similarly, to contamination by means of solid waste, liquid pollution may result from accidental spillage of fuels, oils, cement–laden water, curing compounds, sealants, paints and other chemicals. These materials are all associated with day-to-day construction activities and are common throughout construction sites. This pollution can be transported as contaminated run-off into the soil and groundwater systems. In terms of sanitation infrastructure, historical practices in coastal areas, such as the installation of septic tanks and the illegal connection of sewage disposal and stormwater systems, can have severe negative pollution impacts. In the latter amendments to the engineering design, a sewer pump station and accompanying containment facility /overflow pond is proposed (Figure 17). The installation of waterborne sanitation adjacent to the coastal zone, while preferable to the installation of other systems, is still fraught with potential impacts as a result of sewer pump station malfunction as a result of numerous factors (power failure, varied yields etc.). Its location outside of the coastal zone and identified adjacent sensitive areas is commended considering the generally accepted economic and design need to locate such infrastructure at the lowest point.

Figure 17: Proposed sewer pump station adjacent the non-development setback line (SMEC, 2017)

Furthermore, the proposed design concept incorporates a "flexible open space system" which may comprise active recreation areas (sports grounds), and passive recreation areas (seating areas, viewing points), where conditions are suitable. In such instances, fertilizers and insecticides are likely to be applied, which is also applicable to landscaping and general maintenance of resort and residential gardens that are sure to be implemented. Certain chemicals (e.g. some organophosphates like Chlorpyrifos and Diazinon), are known to adversely affect aquatic biota, particularly fish. Pesticides are largely indiscriminate, resulting in the die-off of numerous organisms. These would likely enter watercourses through surface run-off. The use of such chemicals to manage and maintain the vegetation, including lawns, is thus strongly discouraged. Endemic vegetation and grass species should be planted as part of the landscaping scheme, as these are adapted to local conditions and would not require chemical maintenance.

Mitigation:

The establishment of site construction camps should be kept to a minimum. All site camps and storage areas for any development must be sited away from drainage lines, wetlands, steep slopes and other environmentally sensitive areas and outside of dune forests and the coastal zone as a whole. An appropriate

buffer should be applied around sensitive areas with such areas preferably being zoned as no-go areas. Most importantly, construction and associated activities must be undertaken according to a site-specific approved Environmental Management Programme (EMPr) and must be monitored daily by an on-site environmental officer. All solid waste must be removed as soon as possible from each construction point and the broader development site to an appropriate disposal facility. Dumping of vegetation off-cuts in aquatic habitats and other sensitive areas should be prohibited. Regular monitoring of the periphery of construction camps must be undertaken and any accumulated waste removed and disposed of at an appropriate disposal facility.

The EMPr should make provision for the use, handling, storage and disposal of all chemical and contaminated waste and a site-specific method statement must be compiled by the appointed contractor(s) and submitted for approval by the ECO. All chemicals must be stored in specifically demarcated and secured areas, which are suitably lined to avoid any contamination. A Spill Contingency Plan for accidental spillages of chemical substances must also be developed. No discharge of any pollutants, such as fuels, cements, concrete, lime, and chemicals should be allowed into any aquatic or coastal habitats. Regular water quality monitoring of all waster courses and wetlands must be undertaken for the early detection of harmful substances. In the event of an accidental spill from any construction contractor, resident or hotel operator, a penalty should be issued and the 'polluter pays' principle applied for clean-up operations and rehabilitation. Best practice building standards should be applied to prevent spillages.

Waterborne sanitation infrastructure, which in this instance has been applied over discrete infrastructure such as septic tanks, soak pits and French drains. The location of one of the proposed pump stations adjacent the no-development set-back line is proposed to be mitigated via the construction of an overflow pond. This pond should be maintained in the manner designed in order that it can perform its function. A stand-by generator must be installed at the pump station and should also be maintained in correct working order. Under no circumstances must stormwater and sanitation infrastructure be linked such that sewage and stormwater are mixed. It is acknowledged that the infrastructure proposed complies fully with these requirements.

Pesticides must not be applied to the grounds of the proposed development. If the use of chemicals is deemed necessary, a trained aquatic scientist and horticulturalist should be consulted in order to determine what chemicals may be used, in what quantities and during which seasons.

These mitigation measures are not limited to the construction phase, and must be incorporated into an operational phase EMPr where applicable.

