DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED RICHARDS BAY PORT EXPANSION PROGRAMME WITHIN UMHLATHUZE LOCAL MUNICIPALITY IN KWA-ZULU NATAL PROVINCE

DEA REF NO: 14/12/16/3/3/3/103

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TITLE	**:**	***DRAFT EIA REPORT: PROPOSED RICHARDS BAY PORT EXPANSION PROGRAMME WITHIN UMHLATHUZE LOCAL MUNICIPALITY IN KWA-ZULU NATAL PROVINCE***
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For AECOM SA (Pty) Ltd

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EXECUTIVE SUMMARY

BACKGROUND TO THE PROJECT

The Transnet Port Terminals in Richards Bay are a target for major demand growth in bulk products up to 2040. The demand forecast for a rail, road and harbour bound conveyor linked industry, is expected to grow from 23 million tonnes per annum (mpta) in 2012 to over 59 mtpa by year 2040; with the bulk of demand expected to be realised in the next 10 years. It is therefore evident that Transnet needs to expand the Port and recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand.

This EIA is done in terms of Government Notice Regulation (GNR) No. 543, 544, 545 and 546 of 2010 published in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended (NEMA) and the No 921 of 2013 in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).

AECOM SA (Pty) Ltd was appointed by Transnet SOC Limited (Transnet Capital Project) in November 2013 as the environmental consultant to undertake the processes for the proposed Richards Bay Port Expansion Programme. Peter Teurlings (was the EAP until end of June 2015) and now Nicola Liversage of AECOM is the independent Environmental Assessment Practitioner (EAP) in terms of the Environmental Impact Assessment (EIA) Regulations of 2010.

The competent environmental authority is the Department of Environmental Affairs (DEA) and the KwaZulu-Natal Department of Agriculture and Environmental Affairs (KZN -DAEA) is the commenting authority. The application for environmental authorisation was submitted to the DEA on 12 December 2013. The DEA reference number for the environmental authorisation (received on the 20 December 2013) is 14/12/16/3/3/3/103. The Final Scoping Report and Plan of Study for EIA accepted by the DEA on August 2014.

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The EIA process is currently in the EIA Phase and this report, the Draft EIA Report, documents the outcomes of the EIA Phase and the accompanying draft Environmental Management Programme (EMPr). The Draft EIA Report aims to address the potential impacts associated with the Option 3A of the proposed Richards Bay Port Expansion, and to provide an assessment of the project in terms of the biophysical, social and economic environmental factors.

This assessment aids both the environmental authority, in this case the competent authority is the Department of Environmental Affairs (DEA) and the KwaZulu-Natal Department of Agriculture and Environmental Affairs (KZN -DAEA) is the commenting authority.

Associated with the Draft EIA Report is a draft EMPr which will serve as a means to ensure that the issues highlighted in the Draft EIA Report that can be mitigated, are mitigated in a sustainable and effective manner. That is, the Draft EMPr acts as the constraints under which the *construction, operation and potential eventual decommissioning phases of the project are controlled, monitored and assessed.*

OVERVIEW OF PROPOSED PROJECT

During the Pre-feasibility Phase of the Port Expansion study, a Multi-Criteria Evaluation (or alternatives analysis) was conducted where Option 3A was identified as the preferred option for the Expansion of the Port of Richards Bay for continuation into the Feasibility Phase, i.e. this application for an environmental authorisation and the detailed engineering design phase.

The proposed Expansion Programme of the Port of Richards Bay thus entails the following:

- *Extension of the existing railway lines with a rail balloon with split off for Ferro-Manganese, a short train arrival yard and a long train arrival yard;*
- *Construction of new railway siding to the 600 series berths;*
- *Construction of 2 new Tipplers (i.e. rail unloading equipment);*
- *Relocation of the break-bulk from the eastern side of the Port behind the high 700 series berths to the western side of the Port next to the 600 series berths;*
- *Construction of a new discard coal stockpile on the eastern side of the Port behind the high 700 series berths;*
- *Expansion of the magnetite facility to the south;*
- *Extension of the existing Ferro Manganese slab by 260m to the east;*
- *Construction of a new Ferro Manganese slab of 780m in length to the south of the existing Ferro Manganese slab;*
- *Upgrading or realignment of existing roads within the Port;*
- *Construction of a new road-over-rail bridge at the eastern entrance to the Port;*
- *Construction of 32 conveyors totalling 13,084m;*
- *Construction of a new 142,030m^2 container handling terminal;*
- *Construction of 2 new Panamax shipping berths at the 600 series berths, with associated dredging of a channel to a depth of 14m and 800m turning circle;*
- *Extension of the Finger Jetty (800 series berths) with 2 new Capesize Coal shipping berths, requiring significant dredging around the existing Finger Jetty;*
- *Construction of a new 610,000m^3 stormwater surge dam inside the rail balloon, water pump stations, and upgrading of drains throughout the Port;*
- *Development of a Waste Transfer Station inside the Port, which will serve as the 'nerve centre' for managing waste in the Port; and*
- *Construction of a facility to discharge dredged material from the proposed construction of the berths; or*
- *Disposal of the dredged material off-shore.*

The proposed development is located within the Port of Richards Bay and is located on Portions 45, 21 and 157 of Erf 5333 and Lot 223 of the Farm Umhlatuzi, in the uMhlathuze Local Municipality.

PROJECT ALTERNATIVES

The EIA process also requires the identification and analysis of alternatives in order to satisfy the project's need. Therefore, the following items have been identified and are included as part of this EIA Report:

a) 'Do-Nothing' approach, i.e. no development.

b) The Multi-Criteria Evaluation.

c) The Layout alternatives.

d) The Sustainability alternatives.

PUBLIC PARTICIPATION

The Public Participation Process (PPP) included the distribution of documents by post and electronic mail, printed media, meetings with stakeholders and I&APs. All the issues and concerns that have been raised by the I&APs, through the various channels during the EIA process to date, including I&AP registration forms, email communications and the Public Open Day, were captured in the Issues and Response Report.

In keeping with the environmental legislation, it is the responsibility of the EAP to ensure that the public is provided the opportunity to participate meaningfully in the environmental investigation process. This includes identification of issues and review of reports. Accordingly, interested and affected parties (I&APs) are invited to review the Draft EIA Report and the site-specific EMPr from 20 July -28 August2015 at the Transnet offices in the Port and the Richards Bay Public Library that is situated at Kruger Rand Grove in Richards Bay (CBD).

The comments received during the review period of the Draft EIA Report will be incorporated into the Final EIA Report and submitted to the DEA for review, acceptance and potential authorisation. The Final EIA Report will be made available to registered I&APs for a period of 21 days, prior to the submission of the Final EIA Report to the DEA.

EIA PHASE

*All potential significant environmental issues (i.e. social, economic and biophysical) associated with the proposed development, that were identified in the Scoping Phase have been further investigated through specialist studies in the EIA Phase, specifically for the proposed Richards Bay Port Expansion. The consideration of the impacts and their change pre and post-mitigation is summarised in **Table 1-1.***

***Table 1-1**: Summary of Significant Impacts*

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Increased spread of disease		
Level of significance before mitigation	**High**	
Level of significance after mitigation	**Medium**	**N/A**
Reduced road safety		

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Medium	Medium
Increase in informal dwellers		
Level of significance after mitigation	Medium	N/A
Level of significance after mitigation	Low	N/A
Increased noise		
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Medium	Medium
Increased pressure on road and services infrastructure		
Level of significance before mitigation	Medium	Low
Level of significance after mitigation	Low	Low
Increased air emissions and dust		
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Low	Low
Increased criminal activity		
Level of significance before mitigation	Medium	N/A
Level of significance after mitigation	Low	N/A
Loss of recreational areas		
Level of significance before mitigation	High	N/A
Level of significance after mitigation	Medium	N/A
Increased employment opportunities		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Increased opportunities for local service providers		
Level of significance before mitigation	Low	N/A
Level of significance after mitigation	Medium	N/A
Increased investment		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Disruption of port activities		
Level of significance before mitigation	High	
Level of significance after mitigation	Medium- High	N/A
Opposition to the public participation process		
Level of significance before mitigation	Medium	
Level of significance after mitigation	Medium	N/A
Noise impact from construction and operation of railway balloon on receptors during daytime		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Impact on heritage resources: 1) RBP01 - Ephemeral scatter of LIA pottery 2) RBP 03 - MSA and LSA stone tools 3) RBP04 - Ephemeral scatter of ESA and MSA stone tools RBP06 - ephemeral scatter of MSA tools		
Level of significance before mitigation	Low	
Level of significance after mitigation	N/A	N/A
Impact on heritage resources: RBP09 - several shell species of which some have been burnt, as well as a three weathered stone tools.		
Level of significance before mitigation	Medium	N/A
Level of significance after mitigation	Low	N/A
Impact on heritage resources: RBP08 – geological formation that has formed a shelf protruding from the sand dunes, as the dunes are eroded		
Level of significance before mitigation	High	N/A
Level of significance after mitigation	Medium	N/A
Effect of increased SO2 due to shipping		
Level of significance before mitigation		Medium
Level of significance after mitigation	N/A	N/A
Effect of increased NOx due to shipping		
Level of significance before mitigation		Medium
Level of significance after mitigation	N/A	N/A
Effect of increased PM		
Level of significance before mitigation		Low
Level of significance after mitigation	N/A	N/A
Impact on Avi-fauna at Site A – Rail Balloon Area, Secondary Woodland		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Impact on Avi-fauna at Site A – Rail Balloon Area, Freshwater Wetland		
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Medium	Medium
Impact on Avi-fauna at Site A – Rail Balloon Area, Mangrove and Sandflats		
Level of significance before mitigation	High	High
Level of significance after mitigation	Medium - High	Medium - High
Impact on Avi-fauna at Site C – Berth 600 Series Extension		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on vegetation and wetland systems		
Level of significance before	High	High

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
mitigation		
Level of significance after mitigation	High	High
Impact on amphibians within the study area		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on fish fauna		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on macrobenthic fauna		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on Aquatic Vegetation		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on habitat for aquatic vegetation		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on Benthic Invertebrates		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Visual Impacts of visibility of Sediment Plumes		

Associated with the Draft EIA Report is a draft Site-Specific Environmental Management Programme (EMPr) which will serve as a means to ensure that the issues highlighted in the Draft EIA Report that can be mitigated, are mitigated in a sustainable and effective manner. That is, the EMPr acts as the constraints under with the construction, operation and potential eventual decommissioning (or closure) phases of the project are controlled, monitored and assessed.

Significant Findings

In the most comprehensive and up to data assessment of the ecological importance of South African estuaries, Turpie et al. (2002) ranked Richards Bay 26th out of 250 estuaries in the country for conservation importance. Ecological importance in this assessment was defined as "an expression of *the importance of a particular estuary to the maintenance of ecological diversity and functioning on local and regional scales". The ecological importance of an estuary was based on the following criteria: size, link with freshwater and marine environments, rarity of estuary type, habitat diversity and biodiversity importance (in terms of species richness, species rarity or endemism; and abundance).*

What is of particular importance to this study is that Nationally the port was ranked 3rd in the country for the ecological significance of its fish and for its bird communities, 5th for zonal type rarity with a score of 80% (classification of an estuary in conjunction with the biogeographical zone determines how "rare" or "unique" the estuary is for the zone under consideration), a score of 100% for estuarine size (score based on relative size of estuarine area in the country) and a very high score of 85% for biological diversity. In addition, Turpie (1995) ranked estuaries based on water bird assemblages and Richards Bay was ranked 3rd on the Abundance rating, 3rd on the Conservation Value Index, 2nd on the Endemism Index and 1st on the Population Size index.

In a more regional context, when Richards Bay Harbour is compared to the 22 Zululand estuaries in KwaZulu-Natal north of Durban, the system is ranked 6th for overall conservation importance, 2nd for zonal rarity, 8th for biodiversity and is one of only four estuaries with a score of 100% for estuarine size.

The discovery of well-established stands of Zostera capensis which is being utilized by the fauna in the Intertidal Shallows area is of great significance due to the contribution it is making in terms of estuarine ecosystem functioning within Richards Bay Harbour. It is also significant due to this species having been absent from the harbour for more than 30 years and the fact that it is now on the IUCN Red List of Threatened Species and designated as Vulnerable.

PUBLIC PARTICIPATION

The objective of the PPP in the EIA phase of the project is to present the findings of the investigations to the stakeholders and to provide them with an opportunity to comment on these. In order to achieve this, the Draft EIA Report is available for review by registered I&APs for a period of 40 days from the 20 July 2015 – 29 August 2015 at the Richards Bay Library and at the Transnet National Ports Authority (TNPA) offices in the Bayview Centre inside the Port of Richards Bay, for the port tenants.

The comments received during the review period of the Draft EIA Report will be incorporated into the Final EIA Report and submitted to the DEA for review, acceptance and potential authorisation. The Final EIA Report will be made available to registered I&APs for a period of 21 days, prior to the submission of the Final EIA Report to the DEA.

ENVIRONMENTAL IMPACT STATEMENT & REASONED OPINION

The Transnet Port Terminals in Richards Bay are a target for major demand growth in bulk products up to 2014. The demand forecast for rail, road and harbour bound conveyor linked industry, is *expected to grow from 23 million tonnes per annum in 2012 to over 59 million tonnes by the year 2040; with the bulk of demand expected to be realized in the next 10 years. It is therefore evident that Transnet needs to expand the Port and recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand.*

During the FEL2 Phase of the Port Expansion study, a Prioritisation FEL2 Multi-Criteria Evaluation (or alternatives analysis) was conducted where Option 3A was identified as the preferred option for the Expansion of the Port of Richards Bay for continuation into the Front-End Loading Phase 3 (FEL3) study (or Feasibility Phase), i.e. this application for an environmental authorisation and the detailed engineering design phase.

The proposed Option 3A for the Richards Bay Port Expansion was selected due to Geotechnical founding conditions at 600 series berths seem reasonably good for the area, the 600 series coal berths can be constructed in the dry in a coffer dam which is in many instances simpler than marine based construction. The new Break Bulk berths could be converted to container berths in future.

The prevention of the proposed project will result in the Port of Richards Bay not being able to cater for the increase in the general freight demand that is predicted by the year 2040.

The advantages of the Proposed Richards Bay Port Expansion development include the following:

Increase in employment opportunities

It has been projected that within the South African economy 9,151 jobs (skilled and unskilled) will be created directly, 3,810 jobs indirectly and 8,198 jobs induced as a result of the proposed port expansion.

As a result of the expansion, the port will be able to handle a higher volume of cargo.

Increased opportunities for local service providers

During construction, various services will be required which can be fulfilled by local service providers. Examples of such services include security, fencing, accommodation, earth moving, refuse removal, transport, etc. The appointment of local service providers will lead to further employment for the local population and, thus, put a greater amount of money into the local economy.

Increased investment

During communication with representatives from the Zululand Chamber of Commerce and Industry it was reported that the presence of the port is a significant 'pull factor' for industry into the area (Patterson. M, pers. comm., 2015).

The importance of the port for investment in Richards Bay was also confirmed during discussions with the Richards Bay Industrial Development Zone. It was noted that the construction of the container terminal will assist the IDZ in attracting investors. This is particularly important for industries involved with mineral beneficiation as they require containers to transport processed goods (Ngcamu. S, pers. comm., 2015). Thus, in the event of the port expansion being confirmed and construction *commencing, there is an increased likelihood that investors will consider Richards Bay as an area with a competitive advantage. This in turn has numerous secondary impacts such as employment creation.*

It needs to be noted that the increase in investment may spread further afield than the primary and secondary study areas. It is possible that the proposed expansion to the port and the existing rail and road networks to the port may make investment in large industry and mining activities inland more viable. Thus, the importance of the port expansion in terms of attracting investment also needs to be considered on a tertiary (provincial and national) scale.

Negative impacts associated with the proposed Richards Bay Port Expansion were determined and assessed and it was found that, with implementation of specialist recommended mitigation measures, all potential impacts can be reduced to a "very low","low" or "medium" negative and/or positive significance (as per summary presented in Table 1-1).

The EAP is of the opinion that the EIA and associated PPP for the proposed Richards Bay Port Expansion fulfil the process requirements of the NEMA, specifically the EIA Regulations of 2010. The assessment of the issues identified in the Scoping Report as raised by the I&APs, and considered in greater detail in the EIA Report with its related specialist studies, indicated that the significance of potential impacts associated with the proposed development can be reduced to a "low"/"medium", if the recommended mitigation measures are implemented.

The EAP is of the opinion that the proposed Richards Bay Port Expansion development located within the Port of Richards Bay and is located on Portions 45, 21 and 157 of Erf 5333 and Lot 223 of the Farm Umhlatuzi, in the uMhlathuze Local Municipality should be authorised, per the recommended Option 3A.

Conditions of the environmental authorisation should include the implementation of mitigation measures in the draft Site-Specific EMPr, the appointment of an independent Environmental Control Officer by TCP and the appointment of a full time Environmental Officer and a full-time Health and Safety Officer by the Contractor to monitor compliance with the draft Site-Specific EMPr.

Upon authorisation, the draft Site-Specific EMPr should also be updated to include specific conditions not yet included in the draft Site-Specific EMPr.

THE WAY FORWARD (DECISION MAKING PHASE)

Once all issues have been addressed by the EAP and presented in the Final EIA Report. The Final EIA Report will be submitted to the DEA along with the EMPr for DEA's decision as to whether or not to authorise the proposed Richards Bay Port Expansion project.

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Explanation
AMAFA	Amafa aKwaZulu iNatali (Heritage KZN)
amsl	above mean sea level
BID	Background Information Document
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
CSR	Coastal Systems Research group of the CSIR
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DBT	Dry Bulk Terminal
dia	diameter
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme (i.t.o. NEMA)
EPA	Environmental Protection Agency
FEL	Front End Loading phases
HIA	Heritage Impact Assessment
GFB	General Freight Bulk
GNR	Government Notice Regulation
I&AP(s)	Interested and Affected Party (-ies)
IDP	Integrated Development Plan
IRR	Issues and Response Report
IDZ	Industrial Development Zone
ISO	International Organisation of Standardisation
km	kilometre(s)
KZN DAEA	KwaZulu-Natal Department of Agriculture and Environmental Affairs
m	metre(s)
MAP	Mean Annual Precipitation
mtpa	million tonnes per annum
MPT	Multi-Purpose Terminal
NECO	Nature and Environmental Conservation Ordinance
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEM: AQA	National Environmental Management Act: Air Quality Act, 2004 (Act 39 of 2004)
NEM: BA	National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
NEM: ICMA	National Environmental Management: Integrated Coastal Management Act, 2008 (Act 24 of 2008

Acronym / Abbreviation	Explanation
NEM: WA	National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
NFA	National Forest Act, 1998 (Act 84 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act 25 of 1999)
NWA	National Water Act, 1998 (Act 36 of 1998)
PIA	Paleontological Impact Assessment
PICC	Presidential Infrastructure Coordinating Commission
PPP	Public Participation Process
RBCT	Richards Bay Coal Terminal
SAHRA	South African Heritage Resource Agency
SANBI	South African National Botanical Institute
SANS	South African National Standards
SDF	Spatial Development Framework
SIPs	Strategic Integrated Projects
SOC	State Owned Company
Stats SA	Statistics South Africa
TCP	Transnet Capital Projects
TEU	Twenty-foot equivalent units
TFR	Transnet Freight Rail
TNPA	Transnet National Port Authority
TPT	Transnet Port Terminal
WRC	Water Research Commission

1 INTRODUCTION

1.1 BACKGROUND OF STUDY

1.1.1 Project Background

The Port of Richards Bay, South Africa's most northern and easterly port is situated 160 km northeast of Durban and 465 km (by road) southwest of Maputo, Mozambique. The Port of Richards Bay consists of the Transnet operated Dry Bulk Terminal (DBT) and Multipurpose Terminal (MPT), along with the privately operated Richards Bay Coal Terminal (RBCT). Other private operators within the port include several wood chip export terminals and a bulk liquid terminal.

The Port occupies 2,157 ha of land area and 1,495 ha of water area at present, but has the potential of expanding when required, making the Richards Bay Port potentially one of the largest ports worldwide. The Richards Bay Port serves the coalfields of KwaZulu-Natal and Mpumalanga, together with timber and granite exporters from as far away as the Eastern and Northern Cape. Exports remain the primary activity of the port. The port has extensive rail and conveyor belt systems servicing the berths from nearby factories and plants. A dedicated railway line connects the port with Mpumalanga and Gauteng, was designed specifically to handle the majority of South Africa's coal exports. Other rail links connect Richards Bay with Durban in the south and Swaziland and Mpumalanga to the north.

The Transnet Port Terminals in Richards Bay are a target for major demand growth in bulk products up to 2014. the demand forecast for rail, road and harbour bound conveyor linked industry, is expected to grow from 23 million tonnes per annum in 2012 to over 59 by year 2014; with the bulk of demand expected to be realized in the next 10 years.

It is therefore evident that Transnet needs to expand the Port and recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand.

The Front-End Loading Phase 1 (FEL1) study (or Conceptual Phase) for the Richards Bay Port Expansion Programme was undertaken by Aurecon and completed during July 2012. The purpose of the FEL1 study was to conceptualise the commercially-viable immediate and long-term engineering options, as well as conduct an environmental fatal flaws analysis of all the options, for rail, material handling and marine to expand the Port of Richards Bay. This will enable the Port to handle the increase in demand of General Freight business up to the year 2040.

The project received a 'green' status from the Transnet Gate Review Panel to proceed to Front-End Loading Phase 2 (FEL2) study (or Pre-feasibility Phase). The FEL2 study commenced during October 2012. This FEL2 study is a further development and re-assessment of the options discussed in the FEL1 study for the bulk materials handling, rail and marine disciplines. These main disciplines were supported by various other discipline investigations including Baseline Environmental Specialist Studies which were undertaken by BKS (now AECOM).

During the FEL2 Phase of the Port Expansion study, a Prioritisation FEL2 Multi-Criteria Evaluation (or alternatives analysis) was conducted where Option 3A was identified as the preferred option for the Expansion of the Port of Richards Bay for continuation into the Front-End Loading Phase 3 (FEL3) study (or Feasibility Phase), i.e. this application for an environmental authorisation and the detailed engineering design phase.

The proposed development is located within the Port of Richards Bay and is located on Portions 45, 21 and 157 of Erf 5333 and Lot 223 of the Farm Mhlatusi, in the Umhlatuze Local Municipality.

This EIA was done in terms of Government Notice Regulations (GNR) No. 543, 544 and 546 of 2010 published in terms of the National Environmental Management Act, 1998 (Act No.107 of 1998) as amended (NEMA) with further due consideration of the NEMA 2014 regulations and the National Environmental Management: Waste Act, 2008 (Act No.59 of 2008) [NEM:WA] and Government Notice 921 of 2013.

1.1.2 Environmental Assessment Practitioner

AECOM SA (Pty) Ltd was appointed by Transnet SOC Limited (Transnet Capital Projects) in November 2013 as the independent Environmental Assessment Practitioner (EAP) to undertake the EIA process and Waste Management Licence for the proposed Richards Bay Port Expansion Development. AECOM meets the requirements for an independent Environmental Assessment Practitioner (EAP) in terms of the EIA Regulations of 2010 and 2014.

1.1.3 Environmental Authority

The relevant environmental authority is the Department of Environmental Affairs (DEA) as the Approving Authority and KwaZulu-Natal Department of Agriculture and Environmental Affairs (KZN DAEA) as the Commenting Authority. The DEA reference number for the environmental authorisation (received on the 20 December 2013) is 14/12/16/3/3/3/103.

The Final Scoping Report including the Plan of Study for EIA was accepted by the DEA on the 9 July 2014, and acknowledgement of receipt was received on the 18 June 2014 (refer to **Appendix 1**).

1.2 PURPOSE OF STUDY

An EIA is a planning and decision-making tool. It identifies potential negative and positive impacts of a proposed project and recommends ways to enhance the positive impacts and minimise the negative ones.

The EIA will address the impacts associated with the project, and provides an assessment of the project in terms of the biophysical, social and economic environments to assist both the environmental authority (i.e. the DEA) and the applicant (i.e. Transnet SOC Limited (Transnet Capital Projects) in making decisions regarding implementation of the proposed project.

An EIA consists of three phases:

a) the Scoping Phase;

b) the EIA Phase; and

c) the Decision-Making Phase.

The main purpose of the Scoping Phase was to identify and define the issues that need to be addressed in the EIA Phase. In this regard inputs from the project team, the authorities and Interested and Affected Parties (I&APs) were considered and integrated into the Final Scoping Report.

The main purpose of the phase at hand, the EIA Phase, is to undertake the specialist studies identified in the Scoping Phase, to integrate the findings and present recommendations for the Proposed Richards Bay Port Expansion Programme with due consideration of I&AP views and comments.

The draft Environmental Management Programme (EMPr) is also generated during this phase, which takes the findings of the EIA Report and presents these in a series of measurable controls that will serve to mitigate impacts to acceptable levels through the provision of controls for the construction, operation and decommissioning phases of the projects life cycle.

The information provided from the EIA Phase is passed on to the competent authority, the DEA, for consideration during the decision making phase.

1.3 PURPOSE OF THIS REPORT

The purpose of the EIA Report is to present a summary of the findings of the specialist studies and provide recommendations on how the project can be implemented in a way that minimises the negative and maximises the positive impacts.

The Draft EIA Report is submitted to DEA and the public simultaneously for a 40 day review period. Following the public review period (20 July 2015 – 28 August 2015), the Draft EIA Report will be finalised and the Final EIA Report will be submitted to the I&APs for final review over a period of 21 days before being submitted to the DEA for decision making.

1.4 Structure of this Report

The structure of the EIA Report is presented in **Table 1-1** and includes a cross-reference to the information requirements per Section 31 of Government Notice R.543 (of 18 June 2010, NEMA EIA Regulations).

