COASTAL IMPACT ASSESSMENT

THE PROPOSED MARINE TELECOMMUNICATIONS CABLE AT AMANZIMTOTI, KWAZULU-NATAL, SOUTH AFRICA

Compiled by:
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Compiled for:
Acer (Africa) Environmental Consultants

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BEACH AND COASTAL DUNE DYNAMICS IMPACT ASSESSMENT

PROPOSED MARINE TELECOMMUNICATIONS CABLE AT AMANZIMTOTI, KWAZULU-NATAL, SOUTH AFRICA

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Front page image	Beach and dune structure

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Glossary of Terms and Abbreviations

Associes	Groupings of species, particularly plants commonly found to occur together.
Dissipative	A dissipative beach is a wide beach with a low profile associated with high energy surf zones.
Dune heel	The leeward extreme of a dune
Dune toe	The seaward extreme of a dune
Eco-morphological	The physical and ecological result of plant and morphological drivers,
Ephemeral	Transient or of short duration
Hs	Significant wave height
Interstitial Species	Inter tidal and beach fauna inhabiting voids within beach sands
Psammo-	Of dunes
Seral	Levels of botanical succession
Slack	A valley or depression with the dune cordon
Transgressive	Mobile or retreating (dune systems).

DECLARATION BY THE SPECIALIST

I, **Simon C. Bundy**, declare that --

- I act as the independent specialist in this application;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the EIA Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Waste Act and NEMA, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Waste Act and NEMA, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B(1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

SDP Ecological and Environmental Services

3 May 2021

PARTICULARS OF AUTHORS/ECOLOGISTS

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DATE OF BIRTH 7 September 1966 **PLACE OF BIRTH**: Glasgow, Scotland.
MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist; Southern African Association of Aquatic Scientists

KEY COMPETENCIES AND EXPERIENCE

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. From a technical specialist perspective, Bundy focusses on coastal and xeric ecological systems. He is competent in a large number of ecological and analytical methods including multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and Department of Environmental Affairs. Bundy acts as botanical and environmental specialist for Eskom. Based in South Africa, he has engaged in projects in the Seychelles, Mozambique, Mauritius and Tanzania as well as Rwanda, Lesotho and Zambia. Within South Africa , Bundy has been involved in a number of large scale mega power projects as well as the development of residential estates, infrastructure and linear developments in all provinces. In such projects Bundy has provided both technical support, as well as the undertaking of rehabilitation programmes.

SELECTED RELEVANT PROJECT EXPERIENCE

Ecological investigations for numerous renewable energy projects, including “Kalbult”, “Dreunberg”, “jUWI”, “Kenhardt Pv1 - 6”, “Solar Capital 2 and 3” and “Lindes”.
Ecological investigations Tongaat and Illovo Desalination Plants : CSIR –(2013 - 2016)
Ecological investigations and Rehabilitation Planning : Sodwana Bay :iSimanagaliso Wetland Park Authority – (2014 - 2018)
Ecological evaluation and monitoring: Plastic pellet (nurdles) clean-up MSC Susanna Marine Pollution Event : West of England Insurance, United Kingdom (2018 - 2020)

PUBLICATIONS

Over a dozen scientific publications, numerous popular articles and contributions to books and documentaries in local and international journals

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KEY COMPETENCIES AND EXPERIENCE

Natalie de Wet has been working at SDP Ecological and Environmental Services since January 2021. Her honours thesis assessed the population genetics of the Critically Endangered Riverine Rabbit. Further course work included research projects on Proteaceae, Sugarbird *Promerops cafer*, rocky intertidal communities as well as climate change. Natalie has previously interned at EnviroPro where she job-shadowed Environmental Assessment Practitioners and Environmental Control Officers.

EXECUTIVE SUMMARY

The proposed landing of a marine telecommunications cable at Pipeline Beach, Amanzimtoti is the subject of a scoping and environmental impact assessment in terms of the National Environmental Management Act (107 of 1998). This report has been compiled to evaluate the bio physical impacts that the laying of such a cable would have on the various inshore coastal processes at Amanzimtoti, as well as to provide recommendations on environmental management measures to be employed on the beach and coastal dunes during and following establishment of the cable.

Two alternative cable landing routes were proposed for two locations in Amanzimtoti, namely Pipeline Beach and Amanzimtoti Main Beach. From an ecological perspective, the proposed cable landing point at Amazimtoti Main Beach would result in higher dune vegetation loss and, according to engineers, has the potential for rock outcropping. In addition, this route traverses the Aliwal Shoal MPA. As such, the Pipeline Beach landing point, which is highly transformed and avoids the Aliwal Shoal MPA, is favourable and forms the bulk of this report.

The point of the cable landing at Pipeline Beach has been shown to be a reflective beach, backed by a stable to transgressive dune system. Transgression has been aggravated by pedestrian traffic to and from the beach, with the construction of buildings and other infrastructure in and around the sand sharing system. As such, the site can be considered to be a highly altered system. It follows from the above that the establishment of a submarine telecommunications cable at Pipeline Beach, Amanzimtoti will have little impact on the eco-morphology of the sand sharing system and the coastline in general.

A number of remediation and mitigation methods are proposed, should the cable be landed at this point, these include:

1. **Burial of the cable to a point approximating >-1m below natural beach level or in close alignment with the shelly layer or transitional layers within the beach profile.**

2. **Where disturbance of the vegetated dune arises, the affected area should be raked back to an angle of repose ~ 27°, and temporarily stabilised.**

3. **Horizontal Directional Drilling (HDD) will be undertaken as a mitigatory measure, proposed by the applicant so as not to disturb the surface of the site in and around vegetated dune.**

STATEMENT

It is contended that the landing of a submarine telecommunications cable and the establishment of related anchor mechanisms along the shoreline and beach-dune interface at Pipeline Beach will, if implemented with the conditions and recommendations presented in this report, give rise to negligible ecological repercussions in the subject area.

1. INTRODUCTION

Acer (Africa) Environmental Consultants have commenced with an environmental impact assessment process, through a scoping and EIA process, to review and obtain authorisation from the National Department of Environmental Affairs, for the installation of a marine telecommunications cable. The cable is part of the 2AFRICA/GERA (East) Cable System linking Africa with Europe and other centres through submarine cables which aims to improve internet traffic through increased speed and data capacity. Two potential landing points in Amanzimtoti, within eThekwini Municipal area, have been proposed for the offshore cable, one of which is located at Pipeline Beach (30°02'04"S / 30°53'56"E) and the other is at Amanzimtoti Main Beach (30° 02’ 83.'S; 30° 53’513'E). However, the landing point at Pipeline Beach has been highlighted as the preferred option due to technical issues arising at Main Beach and therefore forms the bulk of this assessment.