Implementation:

Waterborne sanitation is proposed to be implemented. The additional residential areas and road network proposed to be developed could imply potential additional solid waste and increased contaminated run-off which would need to be mitigated as detailed above. The move away from the previously proposed agricultural concept implies reduced negative impacts from fertilizers and pesticides.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Local	Medium term	High	Possible	-9	Medium
		2	2	3	2		
With mitigation	Neutral	Local	Medium term	Low	Improbable	6	Low
		2	2	1	1		

7.4.3. Storm water Runoff and Contamination

Comment: Construction activities associated with mixed-use, residential and resort development, as proposed, generally result in the replacement of vegetated areas or bare ground with impervious or hardened surfaces. This has the effect of preventing natural groundcover from being able to absorb run-off from rainfall and other precipitation, i.e. increased surface run-off with a correspondingly high potential for

soil erosion. A robust stormwater management system has the potential to mitigate this impact, but the 'first flush' emanating from run-off directed through a stormwater system carries many contaminants, particularly oils, fuels and heavy metals from roads, vehicle parking areas and general traffic, as well as litter and debris. This has potentially serious consequences for aquatic and terrestrial systems such as wetlands, streams, estuaries and the remaining naturally vegetated coastal areas. Specifically, toxic substances and solid waste can contaminate these areas. Furthermore, without flow attenuation, the 'first flush' or 'pulse' of stormwater input has the potential to alter river flow, erosion and deposition patterns, and ultimately river channel morphology.

Mitigation:

The Stormwater Management Plan proposes to protect all life and property from damage by stormwater and floods, to prevent erosion of soil by wind and water, to conserve the flora and fauna of the natural environment, to protect and enhance water resources in the catchments from pollution and siltation and to protect and enhance the local and downstream water courses. Mitigation proposed in this plan considers stormwater runoff from the new hardened surfaces as well as flow attenuation prior to reaching the estuary and coastal environment. While the plan calls for appropriate removal of trash and litter, creative means of 'scrubbing' and removing litter and debris from the runoff must be considered by contractors and approved by the ECO. Direct stormwater discharge into the Mhlali Estuary should be prohibited, and any potential influences on the natural functioning of the estuary mouth must be prevented.

Implementation:

The developer proposes to re-establish natural vegetation along drainage lines and restore wetland areas. These systems, in addition to the stormwater management facilities, swales and wetland areas are proposed to be used to capitalise on the natural ecosystem services of filtration ('polishing' of contaminants) and flood control (slowing flow velocities and promoting percolation) prior to entering the estuary. Sustainable urban drainage principles have been applied in the stormwater management plan, as detailed above.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Local to regional	Long term	High	Highly Probable	-11	High
		2	3	3	3		
With mitigation	Neutral/ negative	Site	Long term	Moderate	Possible	-8	Medium
		1	3	2	2		

7.4.4. Soil Erosion

The earthworks and clearing of land associated with construction activity and development in general leads to soil exposure with the potential for erosion and consequent loss of valuable topsoil. While agricultural activity is known to have already depleted the soil component within much of the study area, healthier soils will still exist in the remaining pockets of indigenous vegetation. There is potential for eroded material to be transported from the site via surface water run-off into riparian, wetland and coastal areas that has the potential to result in eutrophication and oxygen depletion due to the nutrient-rich nature of this run-off from agricultural activities, as well as the siltation of the estuary. The potential for erosion is high, given that the land adjacent to the coastal area of the proposed development is currently used for agriculture, in conjunction with its steep topographical nature.

Mitigation:

Best-practice construction methods must be implemented to reduce erosion, particularly in steep areas. This potential impact is easily and significantly reduced if the following mitigation measures are implemented:

- The development layout must take the natural drainage patterns of the site into account, such that buildings and other infrastructure do not concentrate flowing water (especially during high rainfall events);

- Changes to the natural topography must be minimised, and the shape of mature dunes and other natural features must be retained at all costs;
- Wind-screening and sustainable stormwater control should be implemented to prevent soil loss from the site and reduce the formation of erosion channels (e.g. a network of co-ordinated shallow drains should be constructed during the land clearing phase);
- Filter strips (grass buffer strips) must be implemented wherever possible but as a minimum around the perimeter of each development cluster as soon as construction is initiated;
- Sustainable urban drainage methods, such as porous paving techniques and grass swales, must be incorporated into the design concept to assist in flow attenuation;
- The removal of vegetation (on the whole site as well as specifically those areas closest to the coastal zone) must only be undertaken as it becomes necessary for work to proceed and unnecessary removal of indigenous vegetation (especially in steep areas) should be avoided;
- The time that stripped areas are left open to exposure should be minimised wherever possible. Care should be taken to ensure that lead times are not excessive;
- Wind screening and storm water control should be undertaken to prevent soil loss from the site during construction;
- Topsoil must be conserved and re-used for rehabilitation purposes;
- Procedures that are in place to conserve topsoil during the construction phase of the project are to be applied at the set-up phase i.e. topsoil is to be conserved while providing access to the site and setting up the camp;
- The removal of vegetation should only occur just prior to construction;
- Cleared areas should not be left exposed, and should be promptly rehabilitated/vegetated with indigenous plants;
- A storm water management system adjacent to all arterial/rural roads needs to be implemented to reduce runoff and subsequent erosion;
- Landscaping and re-vegetation should take place perpendicular to the slope to reduce flow velocities and minimise erosion; and
- Post construction, all areas disturbed by construction, including the site camp area, must be rehabilitated.