Table 1-1: Structure of Report

Description	NEMA EIA Regulations (GN R543) Sect 31	Chapter
Introduction and background to the project.	*(2)(b)*	**Chapter 1**
Details of the Applicant, EAP (including expertise) and project team	*(2)(a)*	**Chapter 2**
A description of the proposed project, including the need and desirability.	*(2)(b), (c) & (f)*	**Chapter 3**
Legislation and guidelines that pertain to the project.	*(2)(r)*	**Chapter 4**
A description of the EIA process including the PPP, assumptions, uncertainties and gaps in knowledge.	*(2)(e) & (m)*	**Chapter 5**
A description of the receiving affected environment.	*(2)(c) & (d)*	**Chapter 6**
A summary of the findings and recommendations of the specialist studies, the studies included in the Addenda.	*(2)(j) & (q)*	**Chapter 7**
A description and comparative assessment of all project alternatives identified.	*(2)(g) & (i)*	**Chapter 8**
A description of the methodology used to determine significance ratings.	*(2)(h)*	**Chapter 9**
A description of all environmental issues identified and an assessment of significance.	*(2)(k) & (l)*	**Chapter 10**
A consideration of the draft Environmental Management Programme, the draft EMPr included in the Addenda.	*(2)(p)*	**Chapter 11**
Environmental Impact Statement, including a summary of key findings.	*(2)(o)*	**Chapter 12**
Conclusion and recommendations.	*(2)(n)*	**Chapter 13**

2 PROJECT TEAM

2.1 Applicant

Details of the Applicant are presented in **Table 2-1**.

Table 2-1: Applicant Details

Applicant	Transnet SOC Limited (Transnet Capital Projects - TCP)
Applicant on behalf of Transnet	Ms Bessie S. Mabunda
Postal Address	PO Box 72501, Parkview, Johannesburg, 2001
Telephone	011 308 1747
Fax	011 580 0639
Email Address	bessie.mabunda@transnet.net
Contact Person	Mr Khathutshelo E. Tshipala
Postal Address	PO Box 72501, Parkview, Johannesburg, 2001
Telephone	011 308 4709
Fax	086 686 0622
Email Address	khathutshelo.tshipala@transnet.net

2.2 Environmental Consultant

The independent EAP for the project is AECOM SA (Pty) Ltd; further details are presented in **Table 2-2**.

Table 2-2: Environmental Consultant Details

Environmental Consultant	AECOM SA (Pty) Ltd
EAP	Mrs Nicola Liversage
Contact Person	Mrs Nicola Liversage
Postal Address	P O Box 3173, Pretoria, 0001
Telephone	012 421 3591
Fax	012 421 3501
Email Address	nicola.liversage@aecom.com

2.3 Details of the Authors

As per the requirements of the NEMA, the details and expertise levels of the persons who prepared the report are provided in Table 2-3.

Table 2-3: Details of Authors

Project Manager	Deshni Naicker (Senior Environmental Scientist)
Responsibilities	Project management, compilation of reports and public participation
Highest Qualification	Masters in Environment and Development Studies (Geography)
Expertise to carry out preparation of	Deshni has 6 years of experience. She has undertaken a number of Environmental Impact Assessments (i.e. Basic Assessments; Scoping

Scoping Report	and EIA) under the EIA Regulations of 2006 and 2010 and has also been involved in environmental compliance monitoring and auditing (environmental control officer) on a number of construction projects. Her responsibilities have included undertaking environmental assessments, compilation of regulated EIAs (i.e. Scoping reports, EIA reports, Basic assessments and EMPs), incorporating specialists into the EIA team for any required specialist studies and undertaking the regulated public participation process required for EIAs, of which the following have specific reference: • Proposed Upgrading of Stormwater Infrastructure in Valencia, Addo of the Sundays River Valley Municipality. • Replacement of Existing Fence at the Saldanha Naval Base, National Department of Public Works, Saldanha. • Umhlanga Ridgeside Development, Tongaat Hulett, Durban. • Rethabiseng Extension 5 Phase 1 [Bronkhorstpruit], GDARD, Pretoria. • Danville (Elandspoort) Phase 1 [Pretoria West], GDARD, Pretoria West. • Vodacom Cell Phone Masts, Vodacom, Sandton. • Extension of the Existing Berth 10, Island View, Port of Durban.
Project Director	Nicola Liversage (Beginning July 2015); Peter Teurlings (until end of June 2015)
Responsibilities	EAP, Quality review and approval of reports
Highest Qualification	MSc (Geography)
Professional membership	Professional Natural Scientist – Environmental Science International Association of Impact Assessments SA Green Star SA Accredited Professional
Expertise to carry out review / approval of Scoping Report	Nicola obtained her BSc. Degree at the University of Natal in 1999 majoring in Geography and Zoology. She proceeded with her studies for BSc (Hons) in Geography specialising in Geomorphology and Soil Erosion and GIS and then went on to MSc in Geography all at the University of Natal until 2002, where she obtained her Masters Degree on the topic of "Land Use Change as a Contributing Factor to Sedimentation Rates in the Hazelmere Catchment, KwaZulu-Natal, South Africa". After working as a GIS Analyst both South Africa and in the UK, she was appointed as an Environmental Assistant at SEF in their Pretoria Office, South Africa where she became involved in a variety of environmental projects. She was soon promoted first to Environmental Manager and then to Project Manager. Responsibility during this period included report writing, stakeholder engagement, skills transfer, specialist studies, research and data manipulation, team work. She was also responsible for project management and quality control of some of the projects. The range of projects include Environmental Management Plans, Scoping and EIA, State of the Environment Reports, Environmental Management Frameworks (aka Strategic Environmental Assessments), In 2006 she joined Matrix+ Consulting as a Sustainability &

	Environmental Consultant where she was seconded to assist Anglo Platinum in the compilation, auditing and production of their annual sustainability report. She was responsible for research and development into international standards (including IFC, World Bank and Equator Principles) and to market these services to key mining clients. She was involved in the compilations of policy statements and standards in terms of biodiversity management, climate change. In 2007, she joined BKS (now AECOM) as a Senior Environmental Scientist and is now the Business Line Lead for Environment Africa. Nicola is a Professional Natural Scientist in the field of Environmental Science with the South African Council of Natural Scientific Professionals and a Green Star SA Accredited Professional for New Buildings for the Green Building Council of South Africa. Nicola also sits on the impartiality committee at the SABS.: • CB&I, Albertine Oil Pipeline Route Screening Assessment from Mombasa, Kenya to Uganda, Sudan and Tanzania, (2008) Environmental Scientist • Sasol, Mafutha Pipeline Screening Assessment, (2008) Environmental Scientist • Department of Water Affairs, Lusikisiki Water Resources Feasibility Study, (2010 – 2011), Environmental Task Leader • SANRAL, Ermelo Ring Road Route Determination ESIA, (2012 – current) Environmental Project Advisor • GDRT, Gauteng Strategic Road Network Environmental Evaluation, (2009 – 2010), Environmental Manager • PRASA, Station Upgrades, Screening Assessment (2013). Environmental Advisor • TCTA, Acid Mine Drainage Due Diligence, (2011), Assistant IRP Manager (Integrated Regulatory Process) • West Rand District Municipality, WRDM Strategic Environmental Assessment (SEA) (2011 – current) – Project Manager • Department of Environmental Affairs and Tourism (DEAT) Pixley ka Isaka Seme Local Municipality SEA, (2009 – 2011) – SEA Process advisor • Gert Sibande District Municipality, GSDM SEA (2009 – 2012) – Project Manager • GSDM, Dipaleseng Local Municipality SEA, (2009 – 2012) – Project Manager • GSDM, Mkhondo Local Municipality SEA (2009 – 2012) – Project Manager • GSDM, Govan Mbeki Local Municipality SEA (2009 – 2012) – Project Manager • GSDM, Lekwa Local Municipality SEA (2009 – 2012) – Project Manager • Mbombela Local Municipality, MLM SEA (2005 – 2006) – Project Manager • Mangaung Local Municipality, MLM SEA (2005 – 2006) – Project Manager • West Rand District Municipality, WRDM SEA (2005 – 2006) –

	Project Manager, Environmental Scientist and Geomorphology Specialist • Gauteng Department of Agriculture, Conservation and Environment (GDACE) N1/R21, SEA (2003 – 2004) Assistant Environmental Scientist • Dube TradePort, DTP State of the Environment Report (SoER) (2012) – Project Manager • Bojanala Platinum District Municipality SoER (2011 – 2012) – SoER Advisor • West Rand District Municipality, WRDM SoER (2009 – 2010) – Project Manager • WRDM, Westonaria Local Municipality SoER (2009 – 2010) – Project Manager • WRDM, Mogale City Local Municipality SoER (2009 – 2010) – Project Manager • WRDM, Randfontein Local Municipality SoER, (2009 – 2010) – Project Manager • WRDM, Merafong City Local Municipality SoER, (2009 – 2010) – Project Manager • WRDM, WRDM SoER (2005 – 2006) – Project Manager, Environmental Scientist and Geomorphology Specialist • WRDM, Westonaria Local Municipality SoER, (2005 – 2006) – Project Manager, Environmental Scientist and Geomorphology Specialist • WRDM, Randfontein Local Municipality SoER, (2005 – 2006) – Project Manager, Environmental Scientist and Geomorphology Specialist • WRDM, Merafong City Local Municipality SoER, (2005 – 2006) – Project Manager, Environmental Scientist and Geomorphology Specialist • DEA, Review of State of the Environment Reports, DEAT (2005 – 2006) – Environmental Scientist • Sedibeng District Municipality, SDM SoER (2003 – 2004) – Environmental Scientist

2.4 Project Team

Nicola and Deshni are supported by other members of the project team as indicated in Table 2-4. Input from the Applicant and specialists is important for the completeness of the EIA process and accuracy of project related information.

Table 2-4: Project Team

Name	Role on the team	Company
Nicola Liversage	Project Director & EAP	AECOM
Deshni Naicker	Project Manager; Assistant EAP, Senior Environmental Scientist	AECOM
Ms Bongi Shinga	Public Participation Manager	AECOM
Emmanuel Mmotong	Assistant Project Manager; Assistant EAP,	AECOM

Name	Role on the team	Company
	Senior Environmental Scientist	
Mamokete Maimane	Environmental Scientist and Public Participation Officer	AECOM
Martina Martin	GIS Technologist	AECOM
Dr Brent Newman	Principal Scientist: Project Manager, Data analysis and reporting	CSIR
Roy van Ballegooyen	Principal Scientist: Data analysis and reporting	CSIR / WSP
THC Mostert	Vegetation and Wetland Specialist	CRUZ-Environmental Consultants
Prof DP Cyrus	Bird Specialist	CRUZ-Environmental Consultants
LH du Preez	Frog Specialist	CRUZ-Environmental Consultants
L Vivier and Prof DP Cyrus	Fish and Benthic Invertebrate Fauna Specialist	CRUZ-Environmental Consultants
L Vivier and Prof DP Cyrus	Benthic Invertebrate Fauna Specialist	CRUZ-Environmental Consultants
L Vivier and Prof DP Cyrus	Aquatic Vegetation and Fish Specialist	CRUZ-Environmental Consultants
Simon Gear	Air Quality Specialist	Kijani Green
Mornè de Jager	Noise Impact Specialist	M^{2}ENCO Noise and Acoustics
Gerhard de Wet	Specialist Traffic Engineer	AECOM
Len van Schalkwyk	Heritage Specialist	eThembeni Cultural Heritage
Dr Maria Ovechkina	Paleontological Specialist	eThembeni Cultural Heritage
Dr Rolf-Dieter Heinsohn	Socio Economic Specialist	ACER
Duncan Keal	Social Assessment Practitioner	ACER
Khathutshelo Tshipala	Project Manager: TCP	Transnet
Yolandi Robbetze	Assistant Project Manager: TCP	Transnet
Nelson Mbatha	Transnet Ports Environmental Manager	Transnet
Vincent Matabane	Transnet Freight Rail Environmental Manager	Transnet
Raymond van Rooyen	Transnet Port Terminal Environmental Manager	Transnet
Biance Smith	Environmental Specialist	Transnet

3 OVERVIEW OF THE PROPOSED PROJECT

3.1 NEED AND DESIRABILITY

Government recently adopted an Infrastructure Plan that is intended to transform the economic landscape of South Africa, create a significant number of new jobs, strengthen the delivery of basic services to the people of South Africa and support the integration of African economies.

The Presidential Infrastructure Coordinating Commission's (PICC) work was to assess the infrastructure gaps through spatial mapping which analyses future population growth, projected economic growth and areas of the country which are not served with water, electricity, roads, sanitation and communication. Based on this work, seventeen Strategic Integrated Projects (SIPs) have been developed and approved to support economic development and address service delivery in the poorest provinces. The Richards Bay Port Expansion falls within the SIP 1 project.

Transnet's vision and mission is to be a focused freight transport company, delivering integrated, efficient, safe, reliable and cost-effective services to promote economic growth in South Africa. Transnet aims to achieve this goal by increasing their market share, improving productivity and profitability and by providing appropriate capacity to customers ahead of demand. Transnet Port Terminals (TPT) is responsible for cargo handling and logistics management solutions. TPT's port operations service customers across a broad spectrum of the economy, including the shipping industry, vehicle manufacturers, agriculture, steel and the mining industry. The division operates 17 terminals across six South African ports.

Transnet National Port Authority (TNPA) is responsible for the safe, effective and efficient economic functioning of the national port system, which it manages in a landlord capacity. TNPA's core functions are to plan, provide, maintain and improve port infrastructure to provide or arrange marine-related services, to ensure the provision of port services, including the management of port activities and the port regulatory functions at all South African ports; and to provide aids to navigation and assistance to the manoeuvring of vessels within port limits and along the coast.

Transnet Freight Rail (TFR) is the largest division of Transnet. It is a world class heavy haul freight rail company that specialises in the transportation of freight. TFR's core business lies in freight logistics solutions designed for customers in industry based business segments, mining, heavy and light manufacturing.

TPT's Richards Bay Terminal services primarily the mining sectors in terms of general bulk freight, including some other smaller bulk and break-bulk commodities. A core strategic objective of Transnet for Richards Bay Port is to handle the increased volume demand for freight bulk up to year 2040. The envisaged Port of Richards Bay Capacity Expansion Programme conforms entirely to this objective (Aurecon, 2012).

Furthermore, the uMhlathuze Spatial Framework Plan makes reference to existing and anticipated future development pressures and notes that the strategic location of the municipality (national and provincial economic development node), population increase, the need for more regional facilities and proposed port expansion (with associated industrial development) will increase future development pressures. There is a huge demand for residential development which may be met in the short term but there is reason to believe that the long-term demands for growth may not be so easily absorbed by the area. The City of uMhlathuze has incorporated sustainability principles in their planning, and has considered local environmental priorities but it is evident that they are faced with "a challenging series of decisions" to respond to existing and future development needs (Status Quo Report, 2009).

Transnet's strategic actions for the study area are captured in the Port Development Framework (PDF, 2006) and the more recent Due Diligence Investigation for the Acquisition of Land for Future Port Expansion (in finalisation phase). These strategic plans highlight the potential detrimental and adverse impacts that may be associated with port expansion activities in the future. However, it also reflects the extent to which Transnet has incorporated sustainability principles into their planning, taking cognisance of local environmental priorities and proposing long-term measures to address impacts.

The TPT in Richards Bay are a target for major demand growth in bulk products up to 2040. The current terminal facilities and machinery are near their operational capacity and many of the assets are at or near the end of their useful life, requiring major refurbishment and/ or replacement.

It is therefore more evident that Transnet needs to expand the port and/or recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand. When developing the Port Expansion Programme's FEL-2 deliverables, it was prudent to consider the Programme's interfaces with other programmes to ensure alignment and mutualism.

3.2 PROPOSED AREAS FOR DEVELOPMENT

The proposed Expansion Programme of the Port of Richards Bay (Refer to Figure 3-1 Locality Map) which is subject to this EIA process entails the following:

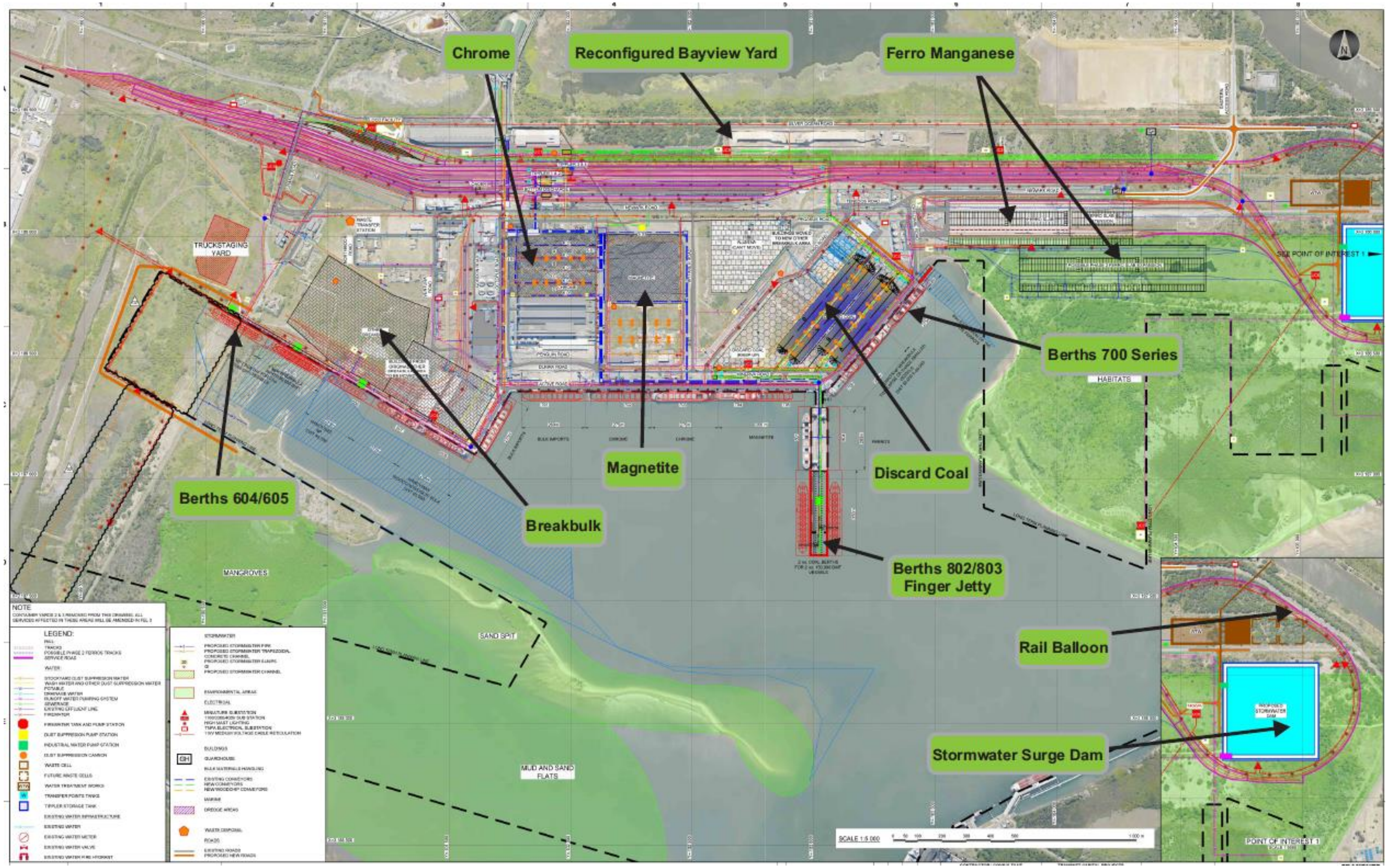


Figure 3-1: Locality Map of Richards Bay Expansion: Proposed Option 3A Layout

3.2.1 Extension of the existing railway lines with a rail balloon with split off for Ferro-Manganese, a short train arrival yard and a long train arrival yard

The balloon is located at the eastern end of the port. Included in this package is the noise mitigation measures proposed to minimize the noise impact on the residential area to the east of the balloon. The infrastructure highlighted in red in the figure below shows the balloon related rail infrastructure. Other areas such as the east Entrance Bridge and locomotive maintenance facility are discussed in later chapters of this report.

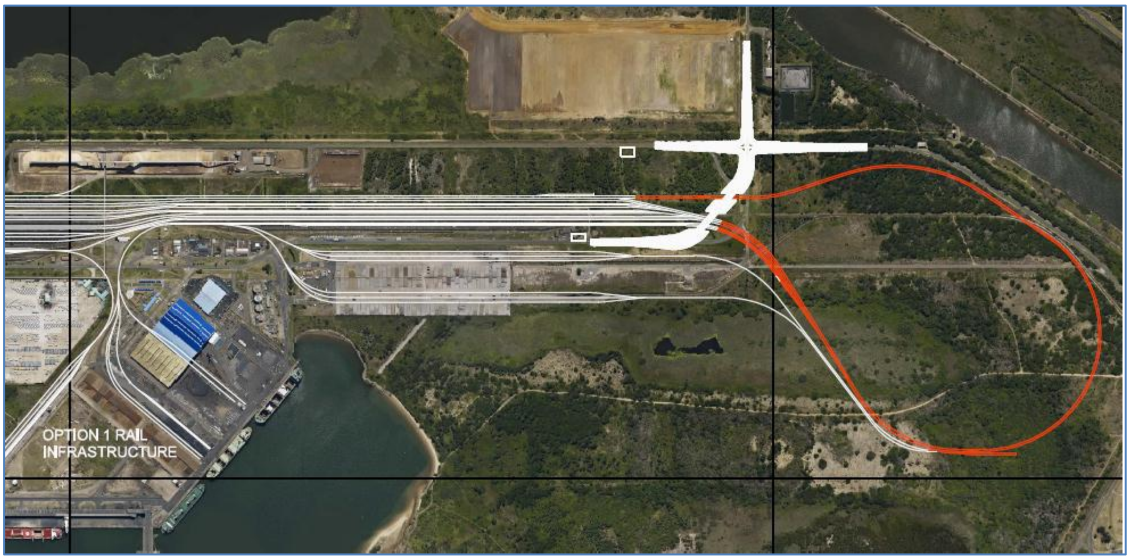


Figure 3-2: Proposed Rail Balloon Layout

The railway balloon is required to allow incoming trains to exit the yard from the same side as they enter without multi-directional movements and shunting which is operationally inefficient. The balloon therefore provides a substantial increase in the efficiency of operations resulting in reduced turnaround times. It also allows for a greater level of safety due to the elimination of shunting. Figure 3- below lustrates the unrestricted movements of an incoming train through the balloon, arrivals yard and exiting concept of via the departure yard.

The balloon is designed to allow for a single service road running on the outside of the balloon. Where the balloon lines increase from two lines at the Ferro slab and bottom discharge off takes, two service roads have been allowed for. This is done to allow for the design criteria of one service road per three rail lines.

The rail balloon traverses through an area at the port that is underlain by significant clay.

The geometric design of the loop has been carefully considered by the FEL2 engineers in order to cater for the geotechnical conditions in this area. The balloon will be predominantly in fill (ranging from 0.6 m to 1.7 m). This fill, together with treatment of the foundation layers with geotextile reinforcement and subsoil drainage will provide a stable platform with minimal subsidence.

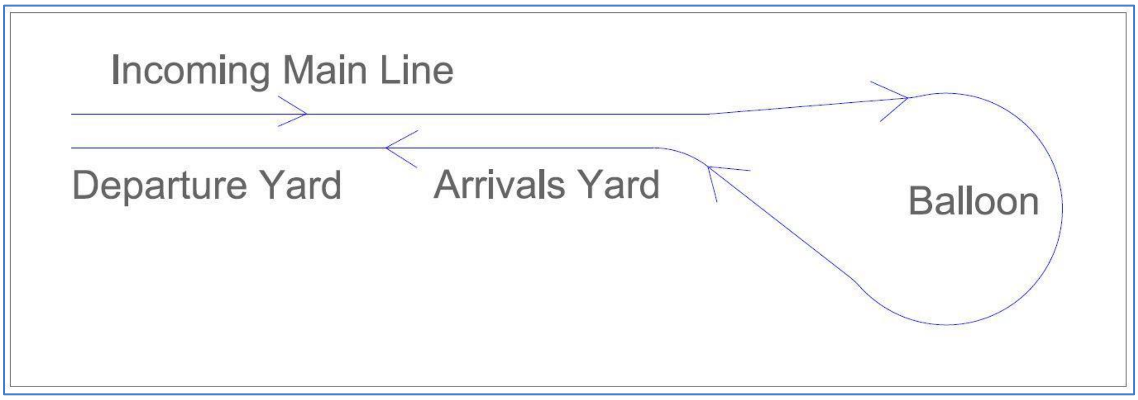


Figure 3-3: Balloon Movements

In the presence of a shallow water table and wetlands, it is recommended that the rail layer works be constructed on a geotextile reinforced foundation. Layers of heavy duty geocell geotextiles are proposed. Geotextiles are mostly used for separation of layers and drainage but they also make some contribution to soil reinforcement. This will be achieved by preventing movement of soil particles while at the same time allowing water to flow maintaining drained conditions of the soil material.

3.2.2 Construction of 2 new Tipplers (i.e. rail unloading equipment)

Offloading will be done by a twin cell tippler (see Figure 3-) dedicated to discard coal.

Figure 3-4: Twin Cell Rotary Tippler

The new tippler (Tippler 4) will be able to tip CCL-8 (Jumbo) wagons with rotary couples at a cycle time of 90 seconds. This will give a design throughput rate of 6400 t/h.

The material will then be conveyed to the stockpile located next to the six (6) series berths on a new conveyor route.

3.2.3 Construction of new railway siding to the 600 series berths

Bayview yard currently consists of rail infrastructure that services the MPT area at the port. This infrastructure is divided into several rail spurs that feed the eastern MPT area and the western MPT area.

The operations for the new railway siding to the 600 series berths will also have the same relationship between arrivals and departures with regards to the assembly of wagons from 25 to 50 wagons, and vice versa. However, this siding is in a location that requires a green fields approach with regards to the railway tracks as well as the supporting infrastructure.

Figure 3-5: The proposed railway siding to the 600 series berths

3.2.4 Relocation of the break-bulk from the eastern side of the Port behind the high 700 series berths to the western side of the Port next to the 600 series berths

Bulk earthworks entail the forming of bulk earthworks terraces for the various structures/utilities. Selected terrace levels aim at cut/fill balance where possible. Other considerations are material handling constraints, drainage and access, both during construction and operation.