This report, as per the terms of reference provided by ACER (Africa), the EAP, serves to provide a bio-physical overview of the beach and dune cordon within and adjacent to the proposed cable landing route. The investigation has been undertaken utilising various, selected parameters and identifies bio physical factors associated with the area that may be considered drivers that determine the status and ecological function of the beach and dune cordon. In addition, the investigation considers the ecological impacts that may arise within the dune system from the establishment of the cable, the most appropriate routing for the cable, as well as mitigation and management measures that may be employed during and post the installation phase.

2. PROJECT DESCRIPTION

Telecommunications company, West Indian Ocean Cable Company (WIOCC), plan to establish a submarine cable that will land at a point along Pipeline Beach, located at Amanzimtoti in KwaZulu Natal, South Africa (Figure 2). The cable will effectively improve international internet traffic via submarine cable between major global centres and Africa. The cable will enter the South African Exclusive Economic Zone (EEZ) and land on the shoreline before traversing the intertidal and beach environment to tie in to a Beach Manhole (BMH) to be constructed at Pipeline Beach. From this point the cable will be routed to the Cable Landing Station at Umbogintwini, a small urban centre located to the north of the landing point.

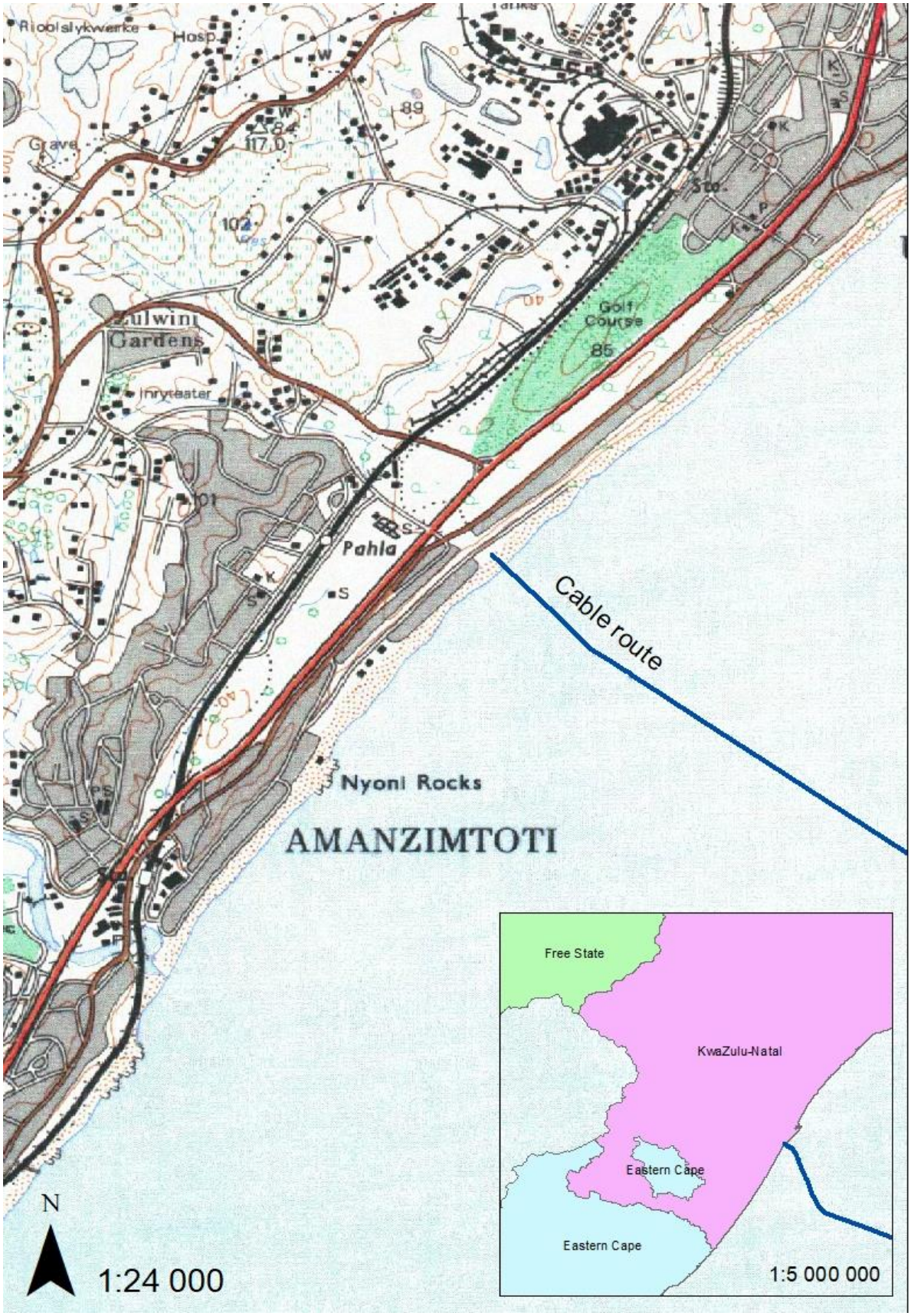

Figure 1. The study site shown on a regional and local scale.