Runoff velocities can be further reduced through reconstruction/reinstatement/rehabilitation of wetland and riparian habitats as directed by a wetland expert. Suitable flow attenuation must be implemented prior to directed flow entering such wetlands to prevent scouring and exacerbated erosion.

Implementation:
Sustainable urban drainage principles have been applied in the stormwater management plan, as detailed above. Other issues have been fully incorporated into the landscape guidelines, also detailed above.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Local to regional	Long term	High	Highly Probable	-11	High
		2	3	3	3		
With mitigation	Neutral	Site	Long term	Moderate	Possible	8	Neutral
		1	**3**	2	**2**		

7.4.5. Protection of Coastal Vegetation & Natural Habitats

The area under study is currently undeveloped, however, historical land use and agricultural practices have resulted in a number of negative environmental impacts and almost complete land transformation. Current negative impacts identified related to potential continued agriculture practices include further habitat loss, continued loss of sense of place, continued drainage of wetlands and potential eutrophication and chemical contamination from farming practices. Remnant coastal forest and riparian vegetation, while protected from

a legislative perspective, could potentially be under threat of transformation through unsympathetic farming practices.

The proposed development concept takes due cognisance of the original coastal feasibility assessment undertaken and previous versions of the impact assessment and depicts and incorporates a number of buffered sensitive coastal areas, highlighting them as environmental assets and no-go areas. The relatively intact vegetated dune cordon has been delineated and development proposed only in those areas where no natural vegetation remains. Furthermore, the environmental assets layer also incorporates areas identified for rehabilitation and expansion and low impact recreation.

The proactive identification of coastal risk (sea-level rise hazard line, proposed limited development line as well as potential slippage areas) , incorporation of above mentioned buffers and the proposed location of development only landward of these lines/areas contributes to the contributes to the mitigation of the potential negative impacts associated with unsustainably located development in the coastal zone associated with this proposed development (see 7.4.1 above). This is most visible in the proposed preservation (expansion and rehabilitation) of natural areas which allows for *inter alia* the migration of species and interconnection between terrestrial, freshwater and coastal ecosystems.

Mitigation:

Implementation of the operational EMPr as well as the specific Open Space Management Plan which should include a specific section related to the proposed protection, enhancement, expansion and showcasing of existing dune, estuary, beach and coastal forest vegetation as well as the protection of open views and view sheds of river and ocean.

Additional detail in respect to boardwalks is provided below.

Implementation:

The updated development concept still includes incorporates as well as buffers sensitive areas identified as well as requiring protection, expansion and rehabilitation.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Local to regional	Long term	High	Possible	-10	Negative
		2	3	3	2		
With mitigation	Positive	Local to regional	Long term	Moderate	Definite	+11	Positive
		2	3	2	4		

Boardwalks

A naturally vegetated dune cordon is considered to be the best form of defence in the face of sea level rise and increased impact of coastal storms. The Tinley South Banks indigenous corridor also plays an important role in:

- preserving “sense of place”;
- preventing encroachment of sand into areas leeward of the beach;
- providing a buffer against coastal winds and salt spray; and
- provides a corridor for botanical genetic movement and expansion.

Construction (installation) method for the installation of boardwalks

Key design requirements for the installation of boardwalks include:

- Siting:
  - Form must maintain and enhance landscape character;
  - Form must recognise natural processes and features and be in keeping with the landscape setting;

- Siting, design and construction of the boardwalk must result in minimal change to the natural drainage patterns and quality of run-off water of the area;
- Siting, design and construction of any structure must result in minimal disruption to soils;
- All efforts must be made to prevent any erosion and minimise adverse impacts to shore stability and habitat; and
- Key view-sheds should be maintained and protected from inappropriate development that may reduce or impinge on the setting.

- Design:
  - Design must respond to potential user characteristics such as type (hikers, runners, bikers, etc.), frequency (daily, weekly, seasonally, etc.) and intensity (volume of users during use periods);
  - Boardwalks must be the minimum width to accommodate the anticipated use (1.8 m moderate use, 4.9 m heavy use). NOTE: Minimum clearance width for two wheelchairs is 1.5 m. Since most elevated boardwalks are constructed with pilings that encroach into the walking surface, 1.8 m must accommodate the pilings, railings, etc. (Width: 1.5 m minimum for 2-way traffic; 1.8 m – 2.4 m average for typical nature area; 3 m – 3.7 m for high use areas);
  - Boardwalk gradient cannot exceed 5% without handrails and landings at minimum 30' intervals. Maximum gradient is 8.33%;
  - Structures must be designed to minimise maintenance and be incorporated into the coastal landscape;
  - Structures must be designed to satisfy the engineering constraints of the special wind and soil conditions of the coastal environment;
  - The design of structures must maintain and enhance the coastal landscape character of the area as expressed in the dominant colours found in the surrounding environment;
  - Signs must be clear and informative but generally unobtrusive; and
  - The design of structures, outdoor furniture, signs and utilities within a locality must be visually co-ordinated.