All terraces or embankments shall have cut and fill slopes at 1:2.5 gradient or as specifically directed by the Geotechnical Engineer based upon slope stability and seismic safety considerations.

All terraces shall have cross falls in two directions:

- Minimum of 1:200 in at least one direction
- Minimum 1:200 in the other direction perpendicular to it
- Maximum cross fall to be 1:50 in any direction

Bulk earthworks design entails a terrace level that suits all operational requirements that include, but not limited to, the following:

- Cut to fill balancing of earthworks quantities within limits
- Surface drainage
- Final levels for bulk materials handling equipment and railway lines

The current paving must be repaired and replaced where required. It was assumed that 25% of the existing paving will be rebuilt. Information on the strength of the existing pavement layers is not available. A full investigation must be done before the detail planning and recommendations of the pavement design can be done. New paving will be aligned to join to the existing paving and to tie up with the proposed stormwater systems.

The stockyard consists of a combination of concrete interlocking paving blocks (which are in good serviceable condition) and precast concrete slabs of 160mm in thickness. The slabs are uneven in elevation and cracked panels are in existence across the site.

3.2.5 Buildings

With the expanded operations, the port terminal would require additional buildings to house various services, as well as refurbishment and removal of existing buildings. Refer to Table 3-1 for a summary of the new buildings required, as well as the existing buildings that will be impacted by the Port Expansion Project.

Table 3-1: Proposed New Buildings and Description

New Buildings	Description
Access Gate House	Access gate house with 3 guards per shift. This building will house document control, drug and alcohol testing facilities, toilets and a kitchenette.
Western Security Gate House	Access gate house with 2 guards per shift. This building will house document control, a security equipment room, a toilet and a kitchenette.

New Buildings	Description
Stock yard Control / Electrical Room	The control building should overlook the stock yards.
Tippler Control Electrical Room	The control building should overlook the tippler.
Generator Room	An open plan room with large doors and door openings to allow for moving of equipment. The room should be well ventilated. Equipment should be placed on a plinth. Introducing a bund wall is a possibility.
UC 1 Substation Building (Small Layout)	Large doors and good ventilation is necessary. Fire detection and fire suppression are required in the transformer room. The transformer rooms are 6m high; all other rooms are 3.5 m high. A basement of 2.5m is required below (not underneath the transformers). Face brick building with concrete roof. Fire detection and fire suppression are required in the transformer room.
UC 2 Substation Building (Medium Layout)	Face brick building with concrete roof. Fire detection and fire suppression are required in the transformer room.
UC 3 Substation Building (Large Layout)	Face brick building with concrete roof. Fire detection and fire suppression are required in the transformer room.
Tippler 1 Substation Building	Large doors and good ventilation is necessary. Fire detection and fire suppression are required in the transformer room. The transformer rooms are 6m high; all other rooms are 3.5 m high. A basement of 2.5m is required below (not underneath the transformers).
Tippler 2 Substation Building	Large doors and good ventilation is necessary. Fire detection and fire suppression are required in the transformer room. The transformer rooms are 6m high; all other rooms are 3.5 m high. A basement of 2.5m is required below (not underneath the transformers).
RBPE Substations 01 - 08	Timber Building with Concrete roof to cover MCC's

Table 3-2: Existing Buildings to be Relocated and Altered

Existing Buildings	Proposed Alterations
Bulk Steel & Cargo Warehouses 1, 2 and 3	• Dismantle the building components and record each component so as to re-use and re-assemble the steel structure and sheeting elements. Services (electrical, water, fire, cranes etc.) are to be evaluated and where possible repositioned in accordance with the building, if not closed/sealed off and made safe. • New concrete footing and surface bed are required for the new, relocated building. • Floors are to be power floated. Clean, prime and repaint the re-assembled steel. Reconstruct the steel frame onto the new concrete stub columns and re-clad with the re-used sheeting where possible. Damaged sheeting must be replaced with new to match the existing profile. The new doors and openings are made wider than those of the existing building's and roof monitors be introduced on the existing structure to incorporate louvers, thereby improving the ventilation within the building. • New doors will have to be constructed to suit the revised door opening sizes and the mechanism upgraded to suit heavier doors. Additional

Existing Buildings	Proposed Alterations
	drainage must be introduced at all door openings to deal with the ingress of rain water into the dry store.
Bulk Steel & Cargo Warehouse 4	• Dismantle the building components and record each component so as to re-use and re-assemble the steel structure. • Asbestos sheeting to be handled within the current health regulations. It should be safely discarded with other hazardous waste according to government regulations. • Services (electrical, water, fire, cranes etc.) are to be evaluated and where possible repositioned in accordance with the building, if not closed/sealed off and made safe. • New concrete footing and surface bed are required for the new, relocated building. Floors are to be power floated. Clean, prime and repaint the re-assembled steel. Reconstruct the steel frame and clad with new pre-coated metal sheeting. • It is recommended that roof monitors be introduced on the existing structure to incorporate louvers, thereby improving the ventilation within the building.
Rail Bulk Materials Load and Off-load Shelter	• Dismantle the building components and record each component so as to re-use and re-assemble the steel structure and sheeting elements. Services (electrical, water, fire, cranes etc.) are to be evaluated and where possible repositioned in accordance with the building, if not closed/sealed off and made safe. • New concrete footing and surface bed are required for the new, relocated building. Floors are to be power floated. Clean, prime and repaint the re-assembled steel. Reconstruct the steel frame and clad with new pre-coated metal sheeting. • It is recommended that roof monitors be introduced on the existing structure to incorporate louvers, thereby improving the ventilation within the building. • 2 x mild steel trusses and a number of gutted elements have been damaged by forklifts and other moving equipment. These will need to be replaced during the relocation process.
Bulk Paper Store	• Dismantle the building components and record each component so as to re-use and re-assemble the steel structure and sheeting elements. Services (electrical, water, fire, cranes etc.) are to be evaluated and where possible repositioned in accordance with the building, if not closed/sealed off and made safe. • New concrete footing and surface bed are required for the new, relocated building. • Floors are to be power floated. Clean, prime and repaint the re-assembled steel. Reconstruct the steel frame onto the new concrete stub columns and re-clad with the re-used sheeting where possible. Damaged sheeting must be replaced with new to match the existing profile. The new doors and openings are made wider than those of the existing building's and roof monitors be introduced on the existing structure to incorporate louvers, thereby improving the ventilation within the building.
Bulk Store Offices	• Demolish brick building after pre-demolition audit and soft strip. Materials that can be re-used include plasterboard, fixtures and fittings and roofing materials, provided such materials are in a good condition. • New building to be relocated and rebuilt with the same accommodation/programme as the current building - face brick double storey offices with toilets, Timber roof structure and sheet metal roofing. The building may not take on the same form as the previous building due to specific site conditions. • Fenestration and glazing to comply with SANS 10400 Part XA, therefore window sizes and positions will have to be reviewed and revised if necessary. The insulation requirements of the building will also have to be recalculated and the insulation possibly re-installed according to

Existing Buildings	Proposed Alterations
	current regulations. • Infill soil, rubble and demolition waste can all be reused as landscaping, as paving or as infill for the rebuilt and new building. Bricks that are not structurally sounds for re-use for the building can also be reused for this purpose.
LDV and Maintenance Workshops	• Dismantle the building components and record each component so as to re-use and re-assemble the steel structure. • Asbestos sheeting to be handled within the current health regulations. It should be safely discarded with other hazardous waste according to government regulations. • Services (electrical, water, fire, cranes etc.) are to be evaluated and where possible repositioned in accordance with the building, if not closed/sealed off and made safe. • New concrete footing and surface bed are required for the new, relocated building. Floors are to be power floated. Clean, prime and repaint the re-assembled steel. Reconstruct the steel frame and clad with new pre-coated metal sheeting. It is recommended that roof monitors be introduced on the existing structure to incorporate louvers, thereby improving the ventilation within the building. • Welding bay to be built to the same size as the existing bay. A better ventilation system is recommended. • The current working operations of the Wash bay are to be evaluated. Before relocating the wash bay several considerations will be taken into account. The wash bay will be rebuilt in the new location to the appropriate size. Improved water saving and recycling processes will be implemented. • New LDV workshop, 3 x overhead cranes, canteen area • New offices will be built with the same accommodation/programme as the current building, although orientation and planning will be revised to allow for a more efficient workflow and greater comfort. • The change room will be built to the same capacity as the existing building, although the planning may be reconsidered where possible the existing fixtures and fittings of the building will be reused. • Oil water separator will be located outside. It will be constructed to the same capacity and area as the existing oil water separator. New techniques of separation might be implemented. • Shade netting for parking to accommodate for the same parking allowance.
Occupational Health Facility	• Demolish brick building after pre-demolition audit and soft strip. Materials that can be re-used include plasterboard, fixtures and fittings and roofing materials, provided such materials are in a good condition. • New building to be relocated and rebuilt with the same accommodation/programme as the current building - facebrick double storey offices with toilets, Timber roof structure and sheet metal roofing. • Face brick walls to match other existing buildings. Fenestration and glazing to comply with SANS 10400 Part XA, therefore window sizes and positions will have to be reviewed and revised if necessary. The insulation requirements of the building will also have to be recalculated and the insulation possibly re-installed according to current regulations. • Infill soil, rubble and demolition waste can all be reused as landscaping, as paving or as infill for the rebuilt and new building. Bricks that are not structurally sounds for re-use for the building can also be reused for this purpose.
Canteen and Dining Building	• Concrete framed building with concrete roof to be demolished. • Mess and ablutions will be rebuilt on new site. • Infill soil, rubble and demolition waste can all be reused as landscaping, as paving or as infill for the rebuilt and new building. Bricks that are not structurally sounds for re-use for the building can also be reused for this

Existing Buildings	Proposed Alterations
	purpose.
CPO Control Room	• If the control room is affected by the site changes, the concrete framed building with the concrete roof will be demolished after the new building has been occupied. • The building will have to be rebuilt on a new site, to the same size and accommodation as the current building. It must be noted though that the new building must be operational prior to the current and existing building undergoing demolition. No components can be re-used or reclaimed from the current and existing building for this reason. • The control room equipment will be upgraded to newer technology to smooth over the transition between the two buildings. • Infill soil, rubble and demolition waste can all be reused as landscaping, as paving or as infill for the rebuilt and new building. Bricks that are not structurally sounds for re-use for the building can also be reused for this purpose.
Existing Substation, LDV Maintenance Workshop and Contractor Offices 1 -3	Currently unaffected – dependent on final rail position.

The following energy saving design principles and equipment selection guidelines will be used:

- Where possible bathrooms and changes room will rely on natural ventilation, as opposed to mechanical ventilation.
- Ductwork will be designed to be low pressure/energy efficient; the maximum friction rate will not exceed 1 Pa/m.
- Generally the designs will make use of split type air-conditioners; these are considered to be one of the most efficient types of air-conditioners for the following reasons:
    - They have relatively high COPs (coefficient of performance)
    - They have very low fan pressure drops, which significantly reduces fan energy.
    - They are not central, as such; the units only need to run when the space is occupied.
    - Split unit and package unit air conditioners will be specified to have inverters on the compressor drives, and use R410-A refrigerant. The inverter drives save energy under part load conditions and the R410-A refrigerant has a zero ODP (ozone depleting potential).

3.2.6 Construction of a new discard coal stockpile on the eastern side of the Port behind the high 700 series berths

Discard coal is the fastest growing commodity in the trade forecast for Richards Bay. It also has the highest throughput of any commodity with the exception of the Navitrade coal stream (4653710-RPT-0087 Capacity Expansion FEL2 BMH Report Rev 00).

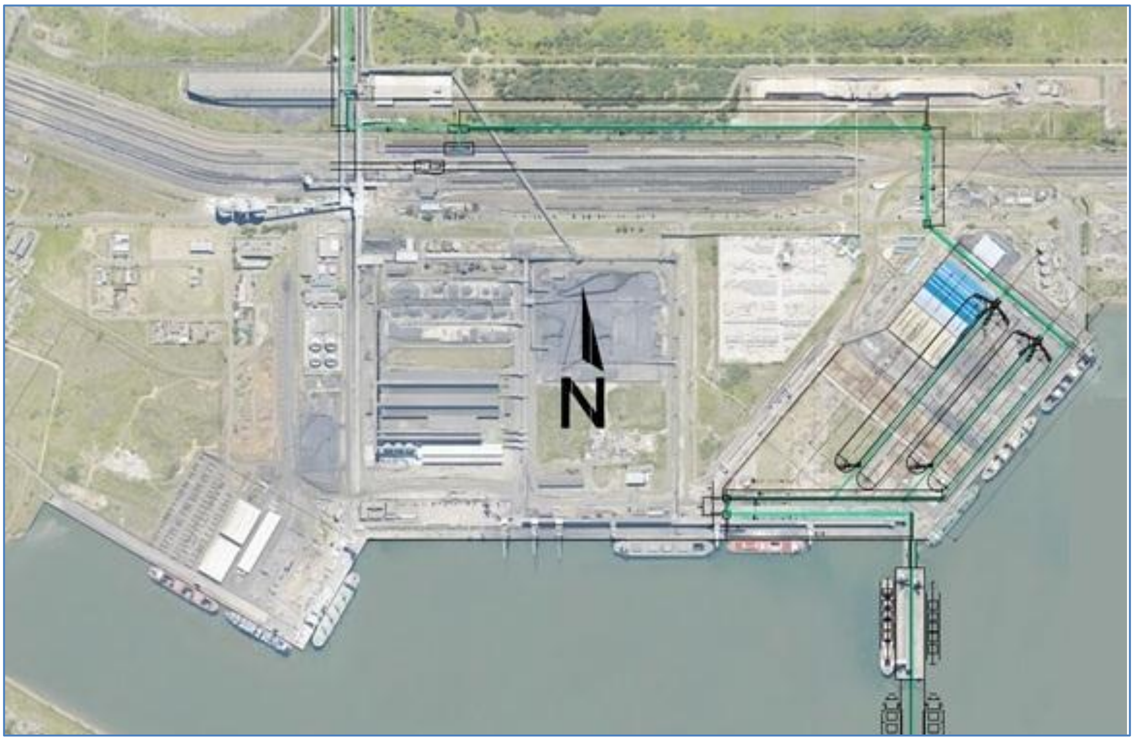


Figure 3-6: Discard Coal – Option 3A

It is proposed that the designed area for the discard coal will be fenced with wind curtains for environmental purposes to prevent contamination.

3.2.7 Extension of the existing Ferro Manganese slab by 260m to the east and construction of a new Ferro Manganese slab of 780m in length to the south of the existing Ferro Manganese slab

The port expansion project requires the Ferro Manganese slab to be extended by 260 m towards the east (see Figure 3-). This extension will allow storage capacity of 10% of the required annual throughput until year 2025.

After year 2025, the demand increases to 8.6 Mtpa, more than doubling the annual demand. For the storage capacity to remain at 10%, the storage area would need to be nearly doubled. For this reason, it is necessary to provide a solution for possible additional rail and BMH expansion.

The additional expansion of the slab for the “beyond 2025” scenario is provided for by extending the slab to the south and providing additional rail infrastructure as shown in Figure 3- below.

Some limited cracking exists in the concrete slabs which need to be sealed. The majority of the existing concrete blocks are in good condition. The cracks will be sealed with a one-component silicon sealant with low-modulus properties. A concrete hardener is to be provided to increase the abrasion resistance and to lower the permeability of the existing slabs (4653710-RPT-0069 Capacity Expansion FEL2 Rail Infra & Operations report Rev 00).

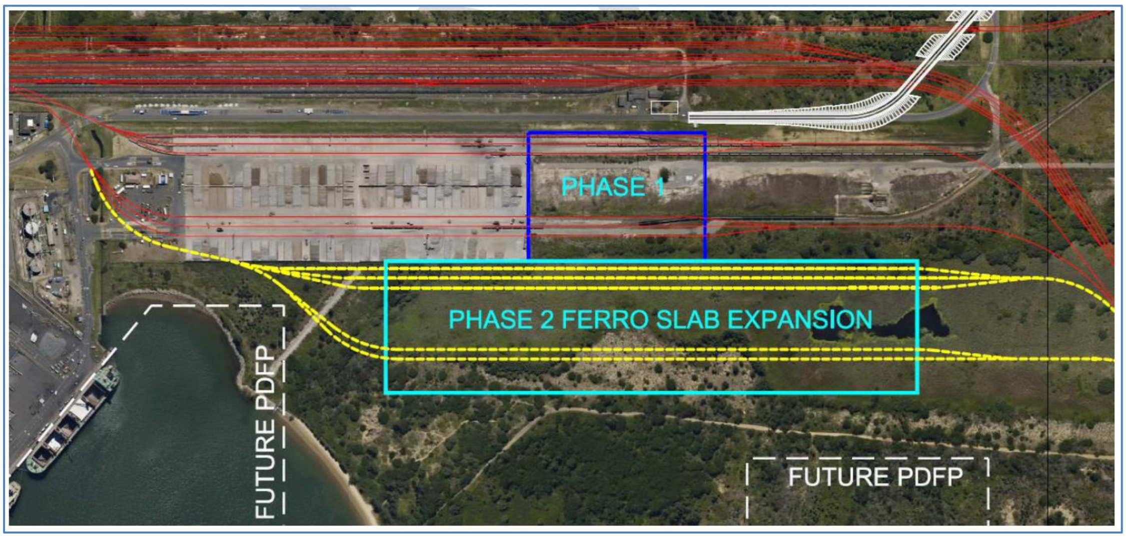


Figure 3-7: Proposed expansion of the existing and new location of the Ferro Slabs

3.2.8 Expansion of the magnetite facility to the south

Currently magnetite is stockpiled within the port by means of front-end wheel loaders reclaiming the commodity from an initial deposit and back stacking into large piles or banks. The material is then reclaimed for export, again by wheel loaders, and transferred into reclaiming hoppers above a reclaiming conveyer line. These lines then convey the commodity onto common port conveyor lines which transfer it to shiploaders for export.

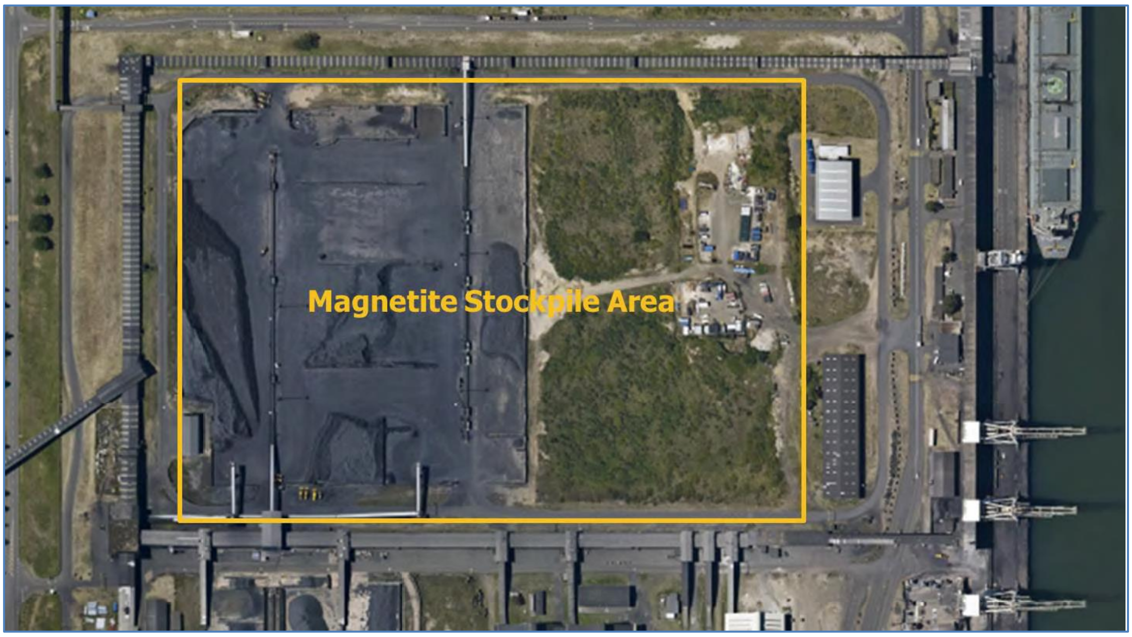


Figure 3-8: Existing Magnetite Stockpile Area

Various options were investigated in the FEL2 phase and concluded that the Stacker and Scraper Reclaimer System would be the most economical in the long run (see Figure 3-9 below).

Figure 3-9: Stacker and Scraper Reclaimer System

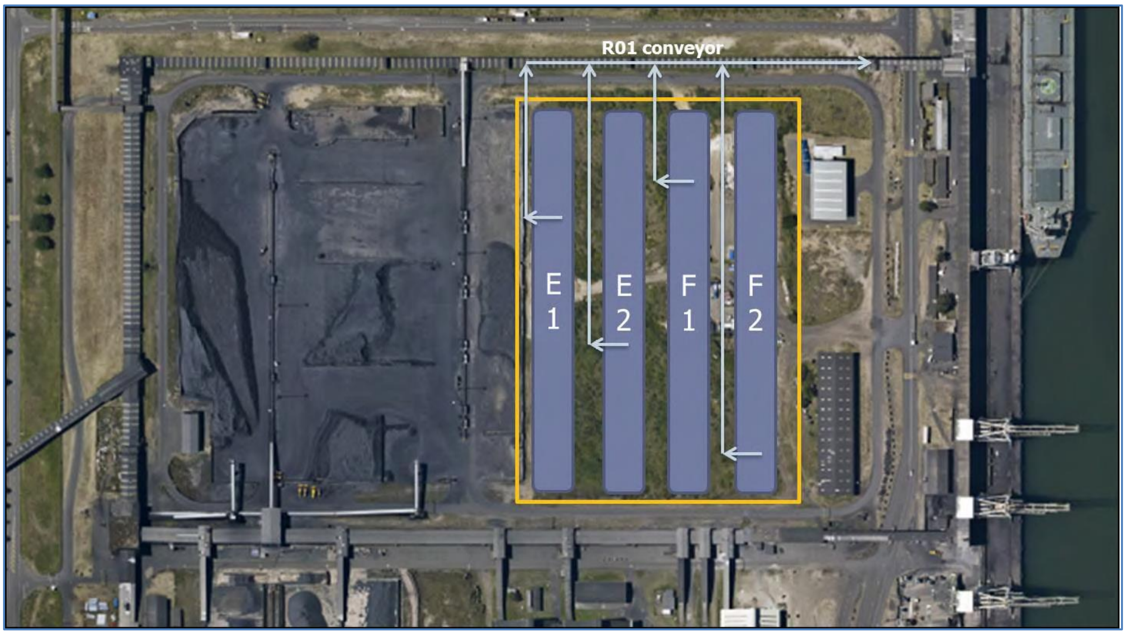


Figure 3-10: Scraper Reclaimer Stockpile Layout and Outbound System Layout

These stockpiles have a capacity of 242 000 tons each and combined capacity of 968 000 tons. Using the 10% stocked annual throughput standard this would yield a throughput of 9.68 Mtpa. This additional throughput could be achieved without impacting on the existing front-end wheel loader operation. The current front-end wheel loader based operation has a throughput of 5 Mtpa. Including this operation of 5 Mtpa the total throughput would rise to 14.68 Mtpa. This capacity might be considered too much for the demand but the extra could be used to handle other commodities, such as chrome, temporarily while its stockpile facility is upgraded as part of the Richards Bay Port Expansion Project. Thereafter the front-end wheel loader operation could be removed, re-designated or also upgraded to a scraper reclaimer and stacker operation.

The exact configuration of the Magnetite Facility Expansion will only be finalised in the detailed engineering study during FEL3.

3.2.9 Upgrading or realignment of existing roads within the Port

Rehabilitation is required on the following roads:

- Newark Road: 46% (1.85km) of the total 4 km road;
- Ventura Road Section: 90% (2.7km) of the total 3 km section; and
- Collector roads: 32% (4.42 km) of the total 14 km.

3.2.10 Construction of a new road-over-rail bridge at the eastern entrance to the Port

In an effort to eliminate the need for two gatehouses/access control points, an alternative layout was developed that would incorporate a central entry and exit point for vehicles making use of the Eastern Entrance (see Figure 3- below).

A major factor to consider in the design of the proposed new road-over-rail access bridges is that of abnormal vehicles that will occasionally make use of the new roadway and bridge structures. Vehicles that have, in the past, been accommodated at Richards Bay were in excess of 60 metres in length, 11 metres in width and height and a mass of 480 ton.

Although vehicles of this nature need to conform to the design parameters as set out in the TRH17 guidelines, the design of the new roadway system and bridge structures has made provision for these super loads. Transnet and Port authorities that are involved in the practical and logistical aspects in the transportation of these abnormal loads should therefore be actively engaged in the horizontal and vertical geometric designs of the new infrastructure going forward. This is all the more important in the light of the fact that the new road system will not be at natural ground level but in fill, minimising the room for error in the manoeuvring of these super loads.

Figure 3-11: Proposed Eastern Entrance Layout with New Road-over-Rail Bridge

This layout incorporates a widened section of Medway Road, slightly south of its intersection with Newark Road East. It should be noted that this widened area is situated atop the primary road-over-rail embankment, approximately 7 m above the existing ground level.

This widened terrace will allow four WB20-type vehicles to park next to each other. This will enable the continuation of traffic in the event that a vehicle on either entry or exit needs to park for an extended period of time. Access control will be conducted on this terrace area.

The need for a road-over-rail access at the port east entrance is based on safety. The location of the rail balloon and the east entrance to the port will carry high volumes of road and rail traffic. It was therefore necessary to provide a grade-separation measure instead of a level crossing at this juncture.

The future configuration of the rail network within the port dictates the location and orientation of the bridge structures that span the rail system. Horizontal and vertical road geometries are consequently directly influenced by both rail and bridge designs.

3.2.11 Construction of 32 conveyors totalling 13,084m

With Option 3 the discard coal is allocated to the finger jetty to utilize the deep berth and this entails that woodchips have to move due to the cross contamination of coal and woodchips and cannot be conveyed in the same gantry. Woodchips are then relocated by conveyors to berth 608.