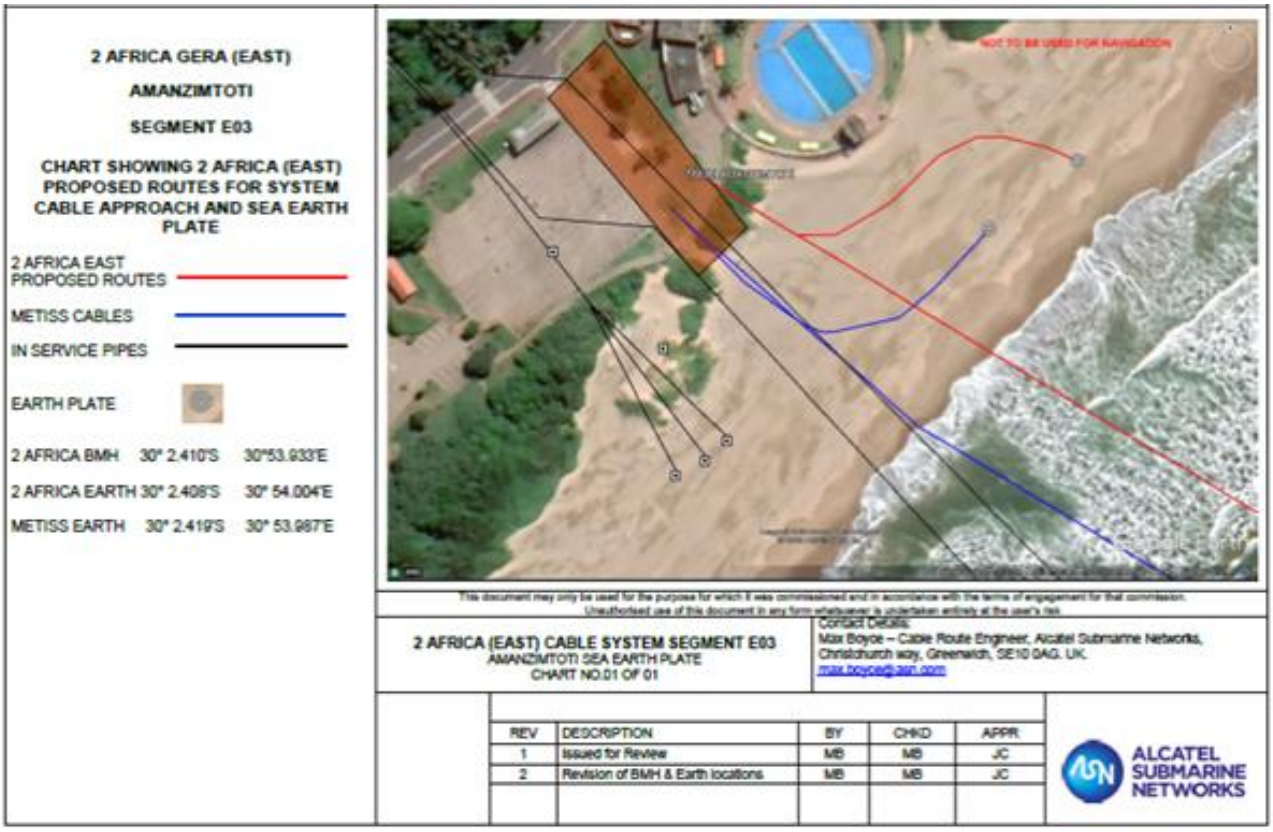

Figure 2. Image of site of cable landing at Pipeline Beach, Amanzimtoti (source ACER Africa).

To install the cable, plant machinery and excavators will be utilised to establish a trench of approximately 1 - 2m below the prevailing natural ground level. Given the nature of dune and beach sediments, it is intended to undertake Horizontal Directional Drilling (HDD) to establish the cable under the dune and connect with the shore based BMH, which will form the anchor point for the cable. Excavated material is to be reinstated over the cable and the necessary "rehabilitation" methods are to be employed.

2.1 Seasonality and limitations

The assessment was undertaken during May 2021, which aligns with the southern hemisphere autumn period. Autumn weather conditions in KwaZulu Natal are characterised by warm to mild weather conditions with low wind speeds and generally moderate wave conditions. Beaches are generally inflated although beach rotation phenomena begins to take effect at this time as maritime and meteorological conditions change. Such variance may obscure the modal condition of the beach and dune environment, often emphasising or concealing factors that may not generally be evident at other times of the year.

In addition, the assessment was conducted during spring tides, which allowed for the inspection of a large portion of the beach face. The seasonality and tides are given due consideration in the interpretation of data. No data or observations for other seasons or tides were available for comparison. Where such data was required for assessment models, assumptions were made, based on accepted trends and predicable seasonal changes. Notably, this study did not consider antecedent weather conditions.

2.2. Applicable legislation

The National Environmental Management Act (Act no. 107 of 1998)

This Act serves to control the disturbance of land and its utilisation within certain habitats. Legislation applicable to the proposed activity include Section 19 of Listing Notice 1, which states -

"The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-
(ii) the seashore; or
(iii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater"

Integrated Coastal Management Amendment Act (36 of 2014)

ICMA presents several principles that relate to sound coastal management practices. Principles applicable to the proposed activity include Chapter 7, Section 58, which stipulates the duty of care and remediation of environmental damage which includes the duty to avoid negative effects on the receiving environment. As such, this Act applies to any activity that has an adverse effect on the coastal environment.

3. METHOD

As per the requirements of Government Gazette 43110 "Protocol for the specialist assessment and minimum reporting content requirements", consideration of The Department of Environment, Forestry and Fisheries' screening tool (https://screening.environment.gov.za), indicates the subject site to be of a "low aquatic biodiversity sensitivity" (Figure 3). The same tool indicates the subject site to have a "high terrestrial biodiversity sensitivity" (Figure 4), however the immediate coastal and beach environment is considered to have low sensitivity. As such, an ecological assessment of the coastal environment was undertaken using the method and approaches discussed below.