- Materials:
  - Practical and cost-effective construction techniques must be applied;
  - Treated wood or recycled plastic “wood” should be used. All fasteners must be galvanised
  - All materials and finishes must be durable in the coastal environment;
  - Handrails: 0.86 m – 0.97 m tall;
  - Guardrails: 1.1 m minimum height. Maximum opening between banisters is 10 cm. Wide top rails can obstruct the view of those seated nearby;
  - Cognisance must be taken of the risks involved in using treated wood (with poly-aromatic hydrocarbons (PAH) and creosote) in a sensitive mangrove environment. Where wood is used in the construction of the boardwalk (pilings, supports, etc.) wood treatment is an essential to ensure the durability of the structure; and
  - Public pedestrian walkways may be constructed from a variety of materials. Whenever possible, pervious or semi-pervious surfaces should be used. Materials such as wood decking (with spaces between the boards), gravel, and porous pavers are considered pervious.

Impact associated with boardwalks

Given the proposed location of the boardwalk within the sensitive coastal environment, site-specific conditions (topography and vegetation) must to be taken into account to ensure minimum impact on the receiving environment whilst ensuring acceptable levels of access, amenity and utility.

Potential impact of boardwalks is detailed below and summarised in the impact rating table below:

- Negative:

    - Potential additional maintenance requirements dependent on materials used;
    - Initial impact on vegetation and surrounds during construction;
    - Potential source of both pollution and alien vegetation ingress as a result of access as well as initial construction disturbance;
    - Potential impact on drainage and disruption of soils;
- Positive:
    - Allows for continued protection of vegetated dune environment (natural defence);
    - Preserves sense of place and enhances the coastal landscape character;
    - Reduces trampling of natural flora;
    - Manages / controls access;
    - Reduces the potential of dune 'blow-outs' as a result of inappropriately designed access;
- Cumulative:
    - Facilitation of access to the coastal environment;
    - Access to the beach provided where previously access was not possible; and
    - Increased understanding of coastal processes and features via potential education programmes.

	Impacts	Status	Extent	Duration	Intensity	Probability of occurrence	Significance
1	Potential additional maintenance requirements dependent on materials used	Negative	Site	Medium-term	Moderate	Possible	**-7**
			-1	-2	-2	-2	
2	Initial impact on vegetation and surrounds during construction	Negative	Site	Medium-term	Moderate	Highly probable	**-8**
			-1	-2	-2	-3	
3	Potential source of both pollution and alien vegetation ingress as a result of access as well as initial construction disturbance	Negative	Site	Long-term	Moderate	Highly probable	**-9**
			-1	-3	-2	-3	
4	Potential impact on drainage and disruption of soils	Negative	Site	Medium-term	Moderate	Possible	**-7**
			-1	-2	-2	-2	
5	Allows for continued protection of vegetated dune environment (natural defence)	Positive	Local	Long-term	Moderate	Highly probable	**10**
			2	3	2	3	
6	Preserves sense of place and enhances the coastal landscape character	Positive	Local	Long-term	High	Highly probable	**11**
			2	3	3	3	
7	Reduces trampling of natural flora	Positive	Local	Long-term	Moderate	Highly probable	**10**
			2	3	2	3	
8	Manages / controls access	Positive	Local	Long-term	High	Highly probable	**11**
			2	3	3	3	
9	Reduces the potential of dune 'blow-outs' as a result of inappropriately designed access	Positive	Local	Long-term	Moderate	Highly probable	**10**
			2	3	2	3	
10	Facilitation of access to the coastal environment	Cumulative (positive)	Regional	Long-term	High	Definite	**13**
			3	3	3	4	
11	Access to the beach provided where previously access was not possible	Cumulative (positive)	Regional	Long-term	High	Definite	**13**
			3	3	3	4	
12	Increased understanding of coastal processes and features via potential education programmes	Cumulative (positive)	Regional	Long-term	Moderate	Possible	**13**
			3	3	3	4	

Mitigation

- Materials must consist of either treated wood or polly-prop or eco-wood to ensure the maintenance of the landscape character as far as possible and to ensure durability;
- The optimal elevation of the boardwalk must be determined by a dune ecologist, specifically in terms of allowing for the continued growth of dune vegetation without blocking sunlight;
- The optimal width of the boardwalk must be 1.5 m minimum;
- The exact route through the dune environment must be determined on-site in association with a dune ecologist who should identify no-go areas upfront;
- Access points from the boardwalk into the neighbouring environment must be avoided;
- All efforts must be made to allow for access to the boardwalk by disabled persons through the construction of a ramp;
- Design of access (ramp and/or stairs) onto the beach as well as the decks must take cognisance of the dynamic nature of the beach sand and be able to accommodate variation in heights;
- Provision must be made for viewing areas / decks with seating which is cantilevered landwards of the boardwalk and shaded if practical;
- Boardwalks must be elevated above the vegetated dune cordon. The height of the boardwalk can vary but must be elevated ~1 m above the substrate;
- Any protected trees as well as the unnecessary clearing of any coastal vegetation must be avoided;
- Boardwalks located in forested areas must wind around existing trees, rather than removing them so that the forest canopy remains intact;
- Rubbish bins must be provided along the route; and
- Informative and education signage can be installed to educate users.