The material will be collected onto a conveyor WCCV01 north of the rail yard from the existing conveyors to convey the material west to discharge the material onto WCCV02, WCCV03 and WCCV04 respectively up until berth 608. The current woodchip ship loader will be relocated to berth 608. The conveyor network will be a like-for-like and will be able to achieve the same throughput rates as the current system.

3.2.12 Construction of a new 142,030m² container handling terminal

It is predicted that the Port of Richards Bay will have to accommodate a container terminal that will be able to handle 100 000 TEU containers. The preferred container layout option has space for 1,210 slots within the 142,030m^2 area (see Figure 3-12).

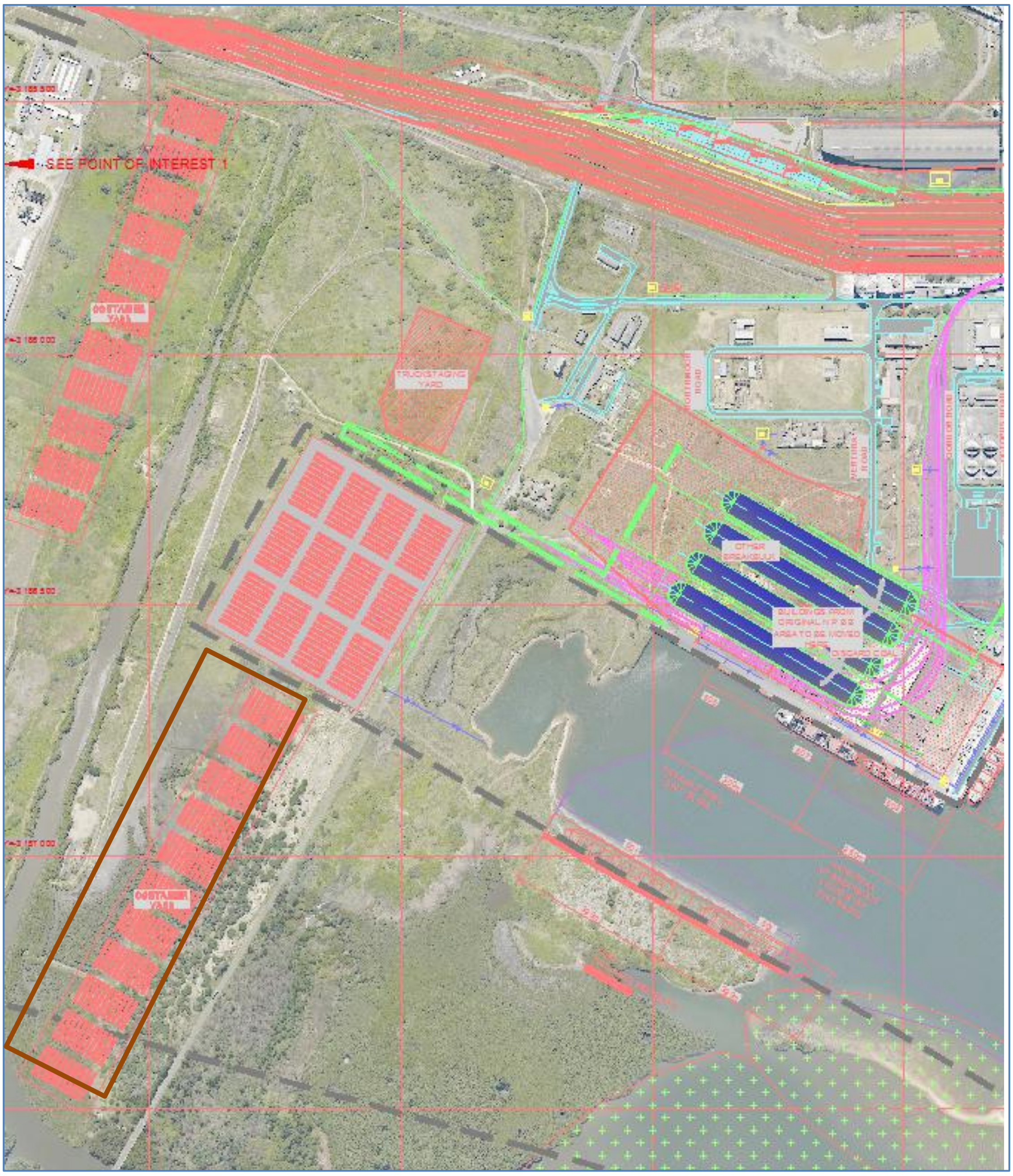


Figure 3-12: Preferred Container Layout Option (Brown Rectangle)

The area will be configured with 11 blocks, where one block will have 11 rows and 10 columns, this will give you 1,210 slots, and one slot will have three containers stacked on each other. Between each row there is sufficient spacing to allow for equipment to move and stack or collect containers.

3.2.13 Construction of 2 new Panamax shipping berths at the 600 series berths, with associated dredging of a channel to a depth of 14m and 800m turning circle

It is proposed that two new Panamax size berths be constructed at the 600 series berths (as indicated in Figure 3-13) to accommodate multipurpose vessels. This would create more capacity in the 600 series area for the other breakbulk and should free up berths for priority commodities at the 700 series MPT berths.

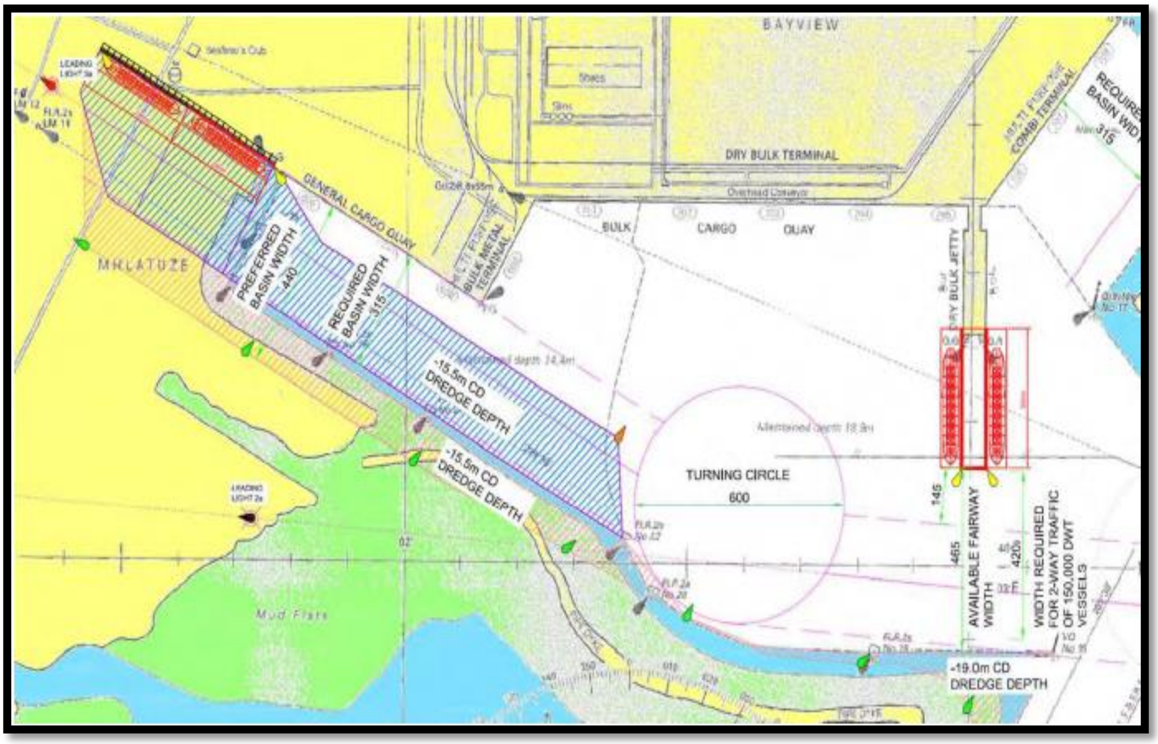


Figure 3-13: Proposed Land and Port Change to Series 600 Berths and Dredging Channel

3.2.14 Extension of the Finger Jetty (800 series berths) with 2 new Capesize Coal shipping berths, requiring significant dredging around the existing Finger Jetty

It is proposed that the DBT jetty be extended to accommodate two new coal berths as shown in Figure 3-14.

Figure 3-14: Proposed Finger Jetty Extension

The advantage of this option is that all coal export can therefore be consolidated at the jetty. Also this option will require the least dredging because the new berths at the 600 series will be constructed for Panamax vessels.

3.2.15 Construction of a new 610,000m³ stormwater surge dam inside the rail balloon, water pump stations, and upgrading of drains throughout the Port

A surface drainage system is proposed to catch and convey the 10 mm first flush generated by each catchment. Concrete trapezoidal channels with side slopes of 1:1.5 are proposed to cut the dirty water off and convey it to a collection sump. Due to the flat area a required minimum slope of 0.4% will not suffice. It was necessary to implement a lesser slope of 0.3% to ensure that the channel depths that reach the sumps do not increase to an insufficient level. The overall channel depths range from 0.15 m to 0.6 m deep.

3.2.16 Storm Water Surge Dam

The first most important factor to consider when designing a dam is to find the required space. According to Regulation 704, a 1:50 year storm should be attenuated on site, which turned out to be a major obstacle in FEL-1. After re-evaluating the design criteria, it was concluded that the surge dam should at least have enough capacity to attenuate ten 10 mm first flush events. This amounts to 100 mm precipitation over the entire dirty catchment area.

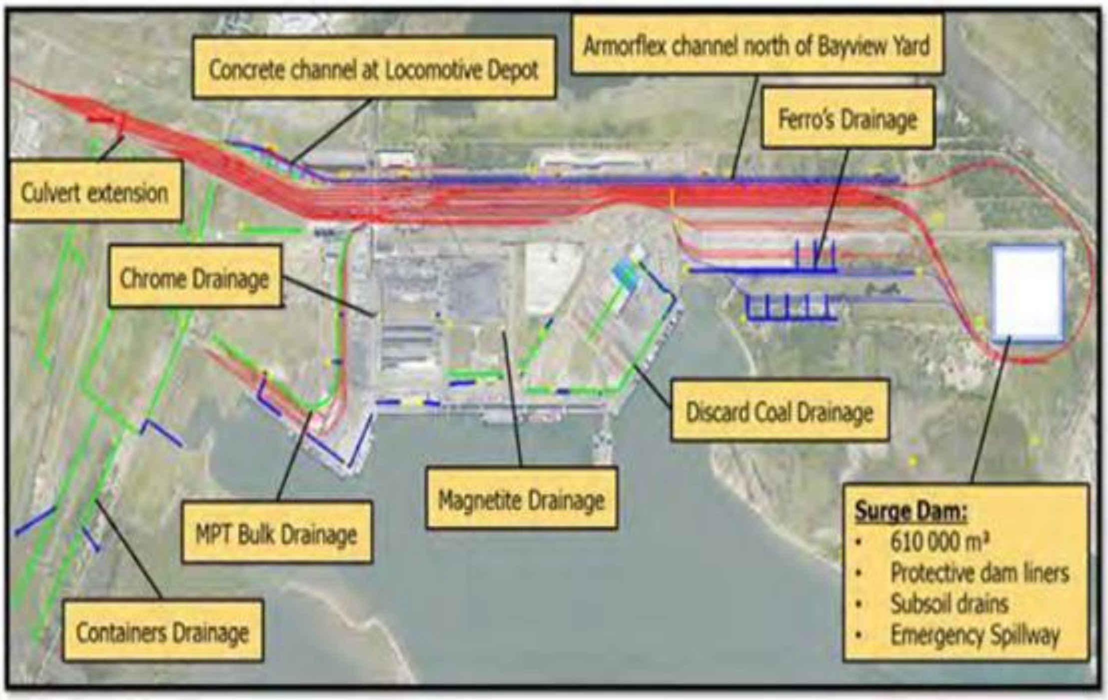


Figure 3-15: Proposed Stormwater Management in the Port

The best available location for the surge dam is within the rail balloon. The dam is proposed to be 5 m deep with a capacity of 610 000 m^3. Subsoil drains will be located under the dam to detect any leakage and the floor slab and side slopes will be lined with protective liners. A 6 m wide silt trap with two overflows is proposed in front of the surge dam to catch most of the incoming silt in the water. After the silt has settled in the silt traps, the cleaner water can overflow into the surge dam to be pumped to a treatment plant.

Seeing that the dam cannot contain a 1:50 year storm it raises a potential flooding risk within the rail balloon. Thus, six 1.5 m x 0.6 m culverts are proposed under the rail to ensure that the rail balloon does not flood in major storm events.

Bayview Yard

The existing channel north of the Bayview yard poses a major clash with regards to the expansion of the proposed rail infrastructure. A 2,592m channel needs to convey a 1:50 year storm event. The channel will be lined with armorflex with a bottom width of 2.75 m, a depth of 5 m and side slopes of 1:2.3. Runoff within the rail yard currently drains into an underground system that discharges into this channel. It will be necessary to extend these 600 mm diameter outlet pipes to connect with the new channel.

The reconstructed channel will intercept flow from the west and east and discharge dirty runoff into collection sumps which will be pumped into the surge dam. Any excess runoff above the 10 mm first flush will be conveyed via the channel and discharged into the sea as it currently does.

Culverts will be extended at the far west side of the extended rail crossing. Four box culverts of 3.6 m x 3 m should be incorporated at a length of 30 m.

3.2.17 Collection Sumps

After the dirty runoff for a catchment has been collected, it will be conveyed via a channel system that discharges the dirty water into a collection sump. A submersible pump, pumps the dirty runoff into a surge dam within 24 hours. Any excess runoff above the 10 mm first flush will overflow from the sump into a minor drainage system and discharge into the sea.

A total of 36 sumps are proposed with capacities ranging from 322 m^3 to 6 383 m^3. The sumps are reinforced concrete covered with a mentis grid. To be able to contain these volumes and with the limited space available, the sump depths range between 5 m to 8 m deep.

3.2.18 Development of a Waste Transfer Station inside the Port, which will serve as the 'nerve centre' for managing waste in the Port

The Waste Transfer Station will be developed on site as the facility where recyclables and waste will be collected and sorted in preparation for processing or landfill. It is a containment area in terms of reducing the risk impact to the environment with the Rolkwing features:

- Proper area for placing or storing of commodities waste streams.
- Efficiency of waste disposal and collection.
- Avoiding the mix and building up of waste streams.
- Dedicated area for controlling and managing waste properly.

The Waste Transfer Station will serve as the "nerve centre" for managing waste in the port. This reverts to the basis of "Best Practice" which is what is practiced globally and contained in legislation.

The Transfer Station will be placed strategically within the port as indicated in Figure 3-16 below.

Figure 3-16: Proposed Waste Transfer Station (orange blob) in relation to Option 3A

3.2.19 Disposal of the dredged material off-shore (see Figure 3-17)

The disposal site used for the dredging at berth 306 is located approximately 5km south of the port entrance, while the borrow site is located approximately 5 km to the east of the port entrance. It is uncertain at this stage of the project on whether these disposal sites are available for future disposal of material as this pends approval by the DEA.

Two disposal sites are currently being used for the maintenance dredging, both offshore of the port, the two disposal sites are named the ‘sand’ and ‘silt’ disposal sites (CSIR, 2004) as shown in Figure 3-17. Approval for the silt disposal site has been granted for a quantity of between 1,0 and 1,2 Mm3 per year. The approval requires an annual survey of the disposal site to be submitted with the permit application. Each of the existing disposal sites cover an area of about 1,7 million m2 and as a guide, can be filled with approximately 1,7mil m3 of dredged material per meter depth.

There is no limit for volumes of maintenance dredging material sent to the reclamation berth for placement onto the northern beach.

No maintenance dredging occurs in the bulk cargo basin because sub-soil in this area is contaminated. An area is currently being prepared where this contaminated material can be placed onshore. This may be an option for the disposal of dredged material.

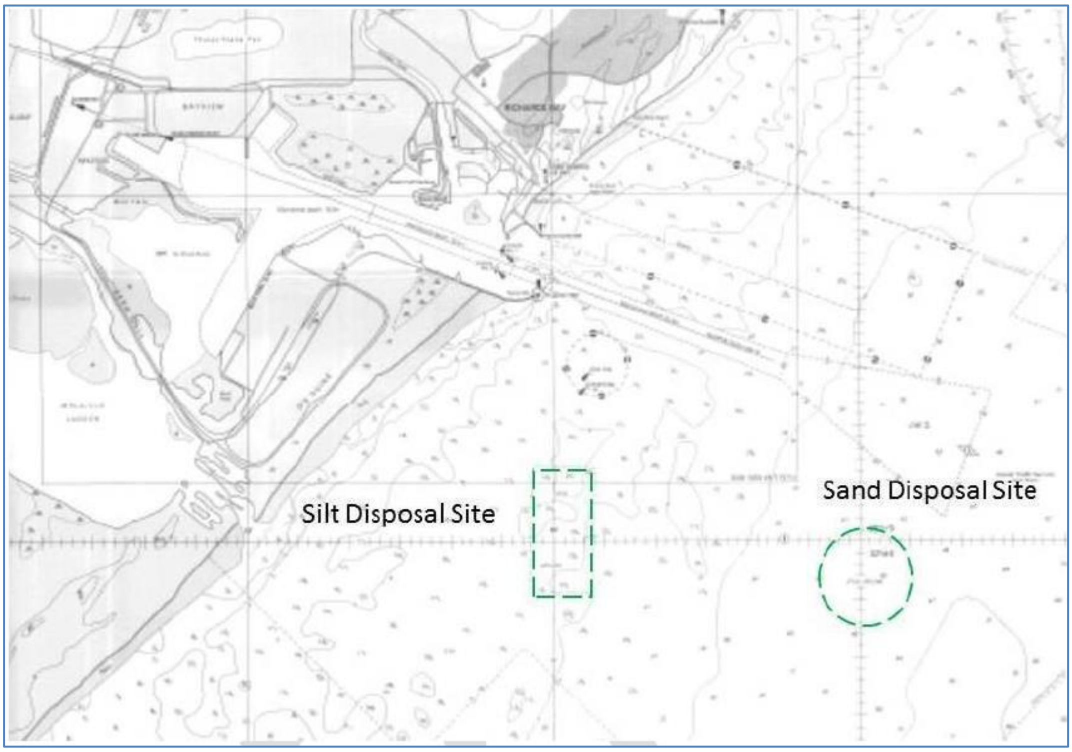


Figure 3-17: Existing Off-Shore Dredge Disposal Site Locations

Although offshore disposal sites for the sand and silt material types do currently exist, and approval can be gained relatively easily for additional sites (CSIR, 2004), there are operational cost implications to using offshore disposal sites for the disposal of the silt and sand class material. Employment of a fleet (three to four) of barges will increase dredging costs significantly, whereas utilisation of pipelines (existing infrastructure (owned by the municipality) and/or owned by the dredge contractor) will result in cost savings for the sand and silt materials. The clays and rock material can be piped, but will not be suitable for placement along the beaches adjacent to the port. These materials will need to be disposed of using another method.

The offshore disposal site is used for disposal of periodic maintenance dredging material. An option is to use barges to dispose of future capital dredging spoil on this dumpsite. This would involve pumping material from the dredger to a barge moored alongside, which would then travel out to the dumpsite and bottom-dump the material before returning for another load.

This disposal method is not frequently used in South Africa, and therefore equipment such as barges would need to be mobilised from elsewhere, entailing considerable costs. Such mobilisations would need to be repeated for each future dredging phase. The potential exists for barge disposal for the 600 and 800 series berths.

The slurry being pumped into barges would typically only contain 10% to 30% solid material. To avoid inducing high suspended sediment concentrations in the water, limited/no spillage of the lean mixture over the sides of the barge would be permitted. As a result, the total volume of solid material being transported by the barges will be quite low, resulting in an inefficient operation. Assuming a barge volume of 1500 m^3 (typical barge volumes range from 500 to 2000 m^3) and a solids content of 20%, it would take almost 2250 barge trips to dispose of 1 million m^3. This would result in an increase in the shipping traffic through the port. Given the rates of dredging relative to rates of disposal offshore, it is likely that a small fleet of barges will be required.

3.2.20 Construction of a facility to discharge dredged material from the proposed construction of the berths

Different on-shore dredge spoil disposal options have been investigated in the BKS Dredged Baseline Report (2013) which can be summarised as follow:

- Disposal on the central or southern beach (assuming a practically close pumping distance for the latter) result in significant deposition and high suspended sediment concentrations in the estuary. Maintaining the estuary in good condition in the long-term is considered to be a high priority;
- Disposal at the northern beach results in acceptable deposition and insignificant occurrence of high suspended sediment concentrations in the estuary;
- Northern beach disposal would result in reasonable pumping distances for most planned expansions and the supply of sand that would allow medium term recovery of the depleted beaches to the north. Therefore, this is an appealing disposal option;
- Pipeline disposal is practically not possible on an on-going basis unless sand is separated, since excessive accumulation of sand at the discharge position would inundate the outlet. However, if sand-separation was carried out, then a pipeline could be employed to discharge fine material. Use of the Mhlathuze Water pipeline is preferable (if permission can be obtained, and if feasible from an engineering perspective) as infrastructure is available and the pumping distance would be reasonably short in most cases. However, this would need to be traded off against the cost of re-dredging material that deposits in the channel and against the occurrence of visible plumes at Alkantstrand.
- Land disposal has a low impact on the environment. Unfortunately, disposal opportunities are limited and only a fraction of spoil material could be economically disposed of. Nevertheless, it is recommended that this option be employed where possible and that investigation of land disposal opportunities be given high priority.
- Land-based beneficial uses are also low in impact. Opportunities appear to be limited and it appears that only a very small fraction of spoil material could be beneficially used. The dredge spoils are primarily sediments unsuitable for fill

material because of their high silt content. Nevertheless, it is recommended that beneficial uses be employed where possible and that investigation of beneficial use opportunities be given high priority.

- Barge/vessel disposal offshore will limit impacts to a designated offshore region. However, with the loss of sand offshore and the relatively high expense, this option is not favourable. Yet, it may prove viable if other options prove impractical (or have excessive impact) and/or if conducted in association with a sand winning operation.

The following potential on-shore disposal sites have been identified (Figure 3-18):

- Site 1: South of the Mhlatuze River with more than 5 million m^3 of permanent storage capacity.
- Site 2: Approximately 2 km east of the N2 highway and 8-10 km from the port, with approximately 29 million m^3 of permanent storage capacity.
- Site 3: The Ticor slimes dam is adjacent to the N2 highway and 12 km from the port which can be used for disposal in the long term. The potential volumes that could be disposed of have not been precisely calculated.