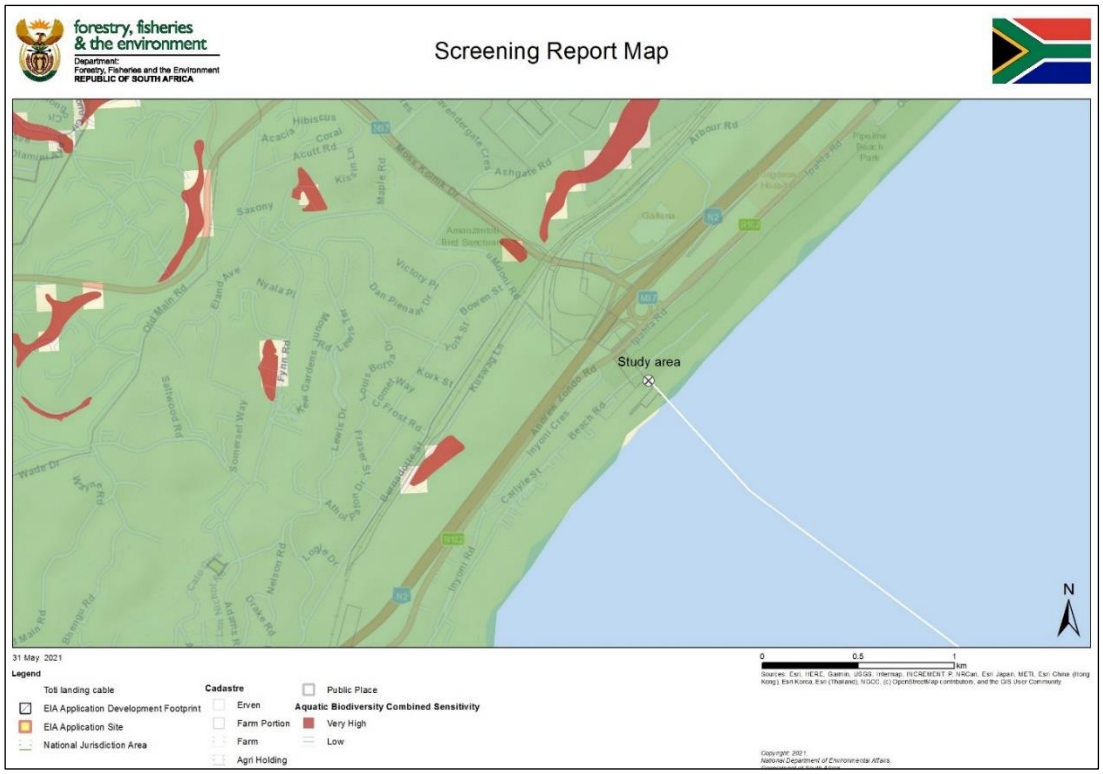

Figure 3. Screening Report Map for the project site showing predicted aquatic species sensitivity (Department of Environment, Forestry and Fisheries 2021)

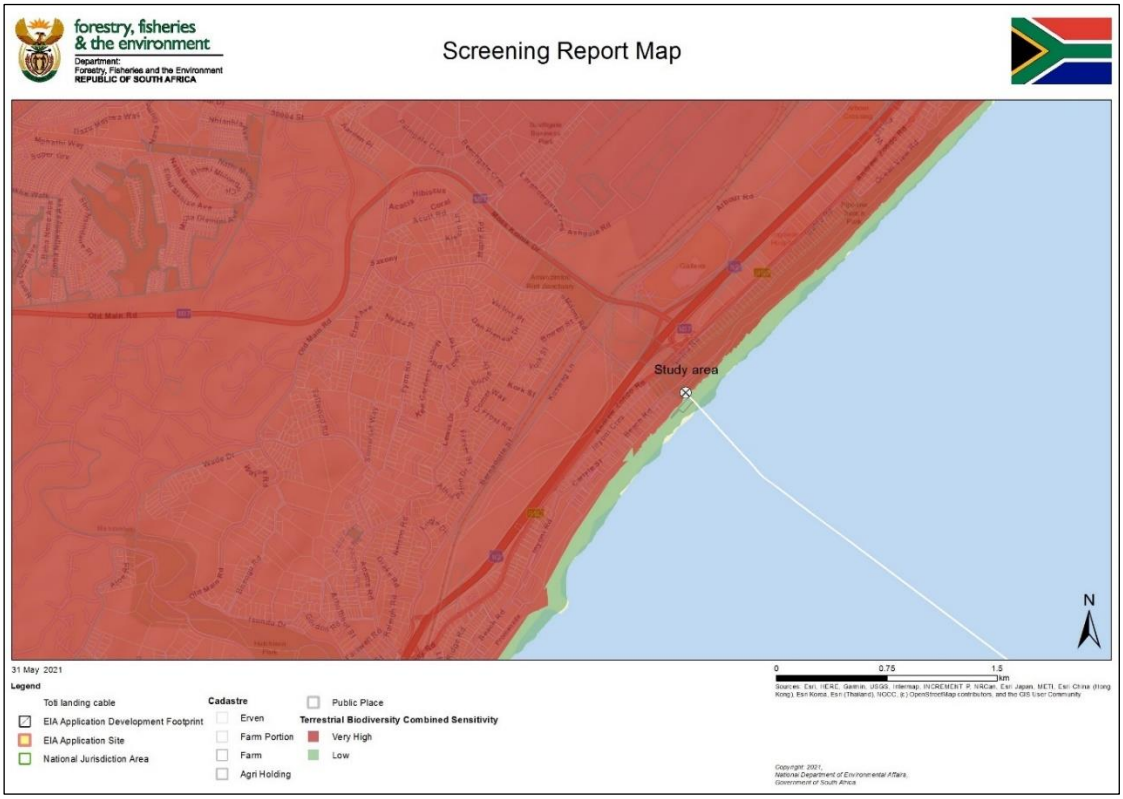

Figure 4. Screening Report Map for the project site showing predicted terrestrial species sensitivity (Department of Environment, Forestry and Fisheries 2021)

In the compilation of this eco-morphological report a desktop review of literature and pertinent information relating to the site was undertaken. Specific consideration was given to aerial imagery of the shoreline and dune cordon. Desktop investigations included the following:

- Review of recent and historical aerial imagery dating from 2004 to 2020.
- Identification and delineation of various plant community associes associated with the frontal dunes.
- Dominant coastal processes were evaluated using available wave and wind data.

In addition, field reconnaissance was undertaken on the 6th of May 2021 whereby:

- Specific features within the supra-tidal environment were identified and logged using a Garmin Montana GPS (Figure 5).
- Dominant species were identified and recorded at the point of landing and such information was used in an integrated manner to confirm the influence of coastal processes on the beach and back of beach environment.
- General observations at each point were made in respect of the gradient of the dune face and the nature and structure of the vegetation at the beach – dune interface.
- General evaluation of macro scale and minor scale coastal processes were undertaken.

Figure 5. Image showing sample points in relation to proposed cable landing point, showing possible cable routes .

4. REGIONAL PERSPECTIVE OF THE SUPRA-TIDAL ENVIRONMENT

Beach and dune environments are continuously changing and shaped by sediment transport within the sand sharing system (Psuty 1994). The sand sharing system is the underlying phenomena whereby marine sediments are shared between the offshore surf bar and the dune cordon. The system is dynamic and is driven by wave and wind energy, with biological components, such as vegetation, also acting as a significant driver. Coastal vegetation is adapted to living within a harsh environment and is characteristic of dune systems. The sand sharing system is influenced by changes in wind, wave regimen, climate state, beach morphology and additional factors which act to influence the eco-morphology of coastal and in particular, dune systems (Hesp 2012).