Implementation

The construction methodology should be sympathetic and appropriate to the site and local conditions of the proposed boardwalks and specific method statements should be submitted by the contractor(s) for approval by the ECO, prior to construction. Examples of sympathetic inclusions in the construction methodology include:

- Clearance of vegetation should be kept to a minimum and preferably cleared by hand, if possible;
- Follow previously disturbed and transformed existing sugar cane harvesting contour paths; and
- Stainless steel screws should be used.

A useful guide to timber boardwalk maintenance and construction, developed by the Carmarthenshire Disabled Access Group in the United Kingdom, provides practical guidance and can be accessed at: http://carmarthenshire-disabled-access-group.org.uk/Dave%20Crofts%20Countryside%20Guides/Boardwalk%20Maintenance%20and%20Construction-r1a.pdf

A boardwalk construction methodology, to accompany the boardwalk typical detail drawing, is attached as Annexure A.

7.4.6. Use of Natural Resources

While current land use within the study area (i.e. commercial sugarcane agriculture) has undoubtedly had an adverse impact on its biodiversity, the establishment of the proposed resort and residential areas within and adjacent to the coastal area is likely to negatively impact on fauna and flora. This includes the likely impact on marine living resources, which are likely to be affected by increased pedestrian traffic along the shoreline and estuary. The need to manage the open space system holistically is reiterated. Applicable / responsible coastal access previously proposed with access to and within sensitive areas managed/ controlled via pedestrian systems and elevated boardwalks, should be maintained.

Mitigation:

The establishment of buffers around sensitive areas will have a mitigating effect on this impact, but regulations regarding the consumptive use of natural resources (flora and fauna) should be strictly enforced and local controls included into the operational EMPr. Non-consumptive use should be promoted, and particularly sensitive areas, such as marginal dune areas, should be demarcated and access restricted. This can be achieved by managing access points to the shoreline. The management and control of the remaining natural areas and the use of natural resources must be included in an operational EMPr as well as in the specific Open Space Management Plan which should include both a monitoring and penalty system. Specific measures to be included are:

- On-going monitoring by Department of Agriculture, Forestry and Fisheries (DAFF) compliance officers formalised by estate manager; and
- Reporting (whistle-blowing) procedures must be communicated to land owners and resort visitors and staff to facilitate stewardship of local resources.

Implementation:

Applicable / responsible coastal access has been proposed with access to and within sensitive areas managed/ controlled via pedestrian systems and elevated boardwalks, where possible.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Local to regional	Long term	High	Definite	-12	High
		2	3	3	4		
With mitigation	Neutral	Local to Regional	Long term	Moderate	Possible	9	Neural
		2	**3**	2	**2**		

7.4.7. Sense of Place

Changes in land use are usually associated with concomitant changes in sense of place. In the case of the proposed development, the sense of place will be significantly altered. Whilst the current sense of place tends towards a rural-agricultural aspect interspersed with remnant natural coastal forest and fragmented natural vegetation, a change in land use to resort development will undoubtedly alter this sense of place towards a more urbanised form.

Mitigation:

While changes in sense of place are difficult to quantify and are often subjective, there are mitigation measures that can be applied to ameliorate the aforementioned changes/impacts. These include the promotion of neutral colours that do not contrast with the surrounding landscape, as well as the implementation of indigenous landscaping and the removal of invasive alien plant species. Materials used to construct infrastructure such as decks, boardwalks and footpaths should prioritise the use of sustainably sourced natural materials rather than synthetic materials.

Implementation:

The final layout plan can be deemed to positively impact on sense of place with its emphasis on:

- creating a settlement with a unique coastal identity and character;
- establishing a functional and visual connection with the sites ecological assets;
- incorporating an integrated open space system; and
- proposing a range of development nodes, precincts and clusters integrated by the broader and dominant coastal landscape character.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Neutral	Local to Regional	Long term	Moderate	Definite	9	Neutral

		2	3	2	2		
With mitigation	Positive	Local to Regional	Long term	Moderate	Definite	+9	Positive
		2	3	2	2		

7.4.8. Amenity/ Recreational Opportunities

The provision of appropriate beach amenity (facilities that aid and improve recreation activities), while a positive impact associated with sustainable development in the coastal zone, is not assessed in terms of its impact in this specialist report as the provision of beach amenity is not part of this development application. Appropriate beach amenity could include ablution facilities, parking, lifesaving, safe swimming, and facilities that provide managed pedestrian access (including access for disabled persons) while protecting sensitive features.