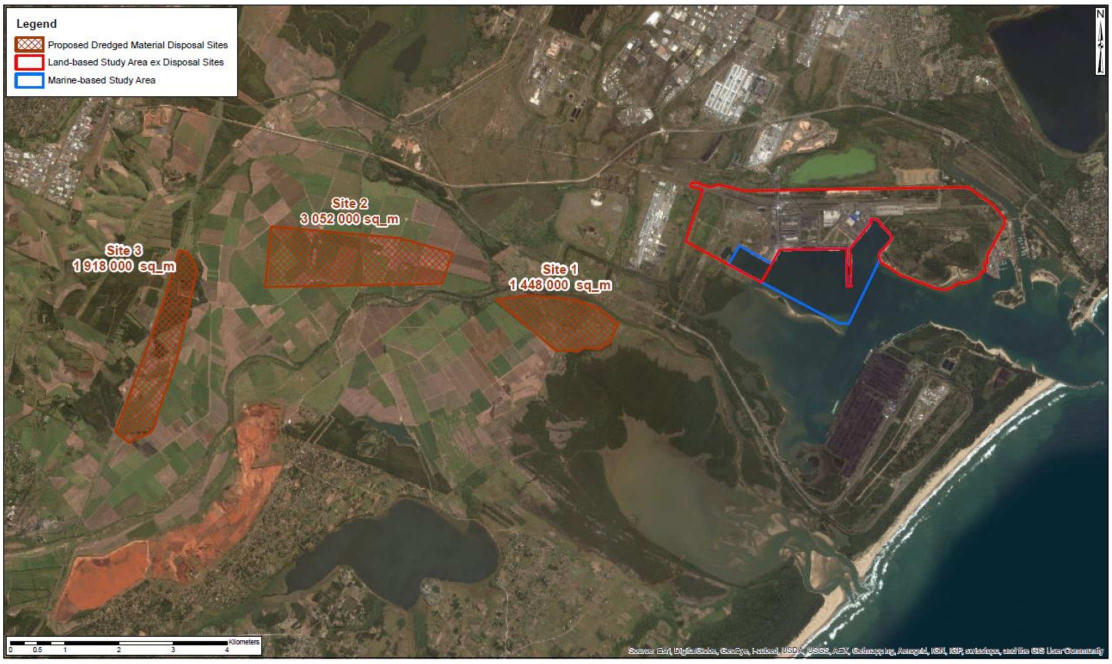


Figure 3-18: Proposed onshore dredging disposal sites

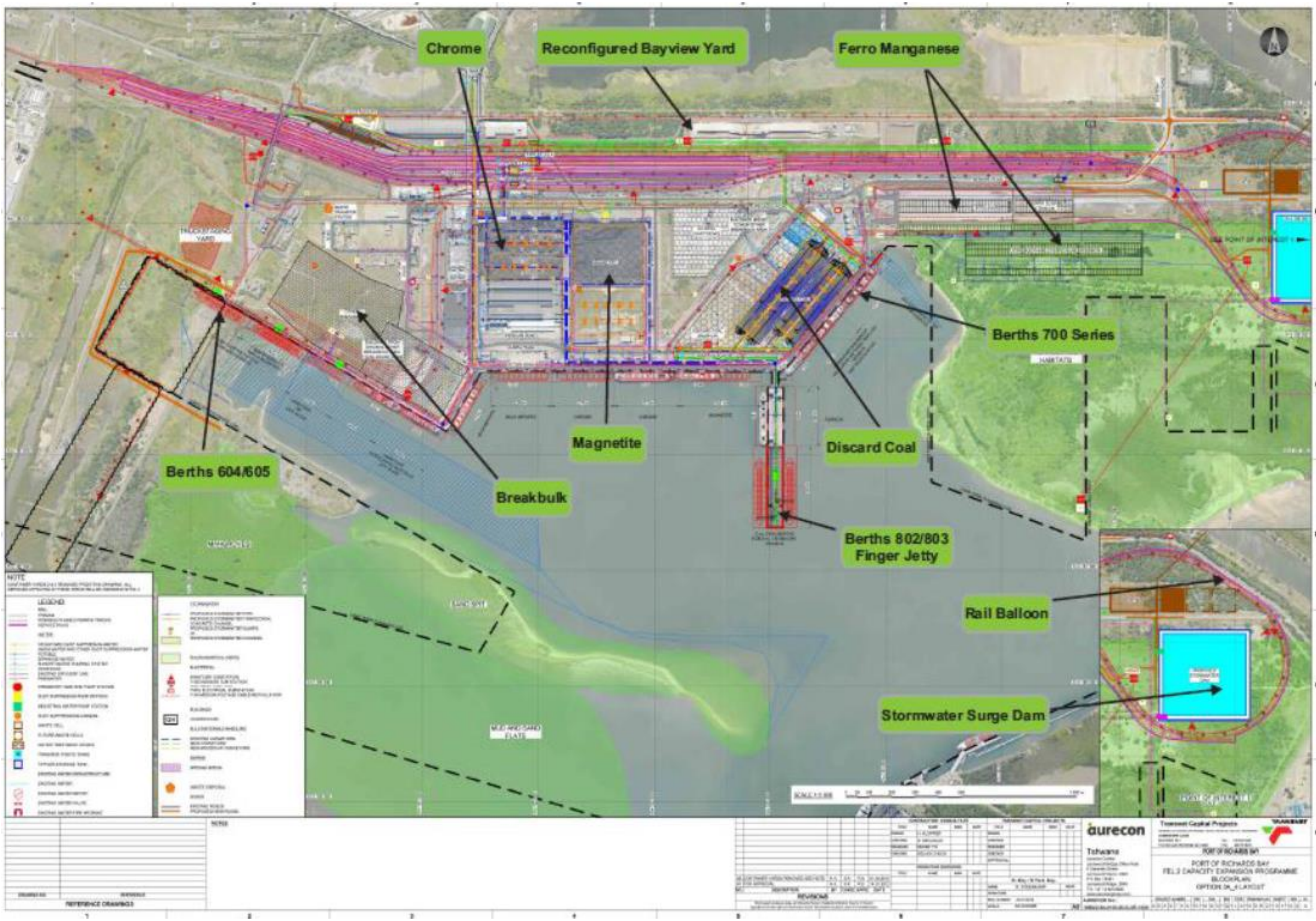


Figure 3-19: Locality Map of Richards Bay Expansion: Proposed Option 3A Layout

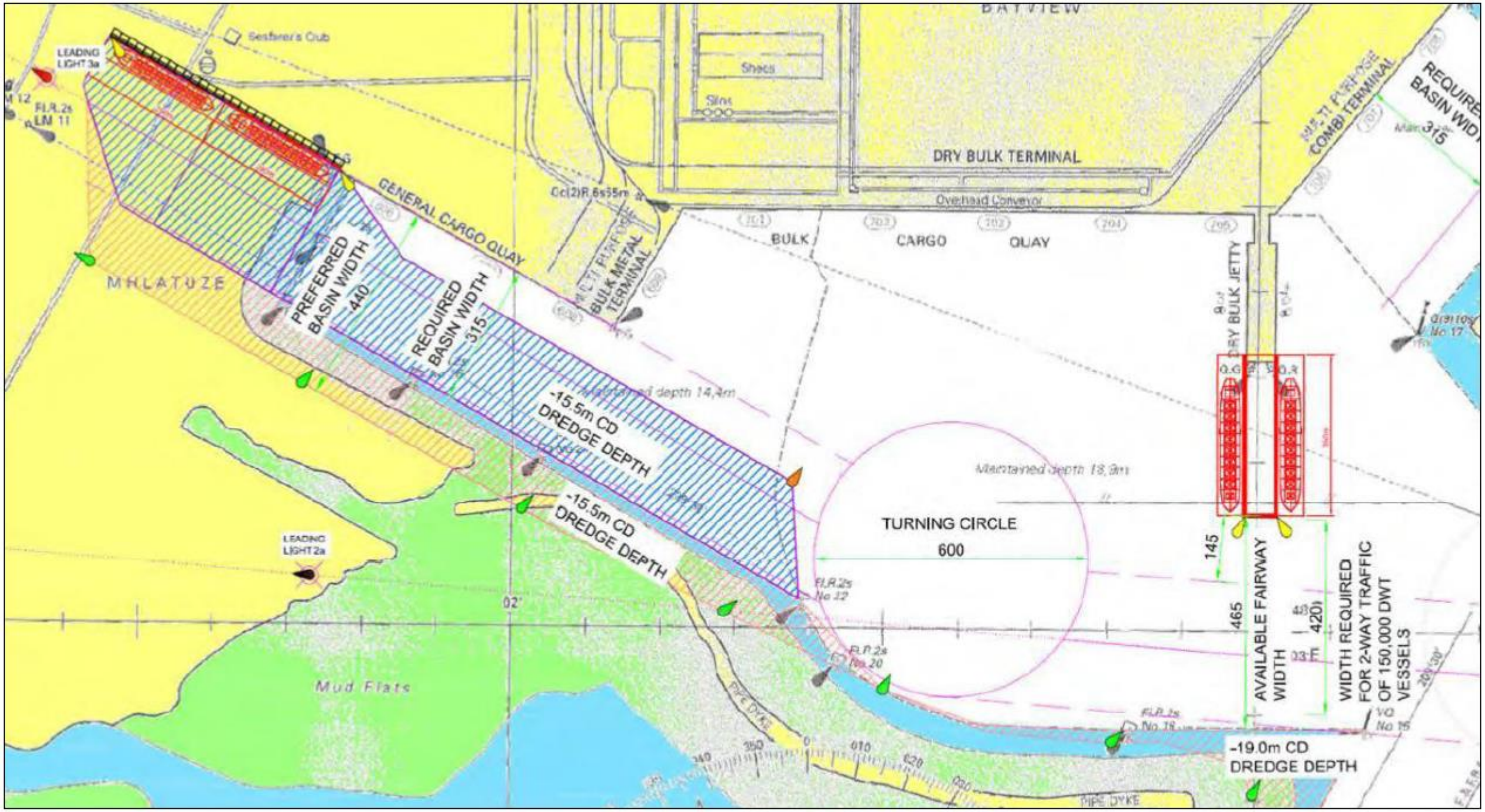


Figure 3-20: Locality Map of Richards Bay Expansion: Proposed Option 3A Layout

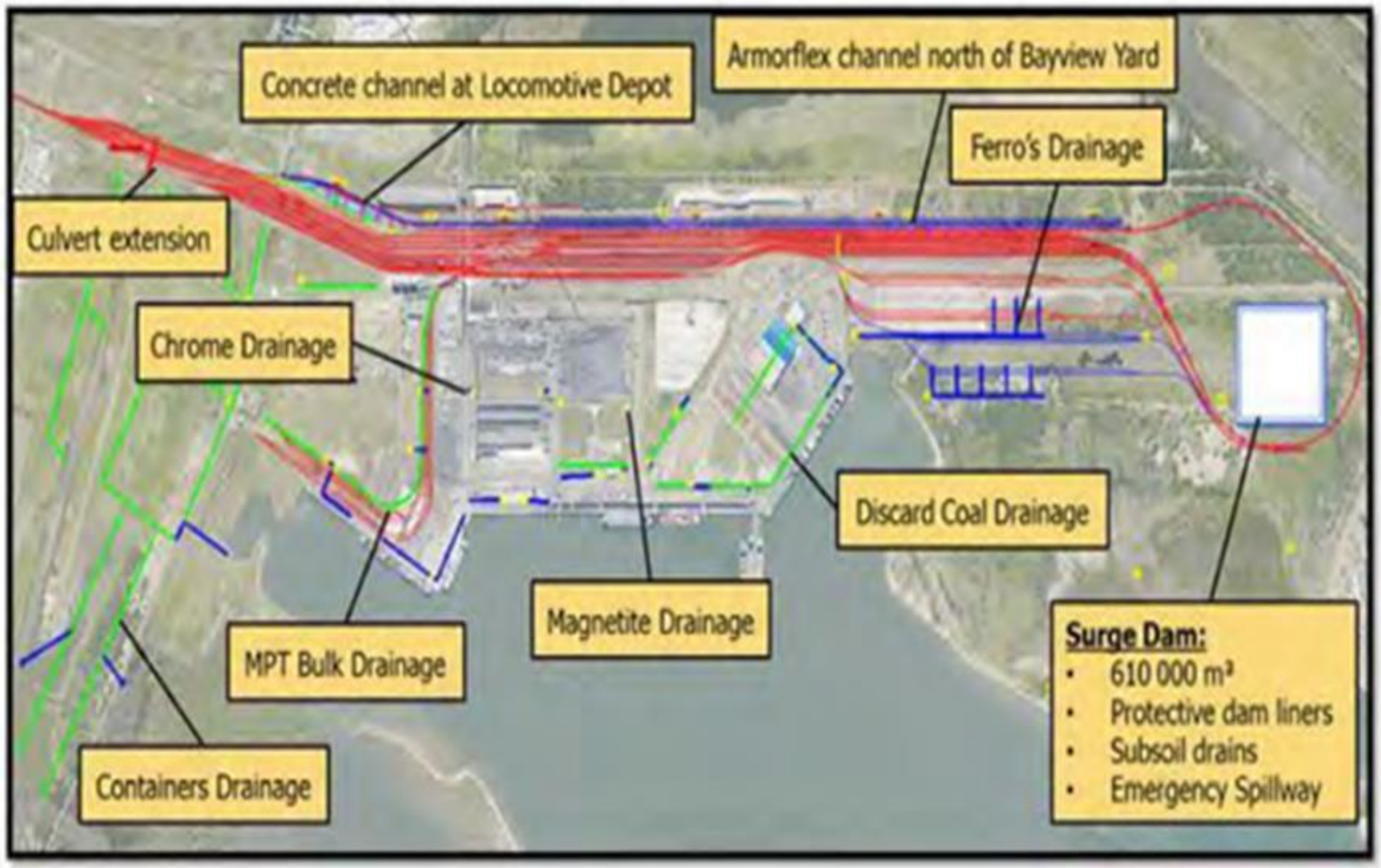


Figure 3-21: Schematic 3: Proposed Stormwater Management in the Port

Figure 3-22: Schematic 3: Proposed onshore dredging disposal sites

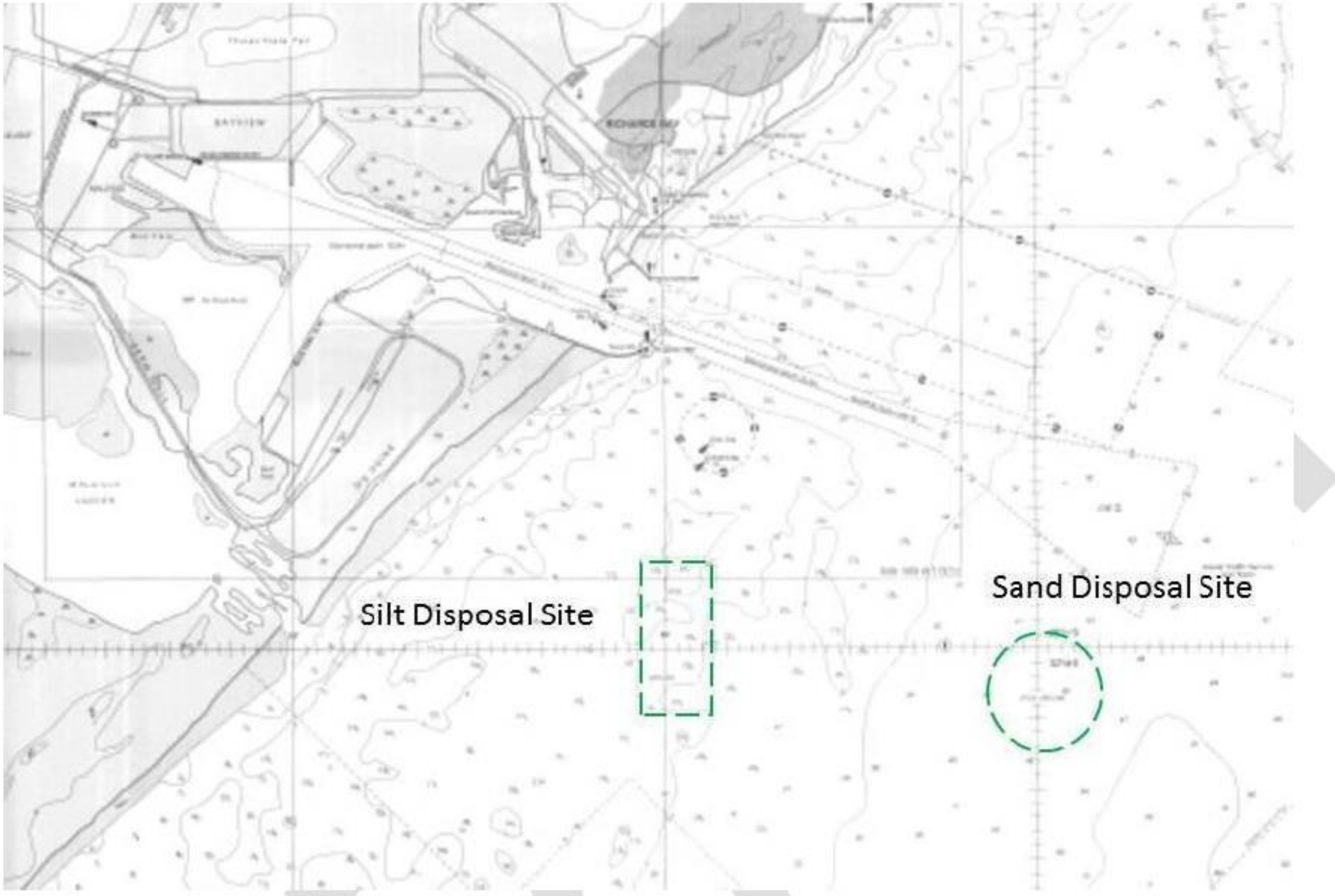


Figure 3-23: Schematic 3: Existing offshore dredging disposal site

3.3 ASSUMPTIONS, GAPS AND LIMITATIONS OF THE STUDY

The following assumptions, uncertainties and gaps in knowledge were identified for this process:

3.3.1 EIA Process

The EIA process is multi-disciplinary, which was informed by the project team (**Section 2**). It is thus necessary to presume that the information as provided to the project team to date by external sources is accurate, appropriate and correct.

Data shown in the maps was supplied by various sources and was used after it was reviewed and verified where considered necessary. Verification was, however, restricted to available sources of information only.

3.3.2 Public Participation Process

Every effort was made to contact all stakeholders and adjacent landowners within the study area. Written notification was provided to the landowner, occupiers of the land, adjacent landowners, the ward councillors and the City of Umhlatuze. Information presented by the stakeholders is presumed to be accurate and presented timeously with respect to the process at hand.

3.3.3 Vegetation and Wetland Assessment

The following assumptions and limitations were made as part of the assessment:

- Unfortunately Site B east of Urania road burnt down shortly before the field surveys were conducted. Although the major components contributing to the structure and composition of the site's vegetation could still be identified and described, many of the less common and rarer species could not be recorded.

3.3.4 Bird Fauna Priority Habitats

The following assumptions and limitations were made as part of the assessment:

- Results from the limited once-off study indicate that the bird fauna is fairly depauperate and no Red Data species or species of significance were recorded. The loss of this habitat will not be of any significance to the bird population in the greater uMhlathuze area.
- However, information from the Final Scoping Report for the TCP Richards Bay Port Expansion project (AECOM 2014) indicates that there will be an impact on the sand spit that lies between the harbour channel and the Kabeljous Flats. Due to not being part of this study, this matter is Red Flagged as it is considered not only to result in a potentially significant impact on the bird fauna but on ecosystem functioning of the

highly significant Kabeljous Flats as a whole. The detail related to this is provided in Cyrus (2014). A second Red Flag has also been identified and relates to the fact that no evaluation of the birds or other fauna has been undertaken for the infrastructure foot print around the Berth 600 Series Extension or to issues relating to the re-routing of the harbour access road to the coal terminal quays.

3.3.5 Fish and Benthic Inverts

The following assumptions and limitations were made as part of the assessment:

- Results from the limited scope of this study has clearly indicate that the Shallow Intertidal area present within the Berth 600 Series Extension area provides the necessary requirements for both small to medium sized juvenile fish of estuarine as well as estuarine associated marine species.
- The Catch per Unit Effort was above average when compared to those recently achieved at Mfolozi and St Lucia Estuaries (D.P.Cyrus pers obs.). The fact that a possibly new species for South Africa was recorded (verification pending) from the limited sampling that was undertaken, indicates possible further importance of this site.
- The attraction to this area is almost certainly the substrata but more importantly the habitat created by the presence of Z.capensis which is known to be an important habitat for a wide range of species, including fish and prawn and particularly for the nursery habitat it provides (Heck et al. 2003; Bloomfield and Gillanders 2005).

3.3.6 Aquatic Vegetation and Fish – Berth 600 Series Extension

The following assumptions and limitations were made as part of the assessment:

- In terms of Site C (Berth 600 Series Extension) only the Vegetation, Wetlands and the birds were not identified for further investigation.
- The components brought forward in this study did not form part of the original brief.
- CRUZ Environmental undertook a short once-of assessment of the fish and aquatic floral of the shallow intertidal area within the Berth 600 Series Extension area.

3.3.7 Air Quality

The following assumptions were made as part of the assessment:

- The dispersion plots indicate that the expected increase in shipping should have a marginal impact on the particulate load of the area, with slightly more serious increases expected in SO_2 and NO_x levels.

- Without a comprehensive understanding of all emissions sources in the area, it is difficult to accurately predict the expected impact that the additional ship traffic will have but it does appear that, although some impact will be felt, that impact is unlikely to be significant in the context of the general pollution profile of an industrial area like Richards Bay.
- Areas that are likely to experience increases and occasional spikes in pollution are the area immediately to the west of the harbour (fortuitously, where the Bayside SO_2 monitoring station is already situated) and along the northern edge of the harbour mouth. These spikes may be exacerbated by the periodic nature of real ship emissions rather than the long term steady emissions that can be modelled here.

3.3.8 Design Criteria

The following criteria should be considered in the design of buildings and structures (where applicable) to support the efforts of Transnet towards a sustainable port:

- Good construction management including:
  - Environmental management and auditing;
  - Waste management (recycling construction waste: rubble, steel, timber);
  - Constructing for airtightness; and
  - Protection of topsoil on site.
- Ensuring the indoor environmental quality is of a high quality, energy and water consumption remains efficient and thus building occupants remain healthy. This includes:
  - Mechanical systems are designed to ensure that there is increased fresh air into the building:
    - Air movement i.e. no stagnant air;
    - Measures to control carbon dioxide build up i.e. carbon dioxide monitoring and measure to increase fresh air when required;
    - Less energy usage through efficient HVAC systems;
    - Less water usage through air cooled systems or water reuse systems
    - Less harmful emissions into the atmosphere by specifying refrigerants with an Ozone Depleting Potential of zero.
    - Allow occupants to control their own temperature zones by providing manual controls, or controllable air vents etc.

- Electrical/ lighting systems that are specified to reduce uncomfortable headaches from low frequency flicker (high frequency ballasts to be used in all fluorescent lighting):
  - Ensuring that lighting is sufficient, but not overdesigned. Keep maintained luminance levels lower than 400 lux;
  - Sub meter all energy uses, in order for building managers to monitor energy consumption so that the causes of high consumption can be resolved;
  - Zone lighting layouts for switching, reducing unnecessary energy consumption when occupants are not in certain areas of the building;
  - Reduce the consumption of energy in peak periods, through the use of ice tanks or photovoltaic panels; and
  - Generators that minimise harmful emissions should be specified.
- Building envelope and materials:
  - High performance glazing, wall and roof insulation to reduce energy loads and keep the building cool in the summer and warm in the winter;
  - Provide windows to allows a lot of natural daylight into the building, but include external shading to eliminate discomfort and glare from direct sun rays;
  - Avoidance of very deep internal spaces within the building, unless well-lit atria are included in design. Allow for external views of all occupants by locating usable area within 8m of a window;
  - Thorough hazardous material surveys must be conducted if buildings are being refurbished or extended;
  - Materials with good acoustic properties to ensure low noise levels should be specified;
  - Timber from certified sustainable forests is preferred;
  - Substitute cement in concrete with flyash/ aggregate;
  - Specify paints, adhesives and carpets with low VOC contents;
  - Avoidance of products with formaldehyde content, for example: composite woods;

- Contractor to source all building materials locally to reduce emissions of transportation and support the local economy;
- All thermal insulation to be manufactured with no ozone depleting substances.

o Wet service design to include rainwater harvesting, grey water recycling, reduction of landscape irrigation;

- Use waterless urinals, water efficient taps, shower heads and toilets; and
- Sub meter all major water uses, in order for building managers to monitor water consumption so that the causes of high consumption can be resolved;

- Provision of facilities to encourage alternative transport to work. Cyclist facilities that include bicycle racks, lockers and showers; preferential parking for car pool vehicles,
- alternative fuel transport and scooters.

3.3.9 FROG FAUNA OF PRIORITY HABITATS

A Frog Fauna assessment that was conducted by Mr LH du Preez from CRUZ Environmental Consultants in October 2014 had noted the following:

In spite of the rain that did fall prior to the visit no open water suitable for frogs to breed was present at the site. Based on sophisticated recording equipment and scientific experience with the group of organisms:

- The study area is not a particularly good site for frogs;
- After prolonged rains the wetland indicated by C in Figure 2 will most likely gather water and will provide suitable breeding habitat for several species including Painted Reed Frogs (*H. marmoratus*), Tinker Reed Frogs (*H. tuberilinguis*) and Water Lily Frogs (*H. pusillus*);
- None of the threatened frog species known to occur in the Richards Bay area would be expected to occur in the area studied;
- Loosing this site will not affect the population of frogs in the greater Richards Bay.

3.3.10 Dredging and Dredge Spoil Disposal Modelling Specialist Study

The Dredging and Dredge Spoil Disposal Modelling Specialist Study was conducted by Mr Roy van Ballegooyen, Mr Brent Newman, Mr Patrick Shabangu and Mr Gert Jacobs in a Joint

WSP/CSIR Report and had noted the following assumptions and limitations that applied to the specialist study:

- The modelling assessment of the dredging and dredge spoil disposal is based on the project description communicated to the specialist prior to and during the study. Where this information has been deficient, particularly in terms of the dredging description, the specialists compiling this study have provided the necessary specifications based on their experience of similar dredging projects under the assumption that this will be acceptable to all relevant parties having an interest in the Port of Richards Bay Capacity Expansion EIA;
- The modelling study is intended to inform the ecological specialist study of relevance to the assessment of dredging activities;
- Specifically excluded from the study is the assessment of potential dredge spoil disposal impacts on the adjacent shoreline in terms of potential shoreline erosion and/or accretion. This would require a more detailed specification of dredge spoil disposal activities than is presently available. Should there be residual concerns around this issue such impacts may need to be the subject of a detailed specialist shoreline impact assessment study.

4 LEGAL FRAMEWORK

4.1 Introduction

The dominant legislation of reference to the project and the Draft EIA Report is by default that of the National Environmental Management [NEM] suite of acts. This is due to the fact that the aim of the Draft EIA Report is to provide sufficient relevant information to the DEA, such that they are able to reach an informed decision as to whether an Environmental Authorisation (EA) should be granted with an accompanying waste permit for the proposed Richards Bay Port Expansion Development.

4.2 General Overview of Relevant Legislation

The proposed and associated infrastructure will be controlled by the following list of legislation (**Table 4-1**). A number of the specific pieces of legislation are considered in greater detail in the sections to follow.

Table 4-1: Summary of Applicable Legislation

Legislation	Sections	Relates to
The Constitution (No 108 of 1996)	Chapter 2	Bill of Rights
	Section 24	Environmental rights
	Section 25	Rights in property
	Section 32	Administrative justice
	Section 33	Access to information
National Environmental Management Act (No 107 of 1998) as amended	Section 2	Defines the strategic environmental management goals, principles and objectives of the government. Applies throughout the Republic to the actions of all organs of state that may significantly affect the environment.
	Section 23	Determines that Integrated Environmental Management should be employed when any policies, programmes, plans or projects are drawn up to minimise the impact on the environment. The duty of officials to prevent pollution and ecological degradation, to promote conservation and secure ecologically sustainable development and use of natural resources.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
	Section 30	Control of emergency incidents and duties of persons responsible.
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)	Sections 56 and 57	These sections deal with the listing of species that are threatened or in need of national protection and restricted activities involving listed threatened or protected species.
	Sections 65-69	These sections deal with restricted activities involving alien species; restricted activities involving certain alien species totally prohibited; and duty of care relating to alien species.
	Sections 71 and 73	These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.