The sand sharing system, including the sub tidal, intertidal, beach and dune system components can be considered, over any given extended temporal period, in a state of equilibrium (Figure 6). It follows that disturbance to this equilibrium results in a shift, with concomitant effects on the system. Such effects may lead to the erosion of beaches, engulfment of vegetation and generally undesirable effects upon the coastline. Such consequences may have serious direct, indirect and cumulative effects upon ecological, social and economic environments.

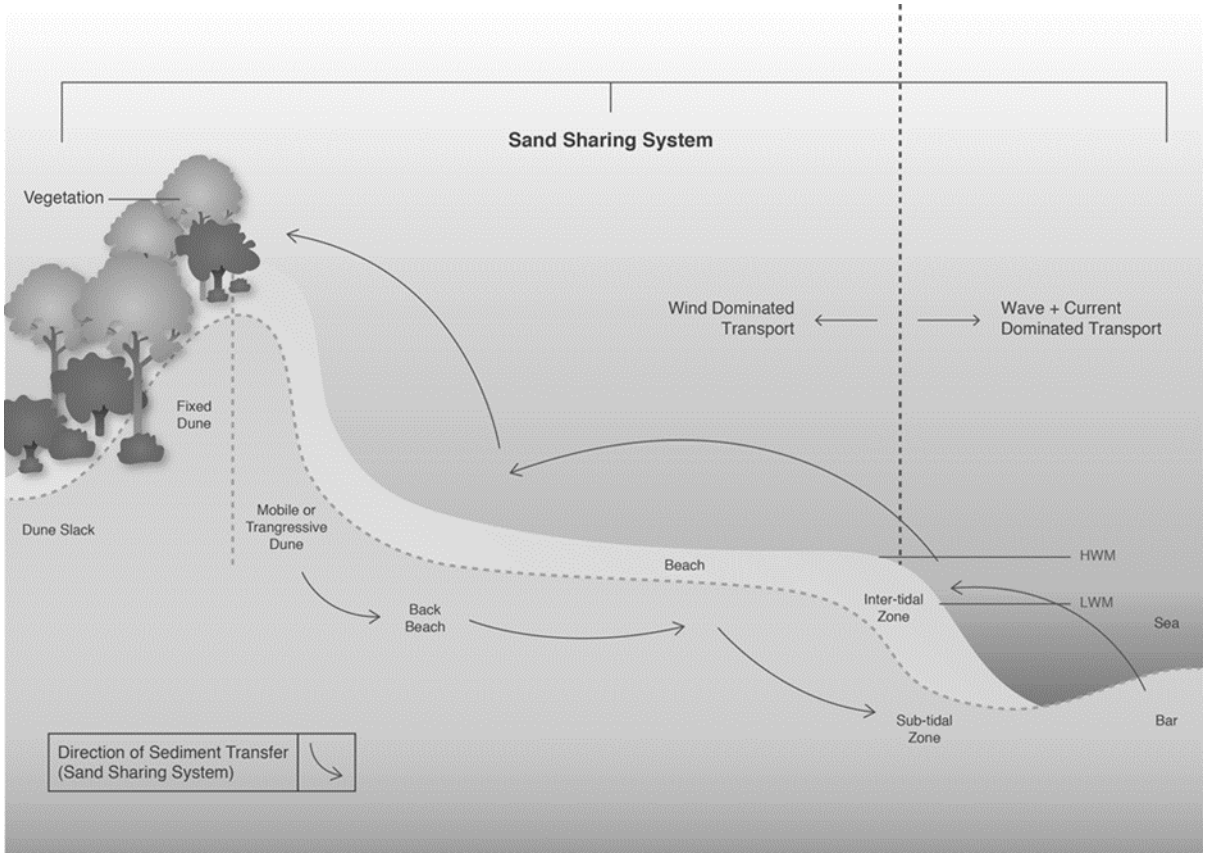

Figure 6. Graphic image showing a sand sharing system and associated processes.

It follows that the most effective "test" in evaluating the impact of activities on a coastline, is to consider where and how, such activity may affect the sand sharing system. This test forms the basis for consideration in this evaluation of the cable – laying activities that are proposed for Pipeline Beach, Amanzimtoti.

The beach and dune environment at Amanzimtoti- North can be described as being a relatively straight portion of shoreline, stretching between the Nyoni Rocks in the south and the uMbogintwini River in the north, forming a shallow embayment. As such, this region forms a loosely defined coastal cell with a generally wide, offshore bar The major sediment source associated with this beach has been considered to be the littoral sediment transport system, augmented by low level inputs from proximal river systems, including the Little Amanzimtoti and Amanzimtoti Rivers and, under some situations, the Umbogintwini River. Sediment supply from the extensive, but now stabilized dune forms at Amanzimtoti has historically supported inshore components of the sand sharing system. However, the impact of stabilization and loss of this sediment resource has been represented by significant erosion events at points along the Amanzimtoti shoreline (Mather *pers comms*). Under such a scenario, the KZN Department of Economic Development Tourism and Environmental Affairs' "Coastal Vulnerability Data base" indicates that the beach and dune cordon are considered "moderate vulnerability" areas (Figure 7).

Further to the above, eThekweni Municipality have compiled a sea level rise model for the area, based upon "Bruun's Rule", a method of predicting sea level rise utilizing elevation and bathymetrical data. Bruun's rule effectively predicts a rate of sea level rise (in Durban this has been identified as 2.7mm/annum (Mather 2009)) and identifies a point where mean sea level will be reached at selected periods in the future. The National Oceanographic and Atmospheric Administration (NOAA) identifies a sea level rise rate of 1.94mm/year (https://coast.noaa.gov/digitalcoast/tools/slr) for Durban, a slightly higher rate of increase than that reported by South African authors Notably, Cooper (1995) predicts that under a rising sea level, some impact may arise on structures that lie proximal to the beach, where undercutting of the beach form may occur. However, these anticipated impacts should generally be limited due to the moderately wide beach at Amanzimtoti. Notably, onlap or landward sediment movement is also predicted to be problematic under a rising sea level.

From an ecological perspective, habitat complexity and species diversity play a significant role in determining the state of beach and dune forms (Hesp 2012). Harris et al (2018) have considered marine areas of critical biodiversity importance across the South African coastline and marine environment. Howsoever the area in question does not lie within any areas identified as being of critical marine biodiversity importance.

Figure 7. Map showing evaluation of beach according to "vulnerability" classification (source CoastKZN).