The establishment of a resort within the study area will result in increased demand for recreational opportunities and amenity, however the ecological and social carrying capacity of the study area beach environment and shoreline is limited, and as such, unable to support high intensity usage by large numbers of people. An extract from this report is included for ease of reference.

Description	Sensitive, relatively inaccessible area with high slippage potential. Attractive and potential diverse alternates beach experiences but high risk swimming. All effort should be made to maximise the value of the neighbouring natural assets. Accessibility: Poor (no road infrastructure and adjacent private property). Beach Access: Difficult due to ecologically sensitive frontal dune system and topography.
Recommendation	Potential low intensity usage due to limited accessibility, sensitive dune environments and potential for slippage.

Figure 18: Christmas Bay Long Beach Segment Assessment

For this reason, a two -fold opportunity exists to:

- improve/establish beach amenity at the nearby Tinley Main Beach and Tinley Manor Launch Site Beach. A public-private partnership between the landowners and the KwaDukuza Municipality to develop and maintain public beach amenity that would benefit local residents and visitors alike is suggested. This would maximise the positive impact of creating beach amenity that emphasises the sustainable, non-consumptive use of the shoreline in this area; and/or
- While not part of this specific environmental impact assessment (but part of the alternate Tinley Beach Enhancement proposed Environmental Impact Assessment currently under investigation), the investigation of the provision of a safe swimming beach to accommodate the needs of both the resort and local residents.

Regardless of the outcome of this investigation and subsequent development application, it is noted that the nature of usage of this beach will still be constrained and unable to support high intensity usage, predominately as a result of the adjacent topography as well as lack of vehicular access (other than for emergency vehicles). Both the proposed resort as well as the residential estates should be encouraged to invest in alternate recreational facilities. As mentioned, emergency vehicular access to the proposed public beach and accompanying amenity will still be required, as a direct result of the potential risks associated with the use of this beach.

7.4.9. Coastal Access

Currently, access to the coastal area adjacent to the proposed development site is limited to access along the shoreline (in a roughly north to south and south to north direction) from the neighbouring areas of Tinley Manor Beach and Sheffield Beach/Christmas Bay. Access from an east to west direction within the confines of the affected property is limited to a single informal vehicular access point accessible with prior permission from Tongaat Hullet Developments and/or the respective farm manager. This is predominantly because of both the land ownership and the current agricultural land use in the hinterland of the study area. Current access to the coast is further hindered by the topography and existence of the vegetated dune cordon and the wetland areas immediately landward of the vegetated dune cordon. The dune vegetation and wetland areas are both natural barriers to access as well as important environmental assets that play a vital role in mitigating risk from a marine sea-level rise/storm surge perspective.

The initial development concept showed the establishment of four resorts at intervals inland of, but set-back from, the vegetated dune cordon and located landward of the identified coastal risk and slippage in such a way as to not impinge on identified environmental assets. The sustainability of this approach from an environmental perspective was commendable; but the fact that the development of resorts in this area has the potential to negatively impact on access to the coast (not access along the coast) is undeniable. A separate study[2] was conducted responding specifically to this restriction of access and considered the prevailing legislative and policy context. National policy directives were considered which state that the overarching objectives of the provision of coastal access are as follows:

- Opportunities for public access must be provided at appropriate coastal locations in context of the environment and social opportunities and constraints; and
- Public access must be maintained and monitored to minimize adverse impacts on the environment and public safety and to resolve incompatible uses (Department of Environmental Affairs, 2014).

In this assessment, the issue of coastal access was considered within a broader spatial context. This was deemed appropriate given that the coastal access is to be reported on at a municipal level in terms of the ICM Act. Furthermore, it is important for municipalities to consider the provision of coastal access at a macro or jurisdiction-wide scale, including the issue of accessibility (Department of Environmental Affairs, 2014). It was also necessary to broaden the scope of the access issue to include factors that are outside the spatial extent of the proposed development but that also influence the demand for and supply of access in the region. These factors include but are not limited to the following:

- The appropriate kind of access for each area based on its intended usage and associated ecological and social carrying capacity:
    - Carrying capacity is indicative of the level of intensity each area can sustain; and
    - Ecological and social carrying capacity is comprised of various factors;
- The adjacent coastal settlement of Tinley Manor Beach and its associated recreation facilities and boat launch site;
    - The close proximity of this area which is better suited to high intensity, diverse recreational use should alleviate the demand for access to such activity on the shoreline of the study area
    - The adjacent settlement of Sheffield Beach and its associated recreation facilities; and
    - Similarly, the proximity of this area should alleviate the demand for access to areas for recreational activity;

- Potential for consolidation/expansion of recreational facilities and amenity at existing swimming beaches located at:
    - Salt Rock;
    - Blythedale Beach; and
    - Zinkwazi;
- Potential for establishment of recreational facilities and amenity at new swimming beaches located at:
    - Tinley Manor Launch Site;
    - Tinley Manor Main Beach;
    - Zetheni;
    - Black Rock;
    - Nonoti; and
    - Iti Bay.