<table>
<tr><th>Legislation</th><th>Sections</th><th>Relates to</th></tr>
<tr><td>National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008)</td><td colspan="2">The NEM:ICMA aims to establish a system of integrated coastal and estuarine management and to ensure that development within the coastal zone is socially and economically justifiable and ecologically sustainable.</td></tr>
<tr><td rowspan="5">National Environmental Management: Air Quality Act (No 39 of 2004)</td><td>Section 32</td><td>Control of dust</td></tr>
<tr><td>Section 34</td><td>Control of noise</td></tr>
<tr><td>Section 35</td><td>Control of offensive odours</td></tr>
<tr><td>Chapter 5</td><td>Licensing of listed activities</td></tr>
<tr><td>Schedule 2</td><td>Ambient air quality standards</td></tr>
<tr><td rowspan="2">National Environmental Management: Waste Act (No. 59 of 2008)</td><td>Section 2</td><td>Highlights the objectives and principles of the Act for protecting health, wellbeing and the environment by providing reasonable measures.</td></tr>
<tr><td>Section 20</td><td>No person may commence, undertake or conduct a waste management activity, except in accordance with:
• the requirements or standards prescribed by said Act and regulations; and
• a waste management licence issued in respect of that activity, if a licence is required.</td></tr>
<tr><td>National Environmental Management: Protected Areas Act (No 57 of 2003)</td><td colspan="2">The aim of the Act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity, natural landscapes and seascapes.</td></tr>
<tr><td>Conservation of Agricultural Resources Act (No 43 of 1983) and regulations</td><td>Section 5, 6</td><td>Implementation of control measures for alien and invasive plant species, especially in urban areas.
Control of wetland areas including rehabilitation thereof.</td></tr>
<tr><td rowspan="3">National Water Act (No 36 of 1998) and regulations</td><td>Section 19</td><td>Prevention and remedying the effects of pollution.</td></tr>
<tr><td>Section 20</td><td>Control of emergency incidents.</td></tr>
<tr><td>Section 21</td><td>Use of water and licensing.</td></tr>
<tr><td rowspan="3">National Heritage Resources Act (No 25 of 1999)</td><td>Section 35</td><td>No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.</td></tr>
<tr><td>Section 36</td><td>No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.</td></tr>
<tr><td>Section 38</td><td>This section provides for Heritage Impact Assessments (HIA), for the construction of any development footprint in excess of 5,000m^2 and rezoning of a site exceeding 10,000m^2.</td></tr>
<tr><td rowspan="2">Occupational Health and Safety Act (No 85 of 1993) and regulations</td><td>Section 8</td><td>General duties of employers to their employees.</td></tr>
<tr><td>Section 9</td><td>General duties of employers and self-employed persons to persons other than their employees.</td></tr>
<tr><td>Hazardous Substances Act (No 15 of 1973) and regulations</td><td colspan="2">Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.</td></tr>
<tr><td>National Road Traffic Act (No 93 of 1996) and regulations</td><td>Section 54</td><td>Transportation of dangerous goods.</td></tr>
<tr><td rowspan="2">National Veld and Forest Fire Act (No 101 of 1998)</td><td>Chapter 2</td><td>Promotes and regulates the formation of fire protection associations which aim to manage and coordinate fire protection and fire services in an area.</td></tr>
<tr><td>Chapter 4, 5</td><td>Organizations are required to make and maintain firebreaks and firefighting equipment and personnel should a risk exist</td></tr>
</table>

Legislation	Sections	Relates to
		that a fire may start or spread from the premises.
National Forest Act (No 84 of 1998)	Section 7	No person may cut, disturb, damage or destroy any protected tree except if a permit has issued.
Water Services Act (No 108 of 1997) and regulations	Section 7	Effluent acceptance from Local Authority.
National Building Regulations and Building Standards Act (No 103 of 1977)	Section 4	Local Authority approval of plans to erect buildings.
	Section 10	Local Authority may prohibit work from continuing and may set standards for earthwork or construction being done.
uMhlathuze Local Municipality By-Laws	Noise Control By-law, 2010 Municipal Health By-law, 2010 Waste Management By-law, 2010 Fire Safety By-law, 2007 Roads, Traffic and Safety By-law, 2007 Water and Sanitation By-law, 2010 Stormwater Management By-law (Draft)	

4.3 National Environmental Management Act

4.3.1 Overview

The National Environmental Management Act (No. 107 of 1998) (NEMA) provides a framework for cooperative environmental governance between the various spheres of government, by establishing principles for decision-making on matters relating to the environment. Furthermore, NEMA promotes integrated management to ensure sustainable resource utilisation and development and requires that the DEA be the lead agent in ensuring effective custodianship of the environment. It also provides that sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where subjected to significant human resource usage and development pressure. The NEMA principles, contained in Section 2, clearly emphasize the need to protect threatened ecosystems and are binding on all organs of state including the local authorities. Furthermore, the principles essentially guide the interpretation, administration and implementation of the Act and any other law concerned with the protection of the environment. An overarching emphasis is the principle that development must be environmentally, socially and economically sustainable.

Section 23 of NEMA further determines that Integrated Environmental Management should be employed when any policies, programmes, plans or projects are drawn up to minimise the impact on the environment. The duty of officials to prevent pollution and ecological degradation, to promote conservation and secure ecologically sustainable development and use of natural resources, originates from the Constitution and NEMA.

For a range of listed activities and depending on the scope of the activity, the responsibility to ensure compliance with NEMA and its suite of linked Acts has been devolved to the nine provincial departments. In this case, the devolved responsibility is to the GDARD.

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation, the result being that NEMA began governing the EIA process with the promulgation of the EIA Regulations in April 2006 (Government Gazette No. 28753 of 21 April 2006). These regulations have subsequently been replaced by the NEMA EIA 2010 Regulations listed in Government Gazette No. 33306 of 18 June 2010 (GN543, 544, 545 and 546 of 18 June 2010, as amended). The NEMA EIA 2010 Regulations are contained in four Government Notices and came into effect on 2 August 2010, as amended. All applications listed in the abovementioned regulations shall be subject to an environmental impact assessment process (i.e. Basic Assessment, or, Scoping and Environmental Impact Assessment Reports) and will require Environmental Authorisation from the relevant competent authority. Section 24F of the NEMA prohibits the undertaking of identified listed activities except by virtue of being undertaken under the control of an environmental authorisation from the relevant competent authority.

On submission of an application the competent authority must consider all the relevant information contained in the Scoping Report and the EIA Report (including any pollution, environmental impacts or environmental degradation likely to be caused if the application is approved or refused) and thereafter make a decision of whether or not to grant an environmental authorisation to the proposed Richards Bay Port Expansion Development. Note that an EA may be positive or negative and may grant approval for the entire requested proposal, or a part thereof.

Certain minimum conditions are attached to environmental authorisations, as required by section 24E of NEMA, however it is at the competent authorities discretion to include additional project specific conditions. In terms of section 24F of NEMA it is an offence not to comply with any condition applicable to an environmental authorisation issued for a listed activity.

Typical conditions that may be applied by the competent authority include but are not limited to:

- Measures to prevent, manage and mitigate environmental impacts to acceptable levels;
- Prevention of pollution of water bodies and groundwater;
- A rehabilitation programme for disturbed natural and/or heritage areas;
- Appointment of an independent Environmental Control Officer (ECO) to oversee the construction phase and to ensure that the development phase is conducted in an environmentally responsible manner;
- Conservation management and visitor management plans; and
- Requirements of other authorities, such as the Department of Water Affairs (DWA), the Department of Mineral Resources (DMR), the South African Heritage Resources Agency (SAHRA), and/or relevant provincial authorities.

The Department of Water and Sanitation has been notified that a Water Use Licence is not attached to this Draft EIR and will be done separately.

4.4 ACTIVITIES APPLICABLE TO NEMA: GENERAL EIA REGULATIONS (2010)

The proposed WDF includes activities that may have a detrimental effect on the environment as listed in GNR 544, GNR 545 and GNR 546 (of 18 June 2010). All applications listed in these regulations require an Environmental Authorisation.

The relevant general EIA activities are listed in **Table 4-2**, as per the application submitted to DEA in December 2013.

Table 4-2: Listed Activities in terms of NEMA – EIA Regulations, 2010

Listed Activity Number & Description		Relevance to the Expansion Programme
R544: 9	The construction of facilities or infrastructure exceeding 1000 m in length for the bulk transportation of … storm water – (i) with an internal diameter of 0.36 m or more; or (ii) with a peak throughput of 120 litres per second or more.	To provide for storm water management solutions and the required structures it is expected that the parameters within this activity will be exceeded. This activity is therefore relevant.
R544: 11	The construction of (i) canals, (ii) channels, (iii) bridges, (iv) dams, (v) weirs, (vi) bulk storm water outlet structures, (vii) marinas, (viii) jetties exceeding $50m^2$ in size, (ix) slipways exceeding $50m^2$ in size, (x) buildings exceeding 50 m^2 in size or (xi) infrastructure or structures covering 50 m^2 or more where such construction occurs within a watercourse or within 32m of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	The construction of the capacity expansion facilities which will involve other activities such as bulk storm water outlets, buildings and other infrastructure as listed in the listed activity will be performed within a watercourse and or the vicinity of a watercourse which therefore makes this activity relevant. Subsequent to construction impacts.
R544: 12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of $50,000m^3$ or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.	For construction and operational purposes, the storage of water in excess of volumes that exceed the parameters given in the listed activity is expected. This activity is thus relevant.
R544:13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 m^3.	Dangerous goods may be stored at the proposed development to a capacity exceeding the given threshold within this activity.

Listed Activity Number & Description		Relevance to the Expansion Programme
R544: 17	The planting of vegetation or placing of any material on … exposed sand surfaces, within the littoral active zone for the purpose of preventing the free movement of sand, erosion or accretion, excluding where the planting of vegetation or placement of material relates to restoration and maintenance of indigenous coastal vegetation or where such planting of vegetation or placing of material will occur behind a development setback line.	This activity is triggered as a result of the need to facilitate and manage the resultant impact of storm water. Due to the capacity expansion, control measures and associated structures to sufficiently manage the expected flow and load may be developed. This activity is thus relevant.
R544: 18	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 from (i) a watercourse, (ii) the sea; (iii) the seashore, (iv) the littoral active zone, an estuary or a distance of 100m inland of the high-water mark of the sea or an estuary, whichever is greater.	Dredging will be necessary to accommodate the significant increase of infrastructure. This activity will be triggered by dredging activities during the construction of the development.
R544: 20	Any activity requiring a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) or renewal thereof.	This activity may be triggered by the need to remove significant volumes of minerals in the form of sand, clay, gravel, soil etc. to facilitate the construction of infrastructure and or structures.
R544: 22	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5m.	The construction of roads for access to specific areas within the proposed development area is required. It is expected that this activity will be triggered.
R544: 23	The transformation of undeveloped, vacant or derelict land to (i) industrial use, outside an urban area and where the total area to be transformed is bigger than 1 ha but less than 20ha.	Although the total area to be developed and transformed is 2877 ha which far exceeds the 20 ha maximum requirement, pockets of vacant or derelict land may be required for transformation that are smaller than 20 ha, for the purpose of e.g. a construction camp/office.
R544: 27	The decommissioning of existing facilities or infrastructure, for (iv) storage, or storage and handling, of dangerous good) of more than 80 m^3 but excluding any facilities or infrastructure that commenced under an environmental authorisation issued in terms of the EIA Regulations, 2006 made under Section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, or Notice No. 543 of 2010 (to confirm if magnetite, ferrochrome and ferromanganese are listed as dangerous).	The removal or decommissioning of existing infrastructure will be undertaken to accommodate for other infrastructure development which triggers this listed activity.

Listed Activity Number & Description		Relevance to the Expansion Programme
R544: 28	The expansion of existing facilities for the process or activity where such expansion will result in the need for a permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of Section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	The expansion of the port will result in an increase in storage capacity and handling of increased volumes of materials/ goods (e.g. coal). Increased transportation into and out of the development area will also influence the relevance of this listed activity.
R544: 37	The expansion of facilities or infrastructure for the bulk transportation of sewage or stormwater where: (a) the facility or infrastructure is expanded by more than 1000m in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more, excluding where such expansion (i) relates to transportation of water, sewage or stormwater within a road reserve, or (ii) where such expansion will occur within urban areas but further than 32m from a water course, measured from the edge of the watercourse.	The existing water and storm water infrastructure system will be expanded to which the volumes or lengths are unknown at present. The capacity of the systems to be developed is also unknown.
R544:39	The expansion of (i) canals; (ii) channels; (iii) bridges; (iv) weirs; (v) bulk storm water outlet structures; (vi) marinas; within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line.	The expansion of the proposed development is associated with the listed infrastructure in the activity and it is within the vicinity of watercourse or watercourses.
R544:40	The expansion of (i) jetties by more than 50 m^2; (ii) slipways by more than 50 m^2; or (iii) buildings more than 50 m^2 within a watercourse or within 32 metres of a watercourse, measured from the edge of watercourse, but excluding where such expansion will occur behind the development setback line.	The port expansion would result in the demand for additional and or expansion of buildings to facilitate various services. This activity is relevant in this regard.

Listed Activity Number & Description		Relevance to the Expansion Programme
R544: 43	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 m^2, excluding such expansions within existing ports or harbours where there would be no increase in the development footprint or throughput capacity of the port or harbour.	With the expected expansion of the port which will increase the throughput capacity of the port and consequently the development footprint
R544: 44	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 m^2, excluding such expansions within existing ports or harbours where there would be no increase in the development footprint or throughput capacity of the port or harbour.	The proposed area to be development is about 2877 ha and it is at the edges of the coast. The conditions provided within this listed activity are therefore applicable to the proposed development.
R544: 45	The expansion of facilities in the sea, an estuary, or within the littoral active zone or a distance of 100 m inland of the high-water mark of the sea or an estuary, whichever is greater, for (i) fixed or floating jetties and slipways where such expansion will result in an increase in the development footprint of such facilities but excluding where such expansion occurs (b) within existing ports or harbours where there will be no increase in the development footprint or throughput capacity of the port or harbour.	Due to the expansion of the port, existing infrastructure (e.g. buildings, water infrastructures) will need to be expanded to provide for the increase in service requirements.
R544: 53	The expansion of railway lines, stations or shunting yards where there will be an increased development footprint, excluding (i) railway lines, shunting yards and railway stations in industrial complexes or zones, (ii) underground railway lines in mines, (iii) additional railway lines within the reserve of an existing railway line.	Existing rail infrastructure will be expanded to help improve transportation requirements of the proposed capacity expansion programme. This will involve construction on virgin land and thus will increase he development footprint.
R544: 54	The expansion of an island, anchored platform or any other permanent structure on or along the sea bed, where the expansion results in an increased development footprint.	This activity is relevant because the proposed expansion magnitude of 2877 ha will significantly increase the development footprint.
R545: 3	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 m^3.	Considering the magnitude of the proposed development it is expected that the construction of such facilities at the provided capacities or even more will be undertaken.
R545: 6	The construction of facilities or infrastructure for the bulk transportation of dangerous goods (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.	Due to the magnitude, associated functions and activities of the proposed project it is expected that the threshold in this activity will be exceeded.

Listed Activity Number & Description		Relevance to the Expansion Programme
R545: 8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275kV or more, outside an urban area or industrial complex.	Increased electrical capacity to feed the proposed expansion will be developed. It is expected that the required capacity to service the port expansion will be within the conditions given in this listed activity. This activity is thus relevant.
R545: 11	The construction of railway lines, stations or shunting yards, excluding (i) railway lines, shunting yards and railway stations in industrial complexes or zones; or (iii) additional railway lines within the reserve of an existing railway line.	There is a need to provide for additional rail structures to assist facilitate transportation requirement for the capacity expansion programme. Development of new and expansion of existing rail structures will be constructed to help facilitate transportation services. This activity is triggered.
R545: 14	The construction of an island, anchored platform or any other permanent structure on or along the sea bed.	The port expansion will involve the development of infrastructure along the sea bed. This activity is therefore relevant.
R545: 15	Physical alteration of undeveloped, vacant or derelict land for industrial use where the total area to be transformed is 20ha or more.	The total area to be transformed is 2877 ha. The impacts of such large developments include, *inter alia,* ecosystem degradation and habitat destruction. This activity is therefore triggered.
R545: 19	The construction of a dam, where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5m or higher or where the highwater mark of the dam covers an area of 10ha or more.	To provide for the storage of storm water and water required for construction and operational purposes, it is expected that this activity will be triggered.

Listed Activity Number & Description		Relevance to the Expansion Programme
R545: 24	Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is greater, in respect of: (i) facilities associated with the arrival and departure of vessels and the handling of cargo, (ii) piers, (iii) inter- and sub-tidal structures for entrapment of sand; (iv) breakwater structures; (v) coastal marinas; (vi) coastal harbours or ports; (vii) structures for reclaiming parts of the sea; (viii) tunnels; or (ix) underwater channels; But excluding – (a) activities listed in activity 16 in Notice 544 of 2010. (b) construction or earth moving activities if such construction or earth moving activities will occur behind the development setback line; (c) where such construction or earth moving activities will occur in existing ports or harbours where there will be no increase of the development footprint or throughput capacity of the port or harbour, or (d) where such construction or earth moving activities take place for maintenance purposes.	Activities associated with the expansion of the port include construction of or increase in capacity of water infrastructure and other facilities. Such construction will occur within the sea as well as in close proximity to estuaries and other water courses. With the increase in the footprint of the port, this activity is thus relevant for the proposed development.
R546:4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres, (a) In KwaZulu-Natal … (i) In an estuary; (ii) Outside urban areas, in: … (aa) National Protected Area Expansion Strategy Focus areas; …	Road construction due to increased transportation requirements for access into and from the port triggers this activity.

Listed Activity Number & Description		Relevance to the Expansion Programme
R546: 12	The clearance of an area of 300 m^2 or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004. (b) Within critical biodiversity areas identified in bioregional plans.	The land area expected to be developed is 2877 ha and is expected to traverse natural land which constitutes indigenous vegetation. This will impact on sensitive ecological areas such as mangroves. This activity is thus triggered.
R546:13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for (2) the undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010. (a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority. (b) National Protected Area Expansion Strategy Focus areas. (c) In KwaZulu-Natal: (ii) Outside urban areas, the following: (aa) A protected area identified in terms of NEMPAA, excluding conservancies. (bb) National Protected Area Expansion Strategy Focus areas.	The expected area to be developed is approximately 2877 ha which exceeds the threshold within this listed activity.
R546:14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority. (a) In Kwa Zulu Natal… (i) All areas outside urban areas	The land area expected to be developed is 2877 ha and is expected to traverse natural land which constitutes indigenous vegetation. Clearance of site for infrastructure development may result in degradation disturbance and disturbance of indigenous vegetation. This may impact on the natural value of the area. The listed activity is thus relevant.
R546:16	The construction of: (i) jetties exceeding 10 square metres in size (ii) slipways exceeding 10 square metres in size;	Considering the total land area to be developed and the required infrastructural expansions the given threshold within this activity will be exceeded. Therefore this activity is triggered.

4.5 NATIONAL ENVIRONMENTAL MANAGEMENT: INTEGRATED COASTAL MANAGEMENT ACT

The National Environmental Management Integrated Coastal Management Act (No.24 of 2008) [NEM:ICMA] aims to establish a system of integrated coastal and estuarine management and to ensure that development within the coastal zone is socially and economically justifiable and ecologically sustainable.

In order to minimise or mitigate negative environmental impacts, the NEM:ICMA refers to the NEMA provisions for the need to obtain environmental authorisations prior to undertaking certain listed activities. Any of the listed activities that are conducted in the coastal zone will require and environmental authorisation in terms of NEMA. In addition to the NEMA requirements and criteria for environmental authorisations, the NEM:ICMA provides for additional criteria that must be considered by the relevant competent authority when evaluating an application for an activity which will take place in the coastal zone, including:

- The protection of the natural coastal environment as a national heritage.
- The management of coastal resources in the interests of the whole community.
- The promotion of equitable access to the resources and benefits provided by the coast.
- The fulfilment of South Africa's obligations under international law.

4.6 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT

The requirement for an AEL is triggered by listed activity number 14, Category 5, sub-category 5.1: Storage and Handling of Ore and Coal, and possibly listed activity number 11, Category 2, sub-category 2.2: Storage and Handling of Petroleum Products. The licence is issued by the uThungulu District Municipality. An Air Emissions Licence (AEL) number UDM/11-12/AEL0005/1 in the name of Transnet Port Terminal (TPT), which handles the coal in the Port of Richards Bay, is valid until 21 March 2017.

4.7 NATIONAL WATER ACT

The National Water Act (Act No. 36 of 1998) (NWA) aims to regulate the use of water and activities, which may impact on water resources through the categorisation of listed water uses, which encompass water abstraction, flow attenuation within catchments, construction within the flood lines of a river, as well as the potential contamination of water resources. Such activities require authorisation and/or licensing by the Department of Water and Sanitation (DWS) before they may take place.

Table 4-3: indicates the anticipated water uses in terms of the NWA for the proposed Richards Bay Port Expansion as well as for all existing water uses which have not yet been registered as a water use, including pipelines (sewers, water supply and stormwater), canals, channels, and bridges, railway lines and roads crossing water resources.

Table 4-3: Water Uses

Relevant NWA Section & Description		Relevance to the Proposed Programme
S 21 (a)	The taking of water from a water resource	Taking water from a water resource such as a river, aquifer (i.e. taking groundwater for use in dust suppression during construction), wetland (i.e. dewatering of a wetland), or lake.
S 21 (b)	Storage of water	Water will be stored in the proposed storage dam.
S 21 (c)	Impeding or diverting the flow of water in a watercourse	Causing an obstruction to the flow of water in a watercourse or diverting some or all of the flow from a watercourse. The diverted water must eventually be returned to the natural watercourse. It can also be temporary in nature, such as for the safe construction of a bridge or coffer dam (i.e. various roads need to be realigned over existing watercourses, and subsoil needs to be dredged from the estuary).
S 21 (f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	The direct discharge of water or wastewater into a water resource (i.e. if waste or wastewater is directly discharged into the estuary).
S 21 (g)	Disposing of waste in a manner which may detrimentally impact on a water course.	This includes the disposal of contaminated stormwater in the proposed storage dam which would otherwise have detrimentally impacted on the estuary.
S 21 (i)	Altering the bed, banks, course or characteristics of a watercourse	Refers to the physical changes that are made to a water resource such as widening or straightening of a river or dredging in an estuary, the alteration of the streambed and banks are usually needed for construction or infrastructure or across a river, and includes any activity closer than 500m upstream or downstream from the boundary of any wetland or estuary.

Relevant NWA Section & Description		Relevance to the Proposed Programme
S21 (j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Since the Richards Bay Port is an estuary, any application should cover this water use. Also the lining of open stockpiles would be covered with this water use.

In addition, a dam safety licence would be required in terms of the Dam Safety Regulations published in GNR1560 of 25 July 1986 for any dam with a safety risk (i.e. dams with a maximum wall height that exceeds 5,0 m **and** with a storage capacity of more than 50 000 m^3, or any other dam declared as a dam with a safety risk).

4.8 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT

The National Environmental Management: Waste Act (No 59 of 2008) [NEM:WA] aims to regulate waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development, such as through Section 26 (the prohibition of unauthorised disposal of waste) and Section 27 (the prohibition of littering).

This act also provides national norms and standards for regulation and management of waste by all spheres of government and specific waste management measures, provides for the licensing and control of waste management activities, and provides for a national waste information system, compliance and enforcement.

The following regulations apply specifically to the Port Expansion:

- GNR 634: NEM:WA: Waste Classification and Management Regulations;
- GNR 635: NEM:WA: National Norms and Standards for the Assessment of Waste for Landfill Disposal; and
- GNR 636: NEM:WA: National Norms and Standards for the Disposal of Waste to Landfill.

4.9 NATIONAL FORESTS ACT AND NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT

The National Forests Act (No 84 of 1998) controls the management of forestry in the country and aims to promote the sustainable utilisation of forests for environmental, economic and educational purposes. But those listed as Critically Endangered and Endangered under the National Environmental Management: Biodiversity Act (Act No 10 of 2004) [NEM:BA] must receive highest priority for protection, whether in the planning of new conservation areas, or control of development and land use change.

By definition mangroves are classified as natural forests and as such a licence is required for the removal or harvesting of trees. Therefore according to Section 7 of the Act, mangrove harvesting at Richards Bay Harbour and other such forests identified in this study, is taking place illegally.

No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being sentenced to a fine or imprisonment for a period up to three years, or both a fine and imprisonment.

In the case of Richards Bay, three forest types, namely Mangrove Forest, KwaZulu-Natal Coastal Forest and Swamp Forest, occur within the site boundary and are designated as Endangered. The guidelines provided under the NFA for this habitat category are indicated in Table 4-4.

Table 4-4: Guidelines for the Protection of Endangered Forest Habitats

Threat Status Rating of forest type and forest patch	Guidelines	Offset considered if possible
Endangered	No activities or development must be considered that will destroy forest; Low-impact eco-tourist facilities like boardwalks and bird-hides, and small bush-camps, but no buildings and infrastructure.	Only for projects proven to be of national or provincial strategic importance, with no feasible alternatives.

Some of the trees which occur on the sites are listed as protected species (Section 12 (1) (d) in terms of Section 15 of the NFA. These species were included as per Regulation R716 of 7 September 2012 in terms of the NFA. Protected trees many not be "cut, disturbed, damaged or destroyed and no person may collect, remove, transport, export, purchase, sell or donated, except under a licence or exemption granted by the Minister". Contravention of this declaration is regarded as a first category offense by this schedule.

Also, according to NEMBA a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit from Ezemvelo KZN Wildlife or the Department of Agriculture, Forestry and Fisheries. Restricted activities include, among others, hunting, catching, capturing or killing, as well as gathering, collecting, damaging or destroying any threatened or protected species.

The following protected plant species were recorded on site; refer to Table 4-5

Table 4-5: Protected Plant Species recorded on site.

Species	Common Name	Moraceae

Ficus trichopoda	Swamp fig	MORACEAE
Barrintonia racemosa	Powder-puff tree	LECYTHIDACEAE
Bruguiera gymnorrhiza	Black mangrove	RHIZOPHERACEAE
Mimusops caffra	Coastal red milkwood	SAPOTACEAE
Rhizophora mucronata	Red mangrove	RHIZOPHERACEAE
Sideroxylon inerme subsp. inerme	White milkwood	SAPOTACEAE
Dioscorea sylvatica	Elephant's foot	

4.10 Mineral and Petroleum Resources Development Act

The Port Expansion Programme will, where practical, procure material from commercial sources.

In terms of the GN R762 of 25 June 2004, "Exemptions of Organs of State from Certain Provisions of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) [MPRDA]" Transnet is exempt from complying with the provisions of Sections 16, 20, 22 and 27 of the Act.