The “Vulnerability Model” is based on a number of parameters, including “proximity to river mouths”, “elevation”, “stable dune width” and “beach width”. As such, it can be suggested that impact of inter alia storm surge and tide on dune state are the drivers of the moderate coastal vulnerability classification.

According to SANBI, the coastline of the subject area comprises of Sub tropical Seashore Vegetation, backed by Dune Forest (Figure 8) (Mucina and Rutherford 2006). From a habitat conservation perspective, Sub Tropical Seashore vegetation is considered “least threatened” while Dune Forest is considered to be “threatened”. In practical terms however, these habitat types are severely threatened by ribbon development along the coastline (SANBI 2021).

The Provincial Conservation Authority has identified, portions of the study area, in particular the Dune Forest form lying leeward of the beach, as being of critical biodiversity importance from a conservation perspective. Figure 9 below shows that much of the dune cordon is designated as “Critical Biodiversity Area 1 (CBA) – Irreplaceable”. Such areas are areas considered to be in sound ecological condition and are irreplaceable for meeting biodiversity targets and judicious planning would avoid activities being undertaken that affect these areas.

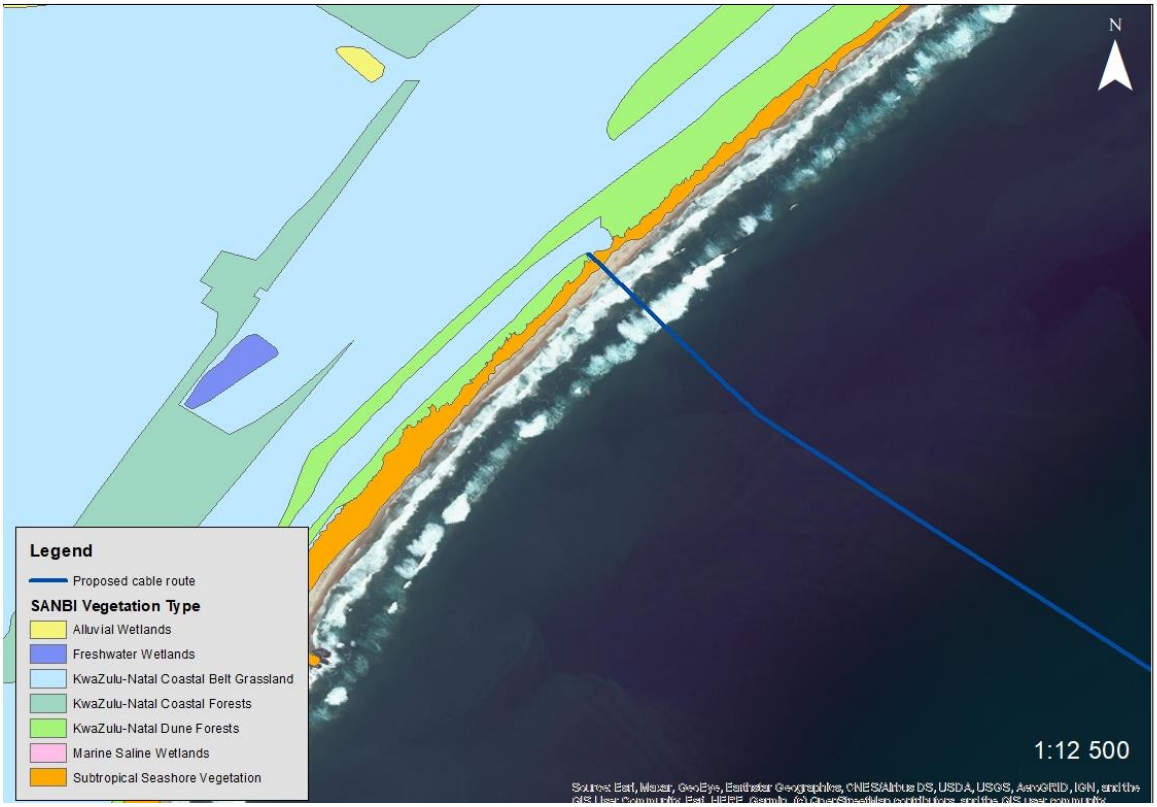

Figure 8. Map indicating subject site and the vegetation types recorded in the region (SANBI 2016).

Figure 9. The extent of Critical Biodiversity Areas in the vicinity of Pipeline Beach, Amanzimtoti.

5. SITE SPECIFIC REVIEW OF SITE

The marine telecommunications cable is proposed to be landed along a portion of the coastline at Amanzimtoti that aligns with the Pipeline Beach pools and recreational facility. Notably, an alternative route for the cable landing has also been suggested which would align with Amanzimtoti Beach carpark. However, this option would require the clearance of more indigenous vegetation and would have an overall larger impact on the receiving environment. As such, the proposed route which lands at Pipeline beach, was of focus for this assessment. At this point the sand sharing system can be considered to be relatively wide and generally shows a wide sub-tidal and inter-tidal environment with an offshore bar that ranges up to 200m from the shoreline. Figure 10 presents an image of the site and also indicates the prevailing winds and wave roses for the region.

From Figure 10 it is clear that the predominant swell direction is from the south-southeast. This swell direction forms the predominant wave direction along the Amanzimtoti coastline. Notably the wave direction lies at between 90° and 110°.As such, it is envisaged that inshore littoral drift is generally low to moderate (Davidson Arnott, 2012), giving rise to a dissipative beach state with sustained moderate to high inflation. Notably, and as indicated in Figure 10, beach inflation is at a maximum near Nyoni Rocks, located to the south, which is the southern-most point of the crenulate bay, which gives rise to a wide beach. This wide beach extends almost a kilometre north, up to and beyond Pipeline Beach, where it shows significant narrowing. This narrowing of the beach is likely to be driven by a deepening inshore gulley and increasing velocity in the littoral drift.

Sands within the beach profile can be classed as fine to coarse materials (3-1ϕ Krumbien) with a low percentage of finer materials. Sands are separated across the beach and dune profile according to elevation, with finer sands being prevalent on the stoss face and crest of the stable dune. A number of smaller ephemeral or hummock dunes are evident across the beach, which are testimony to significant sediment movement and the generally inflated beach form (Figure 11). The presence of the dune pioneer species, *Scaevola plumereii,* is testimony to the surplus sediment being transferred onto the beach, where this cover dependent species prevails. Moving landward, the stable primary dune transitions from a scrub habitat to an elevated dune forest form, dominated by larger woody species including *Mimusops caffra, Ficus burtt davyii* and the shrub, *Chrysanthemoides monilifera*. This vegetation is particularly important in stabilizing the elevated dunes along this portion of coastline, as well as retarding landward movement of sediments. The vegetation ameliorates the primarily, beach-parallel winds, which give rise to aeolian streaming and the transfer of sand along the shore. At Pipeline beach, pedestrian traffic and the presence of built structures have compromised the stabilising influence of vegetation, giving rise to significant engulfment of portions of dune and the landward movement of sediments (Figure 12). Evidently there have been attempts to stabilize the dune form in the past by planting both indigenous and exotic vegetation (*Yucca sp*.), however, for the most part these initiatives have been unsuccessful.