A further potential impact associated with the provision of access in the coastal zone is the biophysical impact on natural vegetation and dune environments. These are dynamic systems that are sensitive to disturbance and encroachment, and incursions through and over dune vegetation can cause long-term and often irreparable damage. Particularly, where access points proliferate and are not formalised, the integrity of the vegetated dune cordon as a natural and resilient defence against the impact of dynamic coastal processes can be severely compromised.

Subsequent development:

As a result of this assessment as well as on-going discussions held with the KwaDukuza Municipality, Tongaat Hulett Developments resolved to amend their planned gated-estate development concept to a now publically accessible, lifestyle and mixed use village theme which includes a mix of residential and a single resort development supported by a range of commercial and social facilities.

Residential and leisure oriented neighbourhoods are proposed to be integrated around village nodes and a high quality, well managed network of public spaces featuring leisure and recreation areas, along with a major new beach resort development and conservation zones.

Access to the coast with this phase of the development is now limited to pedestrian access via paths and elevated wooden boardwalks as well as a single emergency vehicle access to the beach. Parking is provided at the centrally located low impact mixed use zone. This emergency vehicular access is proposed to provide for access to the coast in case of emergency (drownings, other accidents) and is also proposed to provide for emergency access to the proposed safe swimming beach, the Tinley beach enhancement project which is subject to another separate EIA. It is further noted that a significantly sized medium impact mixed use zone is proposed to be provided to the north of the existing Tinley Manor providing for the establishment of additional recreational, amenity and beach access at the Tinley Manor Launch Site.

Mitigation:

With reference to the proposed first phase of development at Tinley Manor (Figure 1), the shoreline of the area under study is not suitable for high intensity beach activities, nor is it a safe swimming beach given the exposed nature of the shoreline. Use of this section of coast should be restricted to low intensity activities such as hiking/walking and recreational/subsistence fishing with limited swimming opportunities. High-intensity beach activities such as a large-scale swimming beach, ski-boat launching and others should be concentrated in beach areas that are more suited to this purpose from an ecological and social carrying capacity perspective. To this end, Tinley Main Beach and Tinley Launch Site Beach are considered more appropriate for the aforementioned high intensity activities, with consolidated beach assessment scores[2] of 41 and 39 respectively. This is due to their comparatively better shoreline morphology, beach slope, prevailing surf conditions (linked to the sheltered nature of the shoreline) and accessibility, among others.

[2] See the Coastal Access and Beach Report prepared by RHDHV as part of the planning specialist report for further details and a ranking of the suitability of these beach areas. The area proposed for the coastal resort development falls within the coastal segment referred to as 'Christmas Bay Long Beach' within this report.

An additional coastal engineering study was proposed to consider this matter taking finer scale modelling into consideration and proposed a beach enhancement to establish a safe swimming area. Accessibility is also a challenge at this potential swimming beach due to the neighbouring topography. This is subject to a separate environmental impact assessment and process.

The provision of emergency vehicular access to the beach is a best practice and safety requirement for a development of this side located adjacent such an exposed shoreline. This access route follows an existing, previously disturbed and transformed cane road which follows the contour levels.

Access within sensitive areas that are unable to support high intensity use must focus on managed access points that facilitate sustainable use of coastal resources. In the case of the proposed development, this will be activities such as hiking and walking along the shoreline. Given the importance and sensitivity of the dune environment for protection from dynamic coastal processes, it is therefore recommended that coastal access within the Christmas Bay Long Beach segment be geared towards a strictly managed pedestrian access over the dune environment which does not compromise its ecological integrity

With reference to the potential biophysical impacts associated with the provision of coastal access (both pedestrian and vehicular), the following recommendations are noted:

- The protection of the existing coastal vegetation on site (as indicated by the proposed development footprint) must be prioritised;
- Beach access points must be managed / controlled and denudation of dune vegetation avoided. Pedestrian access points should be formalised by means of a raised wooden boardwalk that extends onto the beach, allowing for the re-establishment of the dune vegetation underneath the boardwalk as well as a more managed access to the beach (see Figure 6: Location of Resort node, coastal access and boardwalk alignment in relation to the coast(Detail and mitigation measures in respect to boardwalks are provided earlier in this assessment);
- There must be a strong focus on consolidating/limiting the number of access points (informal and informal) onto the beach within the Christmas Bay Long Beach segment;
- Sound and practical architectural guidelines should be applied which take account of the sensitive nature of the surrounding environment;
- Development (detailed design) needs to take cognisance of both the risks and responsibilities associated with developing in the coastal zone;
- Alien invasive species management to be incorporated into routine maintenance and included into the operational EMPr; and
- Vehicular beach access must be restricted except for emergency access and boat launching in line with the Public Boat Launch Site Regulations.

Implementation

Initial concerns regarding the previous gated-estate concept were noted and subsequently addressed.