Hard rock quarries and borrow pits larger than 1.5 hectares require a Scoping Report and Environmental Management Programme (EMPr), whilst borrow pits (less than 1.5 hectares) require only an EMPr to be submitted to the Department of Mineral Resources (DMR) for approval.

In terms of Section 43(4) of the MPRDA an application for a Closure Certificate is required on the cessation or completion of mining activities (i.e. relevant to old borrow pits). In terms of Regulation 57 the following would be required:

- Closure Plan.
- Environmental Risk Report.
- Final Performance Assessment.
- Application Form.

4.11 National Heritage Resources Act

The National Heritage Resources Act (No. 25 of 1999) (NHRA) stipulates in:

- Section 34(1) that no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage authority;
- Section 35(3) that any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority;
- Section 35(4) that no person may, without a permit issued by the responsible heritage resources authority -a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites;
- Section 36(3) that no person may, without a permit issued by SAHRA or a provincial heritage resources authority - a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves; b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals
- Section 38 that a Heritage Impact Assessment (HIA) is required for undertaking the following activities: a) A road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length, b) The construction of a bridge or similar structure exceeding 50m in length, c) any development or other activity which will change the character of a site — (i) exceeding 5 000m^2 in extent; (ii) involving three or more existing erven or subdivisions thereof; or (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years, d) the re-zoning of a site exceeding 10 000m^2 in extent, and e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

4.12 NATAL NATURE CONSERVATION ORDINANCE (NO 15 OF 1974) AND KWAZULU NATURE CONSERVATION ACT (ACT 29 OF 1992)

According to the Natal Nature Conservation Ordinance No. 15 of 1974 and the KwaZulu Nature Conservation Act, 1992 (Act 29 of 1992), no person shall, among others: damage, destroy, or relocate any specially protected indigenous plant, except under the authority and in accordance with a permit from Ezemvelo KZN Wildlife.

4.13 UMHLATUZE MUNICIPALITY'S POLICIES AND PROGRAMMES

4.13.1 uMhlatuze Municipality Spatial Development Framework (2007)

The Spatial Development Framework for the City of uMhlathuze (City of uMhlathuze SDF, 2007) recognizes that development should integrate social, economic, institutional and environmental aspects. Sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

The detrimental environmental impacts of economic growth and development should be mitigated as far as possible. This does not mean that economic growth and development should not take place or that environmental management and conservation not be implemented, but rather that there should be a balance between the two. This would also mean that there will be areas of trade-off between the two (SDF 2007).

This study area falls within the following zones:

- Existing and future green areas (heritage site).
- Existing and future terminals and services.
- Existing terminals and lease sites.
- Future terminals and lease sites.
- Tourism/recreational activity.

4.13.2 uMhlatuze Environmental Services Management Plan

The uMhlathuze Environmental Services Management Plan (ESMP) focuses on planning and management of natural assets at a municipal level. Ecosystem services are critical to the functioning of the Earth's life-support system. These natural environmental services make an important contribution to the economy of the uMhlathuze Municipality. The ESMP aims, among others, to assist in meeting biodiversity conservation targets as set by EKZNW. Four levels of environmental service supply and management zones are recognised:

- Nature reserves (Level 1): includes areas of biodiversity or environmental significance such as estuaries, lakes, major wetlands, natural forests, coastal buffers and critically endangered habitats that are protected in terms of legislation and should be declared as nature reserves.

- Conservation zone (Level 2): includes areas of biodiversity or environmental significance. No development of land for purposes other than conservation should be permitted in this zone.
- Open Space Linkage Zone (Level 3): provides a natural buffer for Level 1 and 2 zones. Transformation of natural assets and the development of land in these zones should only be permitted under controlled conditions.
- Development Zone (Level 4): areas are either already developed or transformed and are not critical for environmental service supply. This zone should be developed in a manner that supports, or at least does not adversely impact on, the sustainability of environmental service supply in Level 1, 2 and 3 zones.

4.14 GUIDELINE DOCUMENTS

The following guideline documents have been considered during the process:

a) Companion to the National Environmental Management Act Environmental Impact Assessment Regulations of 2010, Integrated Environmental Management Guideline Series 5, 2010, Department of Environmental Affairs, Pretoria.

b) Public Participation in the EIA Process, Integrated Environmental Management Guideline Series 7, 2010, Department of Environmental Affairs, Pretoria.

c) Guideline 5: Assessment of Alternatives and Impacts in support of the Environmental Impact Assessment Regulations, Integrated Environmental Management Guideline Series, 2006, Department of Environmental Affairs, Pretoria.

d) South African National Standard – The Application of the National Building Regulations, Part X: Environmental Sustainability, Part XA: Energy Usage in Buildings, SABS Standards Division, 2011. (SANS 10400-XA: 2011).

e) DAERD, (2011) Environmental Management Framework for the Richards Bay Port Expansion Area and Industrial Development Zone. Department of Agriculture, Environmental Affairs and Rural Development (DAERD), Pietermaritzburg, South Africa.

f) Standards South Africa (2005). Ambient air quality – List of common pollutants. South African National Standard 1929:2005.

g) City of uMhlathuze, IDP – Draft Process Plan, 2014-2015.

h) Draft Environmental Management Framework (EMF) report for Richards Bay Port Expansion Area and Industrial Development Zone, 2009.

i) SANS 1929: Ambient air quality – limits for common pollutants.

j) SANS 10103: The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.

k) SANS 10228: The identification and classification of dangerous goods.

l) Due Diligence Investigation for the Acquisition of Land for Future Port Expansion: Port of Richards Bay, 2010.

m) Department of Water and Sanitation- Guidelines on Wetland Offsets, 2014.

5 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

5.1 STUDY APPROACH

The EIA process is a planning and decision making tool that identifies the potential negative and positive impacts of a proposed development. It also recommends ways to enhance the positive impacts and to minimize the negative ones. The environmental studies that will be undertaken will address the impacts associated with the proposed development, and provide an assessment in terms of the biophysical, social, cultural-historic and economic environments. This will assist both the DEA and Transnet in making decisions regarding potential environmental authorisation and implementation of the proposed Richards Bay Port Expansion development, respectively.

The EIA has been undertaken in compliance with the NEMA, specifically Government Regulations Notice (GNR) 543, 544, 545 and 546 of 18 June 2010 (as amended), with further due consideration of the NEMA 2014 regulations, and the NEM:WA. Cognisance has been taken of guidelines and other relevant legislation (as indicated in Chapter 4 above).

5.2 EIA STUDIES UNDERTAKEN BY OTHER EAPS IN PORT OF RICHARDS BAY

The following EIA studies have been undertaken in the Port of Richards Bay:

- Transnet Port Terminals - Richards Bay Terminals AEL Application, 2011;
- Delkor Waste Water Treatment Plant, Draft Scoping Report, Transnet Port Terminals, 2011;
- Proposed E/F Slab Expansion, Port of Richards, 2012;
- Proposed Expansion of Cargo Handling Facilities, Richards Bay Multi-Purpose Terminal, 2009;
- Proposed Expansion of Storage Areas - Richards Bay Dry Bulk Terminal, 2009;
- Basic Assessment (BA) for site clearing and site preparation activities on Lots 4 and 5 of Portion 3 of Erf 11478 in the South Dunes Precinct of the Port of Richards Bay, KwaZulu-Natal;
- Proposed Truck Staging Facility and Associated Infrastructure at ERF SUB 45 OF LOT 5333, Richards Bay;
- Doubling of the Single Railway Track from the Port of Richards Bay to the Nsezi Railyard.

5.3 SCOPING PHASE

The aim of the Scoping Phase of the project was to identify and define the issues that needed to be addressed in the EIA Phase. An environmental scoping site visit was undertaken on the 16 January 2014 by the AECOM project team.

During the PPP, I&APs were identified and given the opportunity to list issues and concerns relating to the proposed Richards Bay Port Expansion development and study area. A first round of public participation was undertaken to identify I&APs, notify them of the proposed development and to afford them the opportunity to identify issues and concerns that should be addressed in the EIA study.

Input from the technical team, the authorities, specialists and I&APs were considered and integrated into the Scoping Report. The Draft Scoping Report (DSR) was made available for public comment over a period of 60 days, from 25 March 2014 – 6 May 2014 The objective of the public comment period was for I&APs to raise issues about the information presented in the DSR and for them to raise any other issues related to the proposed Richards Bay Port Expansion Development. Refer to **Appendix 2** for the PPP Report which includes the issues and response register as well as proof of all interactions with the I&APs.

The Final Scoping Report (FSR) incorporated all comments that were received during the public review period and submitted to the DEA on 04 June 2014 for review and acceptance/rejection. The FSR including the Plan of Study for the EIA was approved by the DEA on 09 July 2014 (refer to **Appendix 1**).

5.4 ENVIRONMENTAL IMPACT ASSESSMENT PHASE

The EIA for the proposed Richards Bay Port Expansion was conducted in accordance with the process as described in Section 26 to 35 of the EIA Regulations (2010) as promulgated in terms of section 24(5) of the NEMA. AECOM is responsible for the process and collation of information from the specialists reports including the issues raised from the PPP.

From the various sources (i.e. site visits, PP, and the expertise of the EAP and the technical team) a range of issues (i.e. biophysical, social and cultural) were identified and assessed during the EIA phase (refer to **Section 10**). Included in the EIA process was the identification of mitigation measures. How these mitigation measures are implemented is included in the draft Site-Specific EMPr (**Appendix 3**), compiled specifically for the design, construction, operation and maintenance, and eventual decommissioning of the proposed Richards Bay Port Expansion development.

The objective of the PPP in the EIA phase of the project is to present the findings of the investigations to the stakeholders and to provide them with an opportunity to comment on these. In order to achieve this, the Draft EIA Report will be available for review by registered

I&APs for a period of 40 days, from 20 July 2015 – 28 August 2015. Refer to the PPP Report, **Appendix 2,** for additional information on the PPP.

On closure of the public review period, comments and issues raised will be noted and incorporated into the EIA Report and EMPr, after which these reports will be finalised and submitted to the DEA for review and issuing of the EA (whether positive or negative).

5.5 DECISION MAKING PHASE

On conclusion of the public review period, the EIA Report and EMPr will be finalised and submitted to the DEA, the competent authority.

The report will be reviewed by officials from the competent authority and an EA will be drafted with possible specific conditions that must be adhered to by the Applicant during the design, construction, operation and maintenance and eventual decommissioning.

Note that the EA may grant the entire proposal as submitted (i.e. positive EA), or only part thereof (i.e. positive EA for only some of the listed activities specified, part of the site, etc.) with specific conditions imposed thereon, or may decide that the risk is too high and reject the proposal (i.e. negative EA). Note that if additional information is required, which will be requested, an EA would not be granted under that situation at that time.

Once the draft authorisation is approved at the various required levels within the DEA, a decision in the form of an EA is sent to the Applicant.

5.6 POST-AUTHORISATION PHASE

Once an EA is granted, the EAP must notify all I&APs of the contents of that EA, and notify the I&APs of the fact that an appeal may be lodged – that is, should I&APs or the Applicant disagree on the grounds of the decision taken they may enter into an appeal process.

If no appeal(s) are lodged, proof of compliance with post-authorisation conditions (as relevant) would then be submitted to the DEA along with a request to commence construction (within the validity periods included in the EA). Once the DEA has approved such submissions, final detailed planning and then construction (i.e. from pegging-out of the first cell and infrastructure on the site) would then be allowed to proceed. Detailed designs will need to be submitted to the DEA and DWS for approval of each phase of development over the life of the Richards Bay Port Expansion Development. The DWS and DEA will then be able to ensure that all future cell developments comply with the latest standards set for landfill cell development.

If an appeal is lodged, a separate appeal process to the EIA process currently being carried out would be initiated. No construction may commence until the appeal has been dealt with by the DEA.

5.7 Public Participation Process

The Public Participation Process (PPP) is an integral part of the environmental investigations that were undertaken for the proposed Richards Bay Port Expansion.

The PPP runs both during and after the EIA process – with only the focus shifting over the lifespan of the project. That is, the relationships between the Applicant and the I&APs continue once the EA has been granted during the implementation phase of the project, and then extending into the operational phase.

The PPP is presented in a detailed stand-alone document in **Appendix 2**, and includes the Issues and Response Report, as well as proof of all interactions with the I&APs. Please refer thereto for more information.

It should be noted that the PPP is in compliance with the relevant EIA Regulations, and the related guideline documents.

5.8 Related Authorisations

Refer to **Section 4.6** regarding the air quality permit and **Section 4.7** regarding the water use licence. Further to this, a meeting was held on the 8 May 2015 with DWS, Transnet and AECOM EAP. The EAP presented the proposed development and impacts as well as aspects of the development to existing water resources that will require DWS input and approval. This included:

- 600 Berth land extension area, this is where the *species Zostera capensis* was found for the first time in 30 years in Richards Bay Port;
- rail balloon land extension area;
- existing rail balloon wetland and Thulazihleka Pan; and
- metal contamination is anticipated if the dredged material is disposed of.

It was established that a water use license is required and this will be applied for at a later date. As part of the review process of the EIA Report and associated documents, the documentation will be submitted to the DWS for review in evaluating the risk to water pollution and technical review of the designs. The DWS will provide information to the environmental competent authority, i.e. DEA, for inclusion into the EA that will lead to a specific WUL forming an integrated part of the EA.

6 DESCRIPTION OF THE AFFECTED ENVIRONMENT

6.1 STUDY AREA CONTEXT

The study area is situated within the uMhlathuze Local Municipality. The natural environment in this area is highly sensitive and under severe development pressure. The local landscape is characterised by interconnected network of hydrological ecosystems that sustains a combination of locally important habitats and species and contributes to the maintenance of one of South Africa's biodiversity hotspots. It also sustains a growing population in an area with very high levels of poverty.

The Port of Richards Bay, South Africa's premier bulk port, falls within the same area. Its strategic location and the availability of land offer opportunities for further growth and port expansion.

6.2 CLIMATE CONDITIONS

Richards Bay has a warm to hot and humid subtropical climate, with warm moist summers. Average daily maximum temperatures range from 29° C in January to 23° C in July. The Mean Annual Precipitation (MAP) is 1 228 mm and most (~80%) of the rainfall occurs in the summer, from October to March. Early summer rainfall is derived mainly from deep convective showers and thunderstorm with occasional hailstorms. Late summer rainfall is less severe with more widespread convective activity associated with sub-tropical easterly circulation patterns. Tropical cyclones and middle-latitude systems have resulted in extreme rainfall events on several occasions and pose a risk to infrastructure within Richards Bay.

Table 6-1: Climate data for Richards Bay (based on monthly averages for a 30 year period, between 1961 and 1990 (SAW, 2005)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Average Daily Max Temp (°C)	29	29	29	27	25	23	23	24	25	25	27	29
Average Daily Min Temp (°C)	21	21	20	18	15	12	12	14	16	17	19	20
MAP (mm)	172	167	107	109	109	57	60	65	77	105	114	86

6.2.1 Wind

The prevailing winds are from the north and north northeast (Figure 6-1), with an occasional southerly component, strengthening in mid-summer. As a result, any dispersion from the site is likely to vary with the passage of weather systems up the coast but will be primarily to the south of the site.

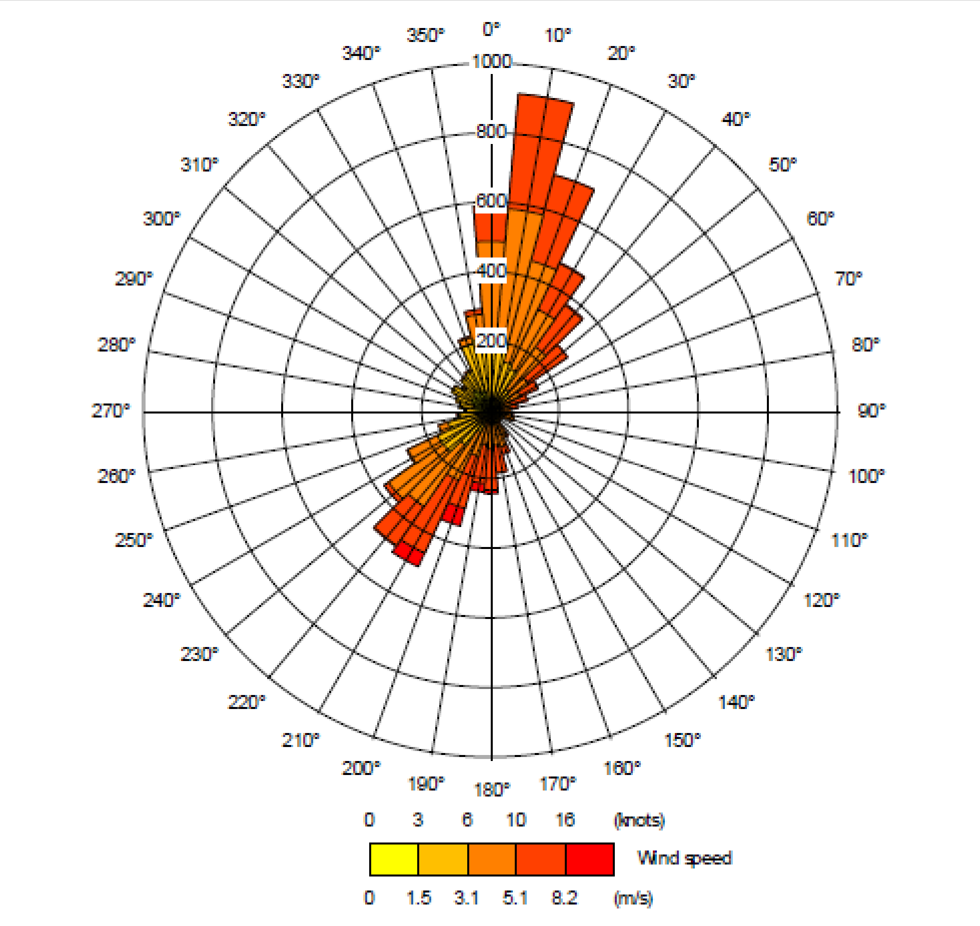


Figure 6-1: Annual wind rose for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 2011)

6.2.2 Precipitation

The site is on the northeast coast of South Africa, in an area known for its warm, moist sub-tropical climate. The region is known colloquially as the KwaZulu-Natal north coast. This region is characterised by regular, year round rain and spells of very hot and humid weather. The annual average rainfall for the region is just over 1200 mm per year (approximately twice the rain received by Johannesburg). Rain peaks in late to mid-summer, in January and February, but the region is also likely to receive rain all year round (Figure 6-2).

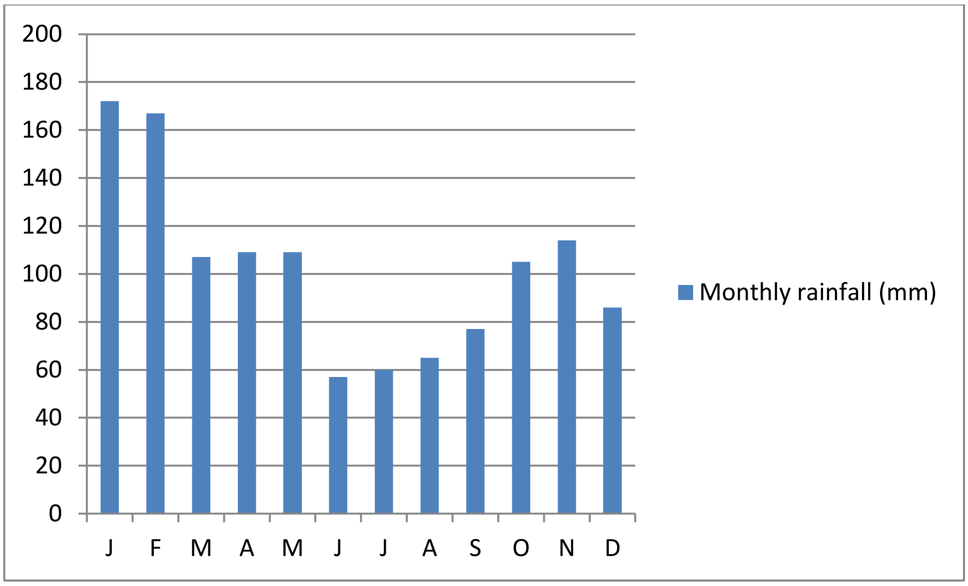


Figure 6-2: Average monthly rainfall figures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (mm per month)

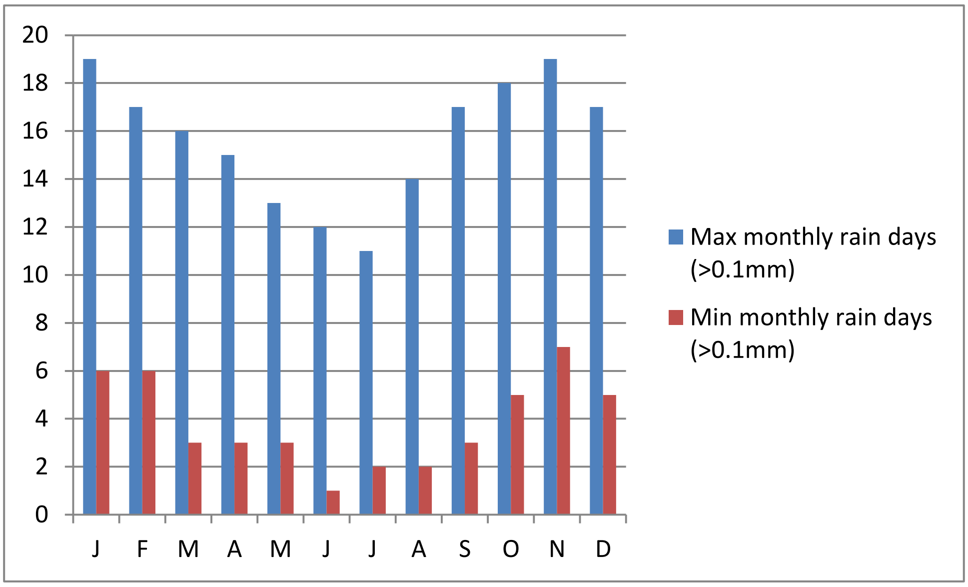


Figure 6-3: Average monthly rain days (days where precipitation exceeds 0.1mm) for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (number of days per month).

The region is characterised by consistently good rainfall, with even the driest winter months receiving at least one day of rain. In summer, rain can be an almost daily occurrence.

6.2.3 Temperature

The climate is consistently warm and moist, with minimum temperatures seldom, if ever dropping below the 10 degree mark. The area experiences hot conditions during the summer, with the warmest period in December and January, when maximum temperatures average close to 30°C (Figure 6-4). Winters are mild with daytime temperatures reaching into the mid-twenties on most days and overnight temperatures never dropping below freezing. Despite it being nominally the dry season, winter remains consistently wet with occasional rain.

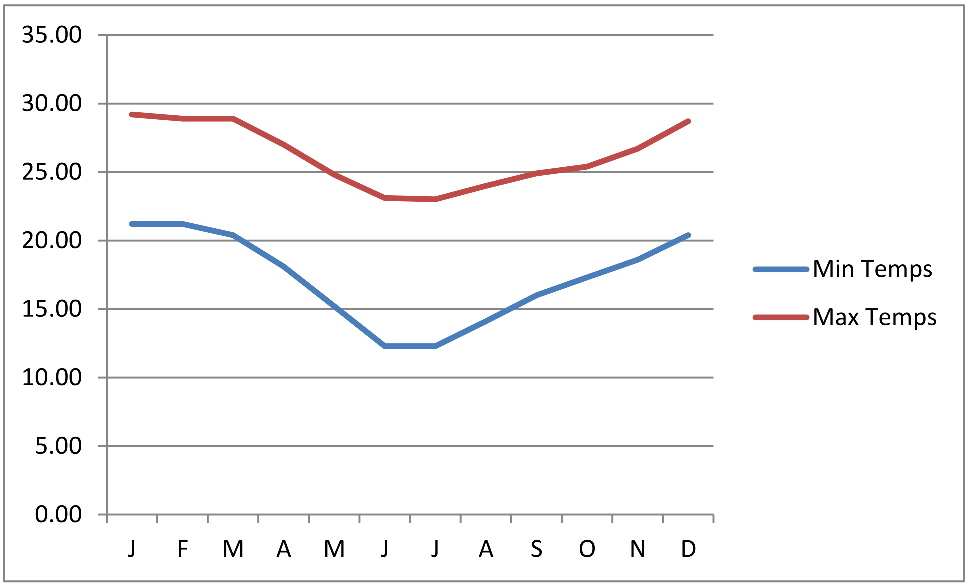


Figure 6-4: Average daily minimum and maximum temperatures for Richards Bay, KwaZulu-Natal Province, South Africa (SAWS, 1961-1990) (°C)

6.2.4 Extreme Weather Conditions

Rainfall variability over the last 30 years is illustrated in Figure 6-2 above. An extreme wet period occurred when Domoina and Imboa struck in 1984 after the 'deepening drought of 1982-1983'. The data highlights the natural local climate variability that is typical of the study area and which makes it vulnerable to flooding and climate change.

6.2.5 Climate Change

There is enough evidence to suggest that climate change is a reality in KwaZulu-Natal (Thornhill, Govender and Khoza; 2009).

The Natural Resources Section of the KZN Department of Agriculture, Environmental Affairs and Rural Development (DAERD) has demonstrated the implications of a warmer province. The DAERD model only used a single climatic variable, namely temperature, for these scenarios. Their scenarios show a clear shift in bio-climatic zones in the province under warming conditions. Such a scenario will change the current sub-tropical climate of the study area into a tropical climate in the near future (+1°C). This may cause significant changes in the area.

The significance of the existing climate change projections lies in the effect that these climate conditions may have on the resilience of the ecosystems in the study area, and whether the socio-economic systems will be able to adapt to changing conditions. For this reason the City of uMhlathuze has commissioned a climate change vulnerability study for the area which was conducted by Zitholele Consulting in 2009.