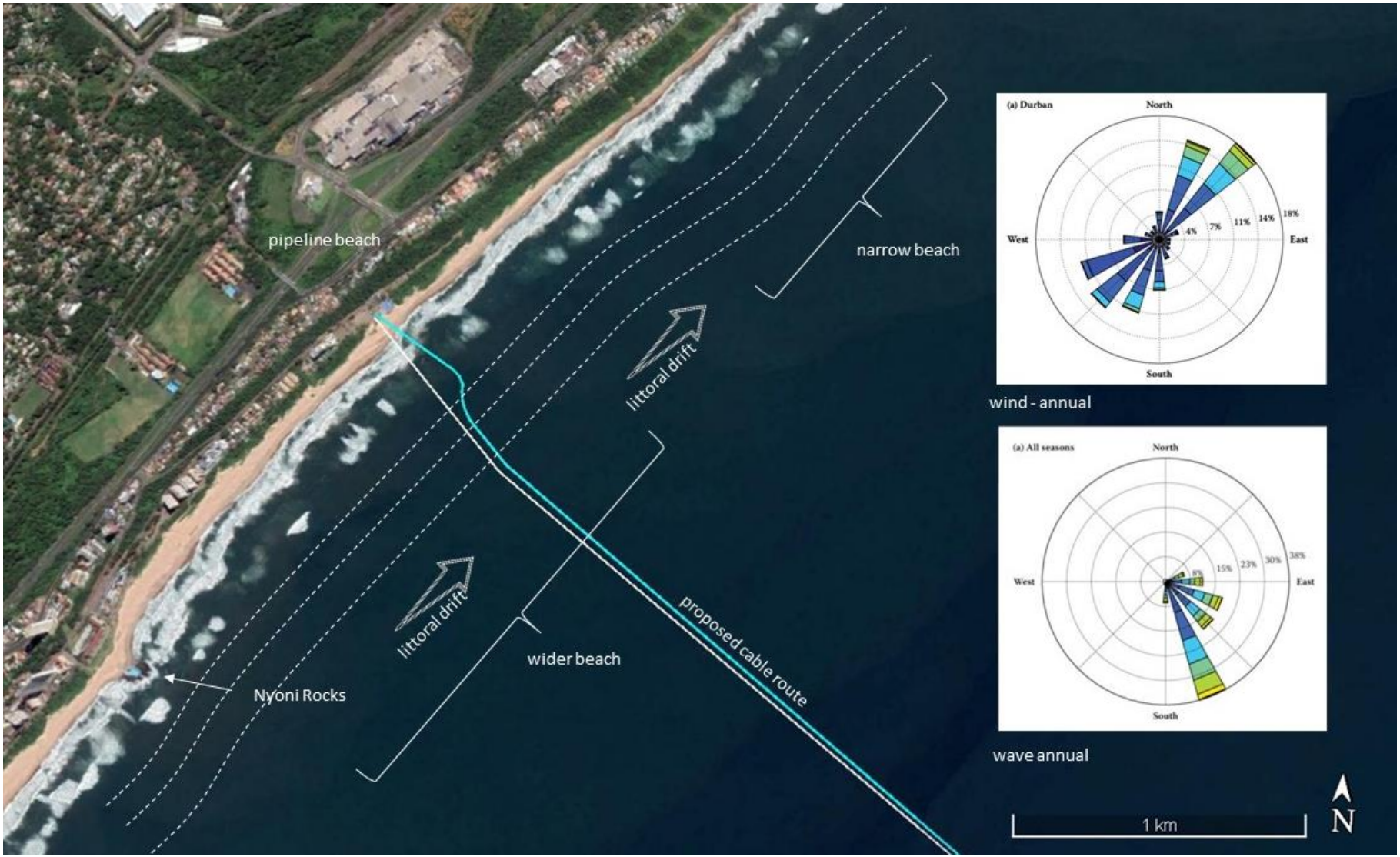

Figure 10. The portion of the supratidal environment that the cable will traverse. White line indicates existing METISS cable.

Figure 11. Image of beach and dune showing dissipative beach and ephemeral dune in background.

Figure 12. Image of heel of dune showing landward transgression.

The proposed cable will be laid through the sub tidal and intertidal environment following the alignment shown in Figure 10. No significant reef or similar structures are evident along this traverse and it is clear that the cable, together with anchor plates, will easily merge with the bed of the prevailing sand sharing system, with little change to the drivers of the system. Within the beach and immediate supra tidal environment, similar deep sands and a modally dissipative beach will allow for the cable to be set at depths greater than -1m below natural ground level. The cable will then progress through an unvegetated portion of dune associated with the main access to the beach with the final +/- 30m being completed using HDD to link with the BMH, that lies in the car park (Figure 13). The cable will lie to the north of an existing METISS cable.

Figure 13. Image showing nature of access point at Pipeline Beach, where the proposed cable will tie into a constructed beach manhole.

5.1 Ecological aspects

From the above, it is clear that the prevailing beach form is indicative of a moderately dissipative beach. With a high turnover of sediment in the inter tidal and supra tidal environment, it is anticipated that much of the prevailing faunal assemblages common to this beach would be highly mobile fauna, as has been suggested by Branch (2018) for 95% of all species within this habitat. Species most likely to be

affected by excavation and laying of the cable are high shore and mid shore scavengers and interstitial species, with such disturbance being confined to a minor portion of the sand sharing system.

In terms of floral species present, vegetated portions on the dune proximal to the cable route are either partially vegetated or transgressive, showing only some minor Zone 1 or "early seral" habitat. Such habitat comprises of in particular *Phylohydrax carnosa, Carpobrotus dimidatus* and *Gazania rigens*. The common lawn grass, *Cynodon dactylon* lies to the lee of the cable route. All of the above species are of low conservation significance and can be easily removed and replanted across the site, following establishment of the cable.