Mitigation	Status	Extent	Duration	Intensity	Probability of occurrence	Significance	
Without mitigation	Negative	Regional	Long term	High	Possible	-11	High
		3	3	3	2		
With mitigation	Neutral/Positive	Regional	Long term	Moderate	Possible	+10	Positive
		3	3	2	2		

8. CONCLUSIONS

The proposed development concept has adopted a proactive approach in identifying environmental assets and sensitive areas upfront by means of the environmental asset layers that were derived from the previous coastal feasibility report. A risk aversive approach also characterises the proposed development concept through the identification and incorporation of coastal risk into the proposed location of development. Such an approach is crucial to ensuring sustainability of settlement in a sensitive, dynamic and potentially

hazardous natural environment such as the coastal zone. The information available (i.e. the development concept drawings) suggests a development footprint that is not in conflict with identified natural hazards such as slippages or sensitive features such as wetlands or the vegetated dune cordon.

Coastal access, which was identified as a potentially significant issue, has been predominantly resolved. Opportunities exist for innovative responses to providing adequate amenity, safe swimming and accessibility at beach locations that are suitable for high intensity activities and can cope with high user numbers. Construction phase impacts can be adequately mitigated through the addition of the proposed mitigation measures to the mandatory EMPr. The assured implementation of an operational phase EMPr is essential to mitigate impacts identified and anticipated to occur during this phase of the development.

A crucial issue that this assessment attempts to illuminate is the ecological and social carrying capacity of coastal assets. If the mitigation measures described above are adequately implemented the coastal area adjacent to the proposed development (which incorporates the dune cordon, beach, shoreline and estuarine environment[3]) will be able to support the kinds and intensities of uses and users implied by the proposed development concept. Beach recreation within the shoreline abutting the proposed development will be limited to low impact activities due to inherent biophysical constraints and sensitive environments.

However, the close proximity of beach areas with significantly better opportunities for higher intensity recreation activity represents an opportunity, not only for proposed resort visitors/residents, but for the broader community to enjoy the benefits of the KwaDukuza coastal area, should the proposed public-private partnership be implemented at Tinley Manor Beach.

9. REFERENCES

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[3] While the Mhlali Estuary is considered to form part of the coastal area, estuarine-specific issues, impacts and mitigation measures form part of the Estuarine Impact Assessment Report prepared by Royal HaskoningDHV.

Annexure A

Boardwalk Construction methodology / Method Statement

- Siting:
  - Boardwalks to be sited as per block layout plan, once approved.
  - The exact route through the dune environment must be determined on-site in association with an ecologist who should identify no-go areas upfront.
  - Minimal change to the natural drainage patterns and quality of run-off water of the area must be made with minimal disruption to soils.
  - Boardwalks must be elevated above the vegetated dune cordon. The height of the boardwalk can vary but must be elevated ~1 m above the substrate (The optimal elevation of the boardwalk must be determined by a dune ecologist, specifically in terms of allowing for the continued growth of dune vegetation without blocking sunlight).
  - Clearance of vegetation should be kept to a minimum and preferably cleared by hand, if possible.
  - Follow previously disturbed and transformed existing sugar cane harvesting contour paths.

- Design:
  - The boardwalk must accommodate multiple users and uses (hikers, runners, bikers, etc.) with widths varying according to anticipated use (1.8 m moderate use, 4.9 m heavy use).
  - The boardwalk gradient cannot exceed 5% without handrails and landings at minimum 30' intervals. Maximum gradient is 8.33%.
  - Beam support / Foundations member sizes vary depending on design loads.
  - Where two boardwalks intersect, or join the junction should be wider than the boardwalks by using an angle or taper at the corners to allow turning space.

- Materials:
  - Treated wood or recycled plastic “wood” should be used.
  - All fasteners must be galvanised.
  - Handrails should be between 0.86 m – 0.97 m in height.

- Method:
  - Clear vegetation and lay out the path of the boardwalk;
  - Do a ‘mock layout’ of the boardwalk using the loose boardwalk materials to establish spacing of piled supports and to determine where stairs and turning points will occur;
  - Dig holes at required spacing depending on width and length of deck. Spacing of piled supports should be according to the length of beam supports (lengths differ depending on the material used and availability at time of construction);
  - Dig holes deep enough to allow the foundation concrete footing to be below the natural ground level so it will not be exposed and unsightly;
  - Mix concrete and pour around the piled support while holding the support 100% upright;
  - Allow concrete to dry around all piled supports before fastening the transverse beams horizontally from one piled support to another;
  - Fasten beam supports at between 300 and 450 mm centres depending on deck material being used;
  - Fasten planking allowing not more than 5 millimetres spaces between planks;
  - Fasten handrail uprights to the outer beam supports ensuring they are 100% upright;
  - Fasten the handrail horizontally between uprights; and
  - Fill in the sides of the handrail with appropriate material to ensure that no-one can fall through.