6. ANALYSIS OF IMPACTS

A wide sand sharing system and dissipative beach environment at Pipeline, Amanzimtoti is indicative of a broadly inflated beach state with high sediment transport within the nearshore and supra tidal environment. Such a state is evidence that the primary drivers of the sand sharing system are the prevailing wave regime and sediment availability (Short 1981).

The cable landing point will traverse the beach and dune cordon at a point that is highly transformed by built structures as well as a high level of pedestrian traffic. Evidently with a deep and inflated beach and dune form at this point, with little vegetative cover of significance, the excavation and establishment of a cable through the sand sharing system will give rise to only limited perturbations in the sand sharing system, which will be of short term duration. These impacts are discussed below.

6.1 Direct and indirect impacts

Table 1 below summarises the nature and form of direct and indirect impacts anticipated for the proposed cable landing that may arise on the three eco-morphological drivers of coastal systems, namely *wind and wave, sediment transport dynamics* and the prevailing *biotic or vegetated dune form*. These impacts are evaluated to identify their significance and the status of the impact.

From Table 1, it is clear that any negative impacts that may arise in response to the establishment of the cable, will be of short duration, evident during the laying of the cable. Establishment of the cable at a suitable depth, will minimise any likelihood of such impacts arising over an extended duration.

Table 1. Review of ecological impacts arising from utilisation of the proposed cable alignment route at Pipeline Beach, Amanzimtoti.

Beach Node Pipeline Amanzimtoti IMPACT	Spatial extent	Duration	Intensity	Frequency	Probability	Irreplaceability	Reversibility	Significance	Status	Confidence	Mitigation
Alteration of drivers of coastal process, (e.g. wind and wave)	Local	Short term	Negligible	Once off	Very Low	Low	High reversibility	Very low	Very Low	High	Cable will align approximately shore perpendicular and lie at point 1m – 2.0m subsurface, effectively having no impact on localized wind and wave regime. Some minor disruption of inter-tidal and supra-tidal wave regime may arise in the short-term during laying of cable
Interruption of sediment transport regime	Local	Short term	Negligible	Once off	Low	Low	High reversibility	Low	Low	High	Minor perturbation expected during construction, with excavation of dune, beach and intertidal zone. Sediment mobilisation at the points of excavation through dune, exacerbating present trends towards engulfment. Use of HDD proposed as a form of "mitigation". Following cable establishment, sediment transport regime should rapidly reach state of equilibrium. Recommended that excavated areas be stabilised temporarily post laying of cable..
Alteration of habitat/eco-morphology	Local	Short term	Negligible	Once off	Low	Low	High reversibility	Low	Very Low	High	Excavation will arise through the primary dune and beach. Reinstatement of materials and natural aeolian winnowing will sculpt excavated area. Use of HDD proposed as mitigation to avoid disturbance of vegetation. Measures to stabilise and possibly replant habitat may be considered close to car park and amenities.

Spatial Extent: Denotes the affected area, - site, local, regional or national.

Duration: The period of time over which the impact will be noted. This may be "long term" (greater than the duration of project), "moderate or medium term" (occurs during the lifetime of the project) or "short term" (less than the lifetime of the project and primarily during the implementation stage of the project).

Intensity: An order of magnitude. Negligible (inconsequential or no impact), low (small alteration of natural systems, patterns, or processes), medium (noticeable alteration of natural systems, patterns, or processes), high (severe alteration of natural systems, patterns, or processes).

Frequency: a description of any repetitive, continuous, or time-linked characteristics of the impact. Once Off, Intermittent; Periodic; Continuous

Probability: The likelihood of the impact occurring as a result of the project being undertaken. Such probability may be "high", "moderate" or "very low" and "low"

Irreplaceability: Resource loss caused by impacts. This may be "high" (the project will destroy unique resources that cannot be replaced), "moderate" (the project will destroy resources, which can be replaced with effort), "low" (the project will destroy resources, which are easily replaceable).

Reversibility: The ability of the impacted environment to return/be returned to its pre-impacted state. Non-reversible, low reversibility, moderate reversibility of impacts, or high reversibility of impacts.

Significance: The nature of the impact in respect to the status quo (i.e. alteration of status quo). Such levels of severity may be "high", "moderate", or "low".

Confidence: An indication of the level of surety that the impacts or the parameters identified, will occur.

6.2 Cumulative impacts

The cumulative impacts anticipated as arising from this activity are predominantly associated with disturbance to the dune cordon. The removal of vegetation and the uplifting of hard pan surfaces, as well as deeper excavation of the dune, may result in the destabilisation of the dune cordon. Howsoever, as a historically and contemporarily transformed beach, the little cumulative impact can be discerned from such actions. It may be advantageous to ensure that areas around the dune are reinstated using vegetation or further attempts to prevent the passage of beach visitors across the dunes, as such endeavours would perhaps prevent the evidently increasing dune transgression at this point. Notably, it is clear that previous attempts to address dune transgression have been unsuccessful.

7. CONCLUSION

Pipeline Beach, Amanzimtoti is a dissipative beach, backed by a steep vegetated dune cordon that shows a high level of transgression in and around the beach facilities. Evidently structures and high levels of pedestrian traffic have compromised much of the dune and beach environment at Pipeline Beach. Pedestrian movement along and over the beach and sand sharing system at this point is envisaged to continue and will likely remain an issue of high impact on this environment. Therefore, it can be suggested that the proposed cable landing point is in a highly altered state. In addition, the beach can be considered to be dissipative in nature and therefore inflated, with a fine to medium sand, which would facilitate the excavation, cable laying and reinstatement of sand across the beach and the back of beach. It follows from the above that the establishment of a submarine telecommunications cable at Pipeline Beach will have little impact on the eco-morphology of the sand sharing system at this point and the coastline in general.

Given the above, the following management recommendations are presented:

1. The cable should be buried within the beach to a depth approximating ~1m below the deflated beach state. Where possible, and within the inter tidal and supra tidal environment, consideration of laying the cable at or around the depth of the shelly layer or "transitional point" within the beach sediments that is marked by increased deposition of shell and related debris, or a change in grain size.

2. Although the use of HDD is proposed to avoid disturbance of vegetation, where disturbance of the vegetated dune does arise, the affected area should be raked back to an angle of repose ~

27°, stabilised using a geofabric and suitably planted with appropriate vegetation (ideally the same dune species that are currently present on the dune cordon).

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