6.3 HYDROLOGY

The main water resources of the City of uMhlathuze area can be divided into marine and freshwater systems that have strong ecological linkages (Mhlathuze Reserve Determination, DWAF, 2000). The Mhlathuze valley further divides the area into the eSikaweni region in the south and the Empangeni and Richards Bay region in the north. The original Mhlathuze estuary was split into the Richards Bay Harbour and a much reduced estuary with a new mouth (Figure 6-4). There are numerous rivers, streams, canals and diffuse seepage zones of freshwater that drain toward the estuary and harbour. These streams are all linked hydrologically and ecologically to a large number of lakes, swamps, and wetlands. The groundwater has strong linkages to all the other water resources that function as drainage boundaries. The groundwater is also the main flow component in some of these resources. Consequently the hydrological network forms a very important component of the water resources as it provides the hydraulic linkages, and often the ecological linkages, between the different resources.

Richards Bay is situated in the Usuthu-Mhlathuze Water Management Area. This Water Management Area is one of three large water management units in KwaZulu-Natal and shares its resources with Mpumalanga, Mozambique and Swaziland.

In terms of its geography, Richards Bay forms part of the uMhlathuze catchment.

The surface water component comprises the following features:

- Estuary;
- Rivers and Streams;
- Lakes;
- Harbour; and
- Canals.

6.3.1 Quaternary Catchment

The proposed study area falls within the W12F Quaternary Catchment.

6.3.2 uMhlathuze Estuary

The uMhlathuze Estuary is situated within a flood plain and is consequently the recipient of rivers, streams, canals and diffuse seepage zones of freshwater that drain towards the estuary and harbour. Surrounding lakes, swamps and wetlands are hydrologically and ecologically linked to these streams.

Also, groundwater is also greatly tied in with the aforementioned water resources and also forms the primary flow component in many of these resources. This hydrological network forms a crucial component in these water resources, as it provides the hydraulic and ecological link between the different resources.

6.3.3 Rivers and Streams

The uMhlathuze River is the largest river system within the uMhlathuze Estuary. It is characterised by a large flood plain that is exposed to intense exploitation and impacts upstream. The Nseleni stream feeds the uMhlathuze in the north-west through Lake Nsezi; the Nsezi stream is the freshwater link between Lake Nsezi and the uMhlathuze River.

The uMhlathuze River and its catchment have been extensively re-engineered over past decades. As a result of this re-engineering, it has reduced water inputs from the river to surrounding water features, which has consequently affected hydrological corridors and ecosystem maintenance.

6.3.4 Lakes

Several lakes form part of the uMhlathuze Estuary. Lakes Mzingazi and Cubhu are categorised as coastal lakes and are fed by rainfall, surface runoff and groundwater. These lakes have a very small stream network and their sustainable yield is believed to be primarily contributed by groundwater.

Lake Nsezi is located at the transition between the coastal plain and hard rock geological features, which provides it with a different hydrological function to the coastal lakes. Lake Nsezi is regarded as a combination lake – it is supplied from both groundwater and surface water from the Nseleni stream and direct rainfall.

6.3.5 Harbour

The harbour is associated with a reshaped water body and highly developed infrastructure areas on the northern and eastern perimeters. The structure of the port and its operations has an influence on the hydrodynamic processes of the harbour. Also, dredge spoils impacts the surf zone to cause in increase in turbidity, which in turn have aesthetic and ecological implications.

6.3.6 Canals

Three smaller streams in the central portion of Richards Bay drain directly into the Bhizolo or Ngodweni Canals, which in turn drains into the harbour area. An important aspect of these canals is their ability to carry pollutants from the industrial area into the harbour.

6.3.7 Bathymetry of Estuary and Harbour

In terms of this study the regional features of importance features (Figure 6-5) are

- The **Mhlatuze Estuary** that constitutes an important habitat and through which turbid waters flow into the adjacent ocean during high rainfall events;

- The **Port of Richards Bay and features within the port** such as
  - the often turbid mud flats,
  - the sandspit that separates the mud flats from the inner basins of the port,
  - the freshwater inflows through the Mzingazi and Bhizolo Canals,
  - the deep port entrance channel in which the flow is tidally dominated and where there is some exposure to swell
- The **beaches surrounding the port** comprising:
  - the Southern Beach to the south of the mouth of the Mhlatuze Estuary,
  - the Central Beach located between the Mhlatuze Estuary mouth and the port entrance, and
  - The northern beaches to the north of the port entrance that are subject to fairly severe shoreline erosion.

Figure 6-5: Key physiographic features of the region

The bathymetry in the vicinity of the Port of Richards Bay is fairly complex. In the offshore region the continental shelf break that is located close inshore (< 5 km from the coastline) at Cape St Lucia north of the port is found further offshore on moving southwards (~ 20 km from the coastline opposite the Port of Richards Bay). The continental shelf break is located even further offshore in the vicinity of Durnford Point where the continental shelf break is more 35 km from the coastline. There exists a large shallow region to the south of Richards Bay known as the Durnford Shoals. These large scale changes in bathymetry strongly influence the waves and currents in the region offshore of the Port of Richards Bay.

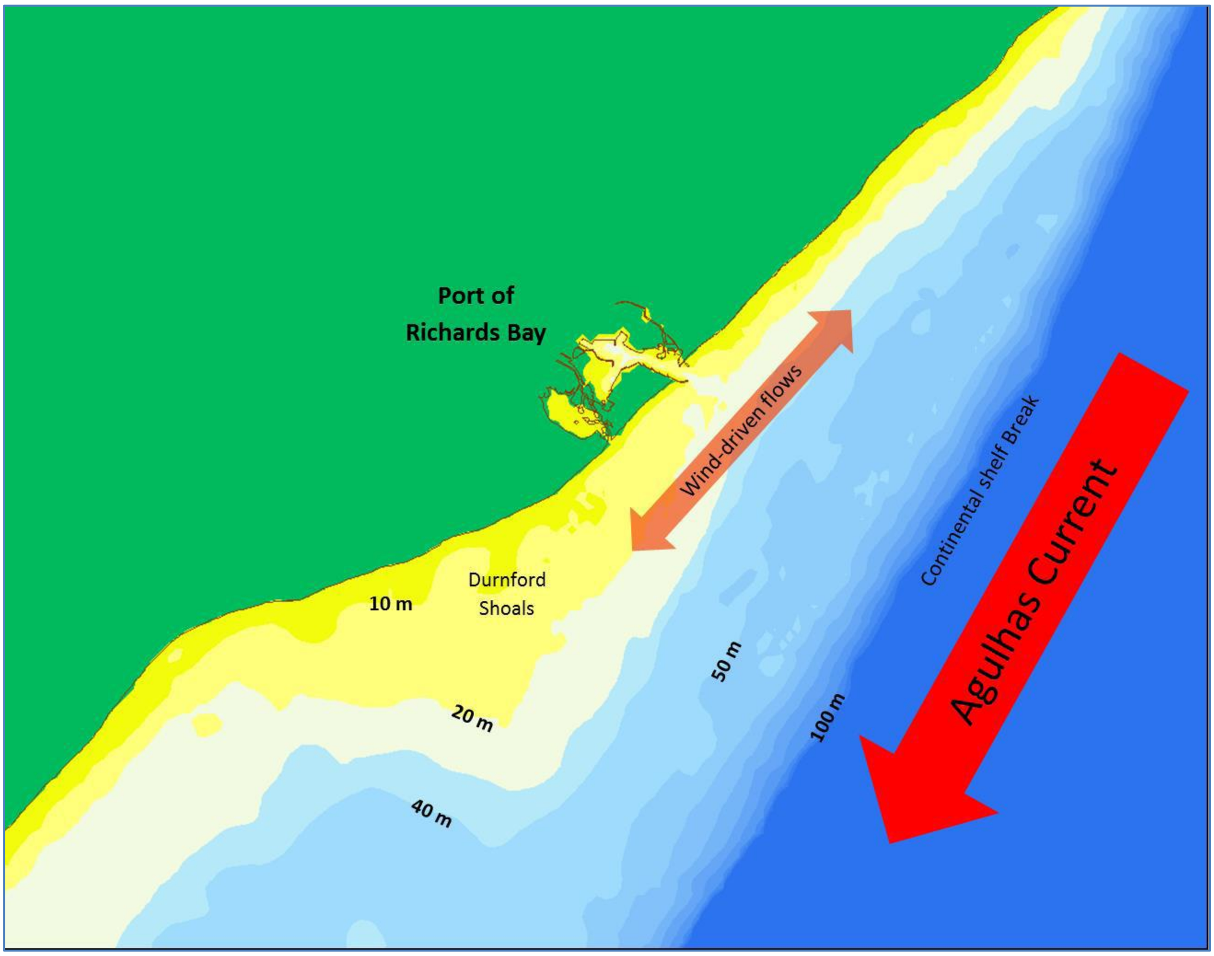


Figure 6-6: Large-scale bathymetry offshore of the Porto of Richards Bay

A more detailed bathymetry for the Port of Richards bay and its immediate surrounds is provided in Figure 6-7 below. Important features within the port are the shallow mudflats, the sandspit that separates these shallow and often turbid waters of the mudflats from the deeper shipping basins both to the north (Inner Basins 1 to 3 maintained to a depth of -18.9 m CD) and to the southeast (Richards Bay Coal Terminal Basin maintained to a depth -19.4 m CD). The deeper navigation channel leading to the port entrance extends approximately 4 km seawards before the depths in the channel are similar to those surrounding the channel.

The adjacent Mhlatuze Estuary in general is shallow except for some of the braided channels and areas closer to the estuary mouth where depth of up to -2m CD or greater occur.

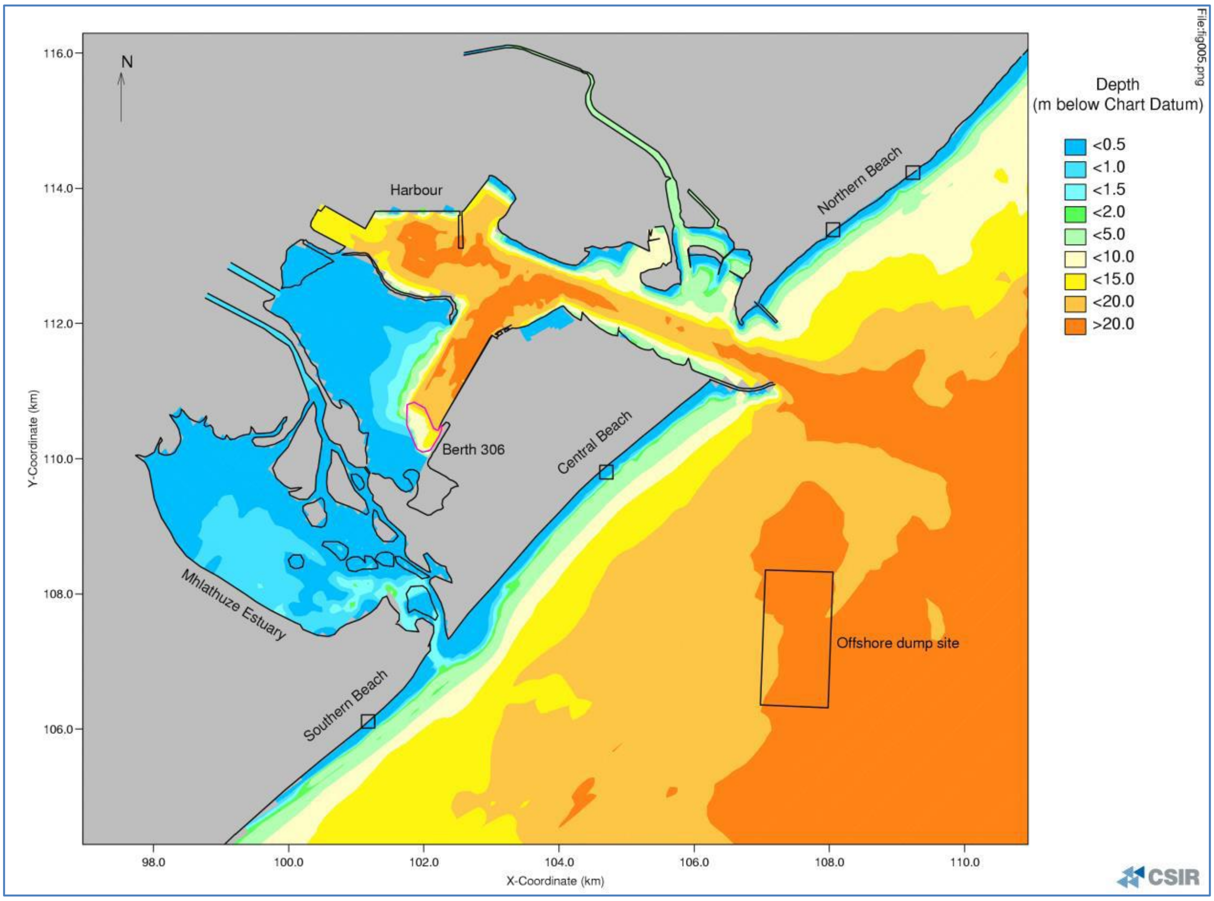


Figure 6-7: Detail of the bathymetry in the immediate environs and within the Port of Richards Bay and the Umhlatuze Estuary (CSIR, 2004c, 2005a)

An offshore bathymetric feature of relevance to this study is the dredge disposal mound that exists offshore of the Central beach in an approximate -20m CD water depth. The present height of this dredge spoil disposal mound is uncertain, however it was sufficiently significant after the Berth 306 dredge spoil disposal operations to have constituted a navigation hazard (Ramsay, *pers. comm*.). There is however evidence that much of the dredge spoil disposed of at this site during the Berth 306 capital dredging has been dispersed, resulting in a less significant bathymetric feature.

6.4 GEOLOGY

The underlying physical geological foundation of the area gives rise to specific landscape features. It also controls the occurrence, distribution and type of water resources in the area, including the groundwater. The Richards Bay area lies on-top of the unconsolidated Cenzonic Era sediments of the Maputaland Lithological Group that stretch along the Maputaland coastal plain into Mozambique as illustrated in Figure 6-6.

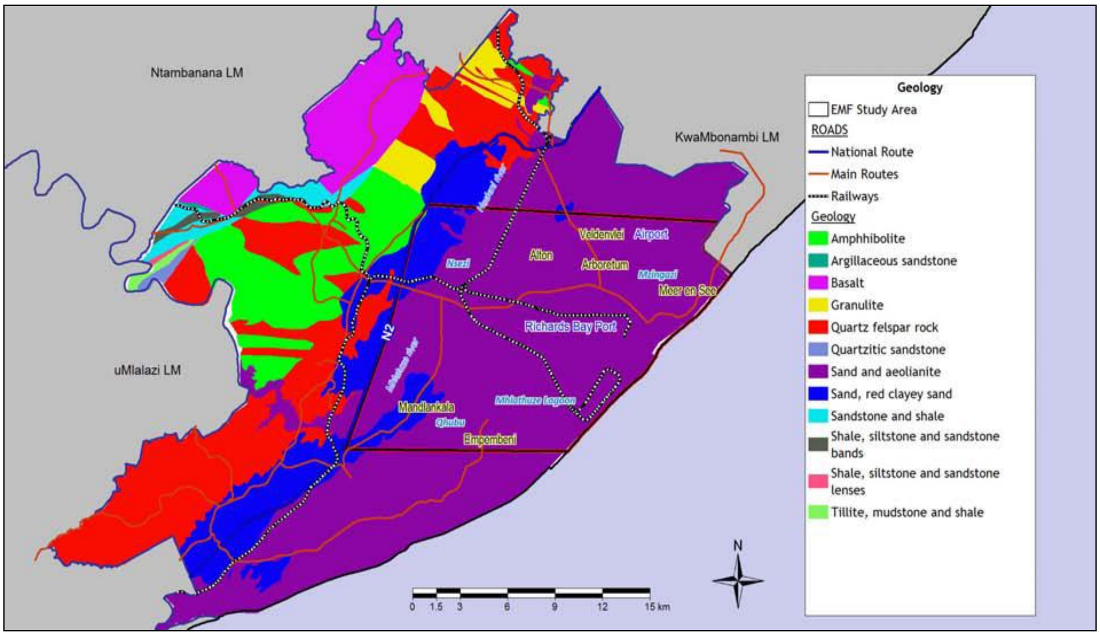


Figure 6-8: Geology of the Study Area.

6.5 SOILS

As stated in the Richards Bay Port Expansion and IDZ Environmental Management Framework, the soils in the area are closely related to the geology and landforms and compromise three main land types, namely deep grey sands, deep alluvial soils and red and yellow adepal soils (Figure 6-7).

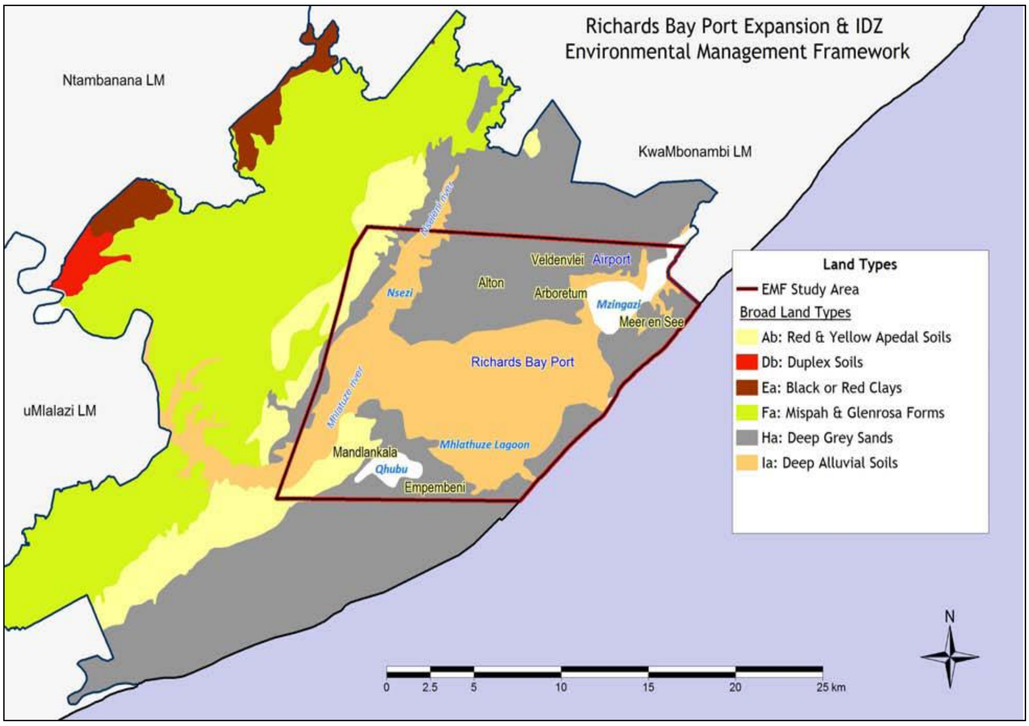


Figure 6-9: Soil Types

6.6 EXTREME FLOODING

The study area falls within a floodplain which, together with the rivers and lake systems forms a complex, dynamic physical and biological system that provides benefits to the humans and the natural systems in the area. Regular floods are necessary for maintain water quality, recharging groundwater, maintaining biological productivity and the general integrity of ecosystems. Although the study area is subject to marked flood-drought cycles, the frequency and magnitude of floods has probably been dampened by the construction of the Lake Pobane (Goedertrouw Dam) and modifications in the local landscape. The N2 freeway and numerous drainage canals in the Mhlathuze flood plain will have changed the natural flooding characteristics of the Mhlathuze Valley. The area is still subject to floods and the maintenance of critical areas within the area would reduce the number and severity of floods. Figure 6-8 illustrates the 1:100 year floodplain.

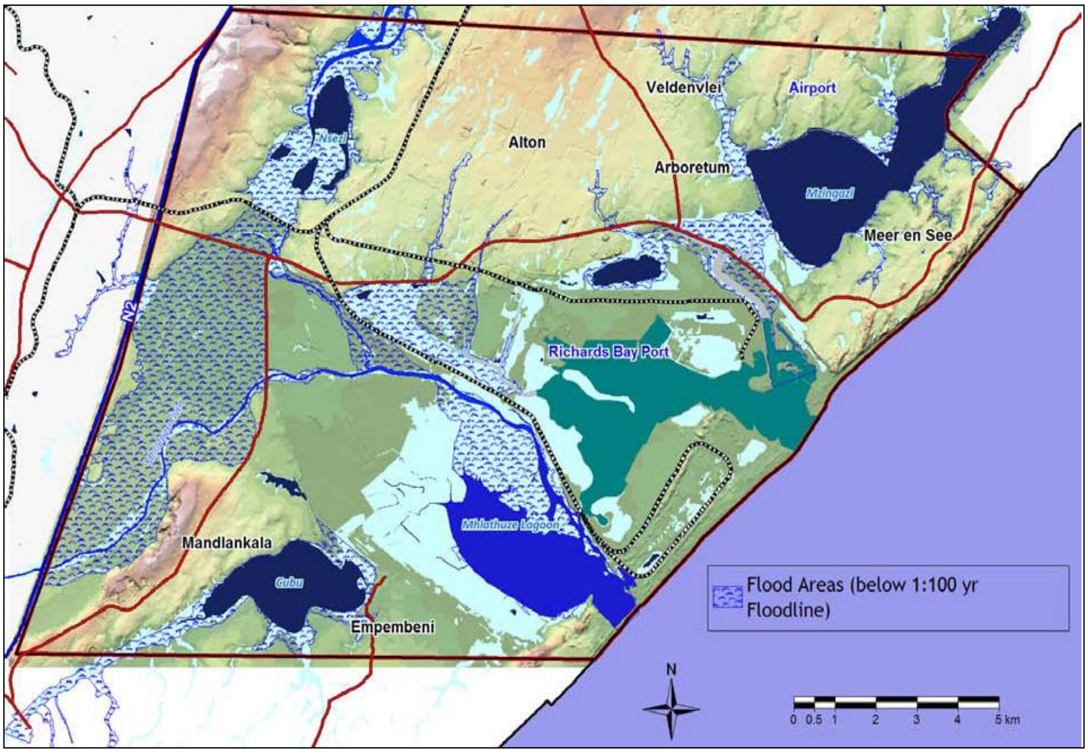


Figure 6-10: Land Types and Flood Areas

6.7 TOPOGRAPHY

Richards Bay is located at the seaward margin of the Mozambique Coastal Plain at an altitude of less than 100m. The Coastal Plain is characterised by an undulating surface of old dune ridges supporting shrub land and forest, swampy drainage courses and lake systems. The dune ridges were formed inn an alternating sequence parallel to the present coastline by a receding Pleistocene sea with the onset of the Würm glaciation (Tinley, 1985).

Both the shore foreland is eroding (Tinley, 1985) and massive dune slumping areas continually along the seaward edge. The red dune sands overlie a thick layer of clay material which influences in situ water drainage. The wetting of the clay by water percolation and seaward drainage which occurs through lateral piping at the point of contact between the dune sand and zones creates unstable conditions along the dune front. This resulted in cavitational dune slumping and the formation of steep basin shaped scars or cirques with flat floors of deep, steep-sided ravines. Because the water table becomes exposed at the cirque floor surface, these areas are usually stabilised with hygrophilous vegetation (Tinley, 1985).

6.8 ROAD NETWORKS

6.8.1 External Road Networks

The road network providing access to the port, see Figure 6-9, is summarised as follows (Mpumalanga Provincial Government, 2010):

- **The National Route 2 (N2):** The N2 is a national route functioning as a north-south link in KwaZulu-Natal providing access to Richards Bay.
- **John Ross Parkway (R34):** John Ross Parkway is a provincial road that connects the port (and surrounding industries) to the N2. The road is a dual carriageway and functions as the main link between Richards Bay and Empangeni (a neighbouring town of Richards Bay). There are currently two road-over-rail bridge structures in John Ross Parkway. The design speed of the road is 100km/h and the speed limit is 80 km/h.
- **West Central Arterial**: The road provides access to the western entrance of the port, linking with the port internal road, Urania Road. The West Central Arterial is the main access road to the discard coal and liquid bulk terminals. The arterial also provides access to the Richards Bay Central Business District (CBD).
- **Harbour Arterial**: The road provides access to the Alusaf Bayside smelters. To the eastern end of the road, it becomes Ferro Close and connects to the John Ross Parkway.
- **Medway Road**: Medway Road provides access to the eastern entrance of the port. It also provides a link to the Multi-Purpose Terminals (MPT) series 7 and the Ferro and Timber storage areas.
- **Bayview Boulevard**: Bayview Boulevard, together with Bridgetown Road, provides access to the eastern section of the port, i.e. The Village (referring to the Richards Bay Waterfront, small crafts harbour, Naval Island and the commercial developments).

Figure 6-11: External Road Network

6.8.2 Internal Road Networks

The internal road network provides access to a number of berths and developments (see Figure 6-10). The main internal routes according to the Mpumalanga Provincial Government (2010) and Kehagias and Otto (2013), are:

- **Newark Road**: Forms the main east-west collector/distributor. The road provides access to the MPT, DBT and the port's administration complex. The road is divided into two sections:
    - − West of the eastern access: The main access road to the DBT.
    - − East of the eastern access: A public road that provides access to The Village.
- **Urania Road / Duine Road**: Provides access to the South Dunes area, where the privately owned Richards Bay Coal Terminal and the Island View bulk liquid storage areas are situated. Urania Road is also the main public road in the port.
- **Medway Road**: The road functions as a link between Newark Road and John Ross Parkway. Parts of the road are outside the port boundary and thus, both port and public vehicles use this road.
- **Bridgetown Road**: Bridgetown Road in conjunction with Pioneer Road, Mendoza Road and the eastern part of Newark Road serve The Village at the eastern end of the port.
- **Silver Ocean Road**: The road connects with Newark Road and provides access to the Shincel operation.
- **Ventura Road**: The road links with Newark Road and is the main road to the port's administration complex.
- **Octopus Road**: The road provides access to the MPT series 6 and connects with Newark Road.
- **Wayfarer Road**: Connects Newark Road with Minerva Road.
- **Petingo Road**: The road provides access to the western side of the MPT series 7 and the staging area and connects with Newark Road.
- **Chaldane Road**: The road provides access to the eastern side of the MPT series 7 and the staging area and connects with Newark Road.

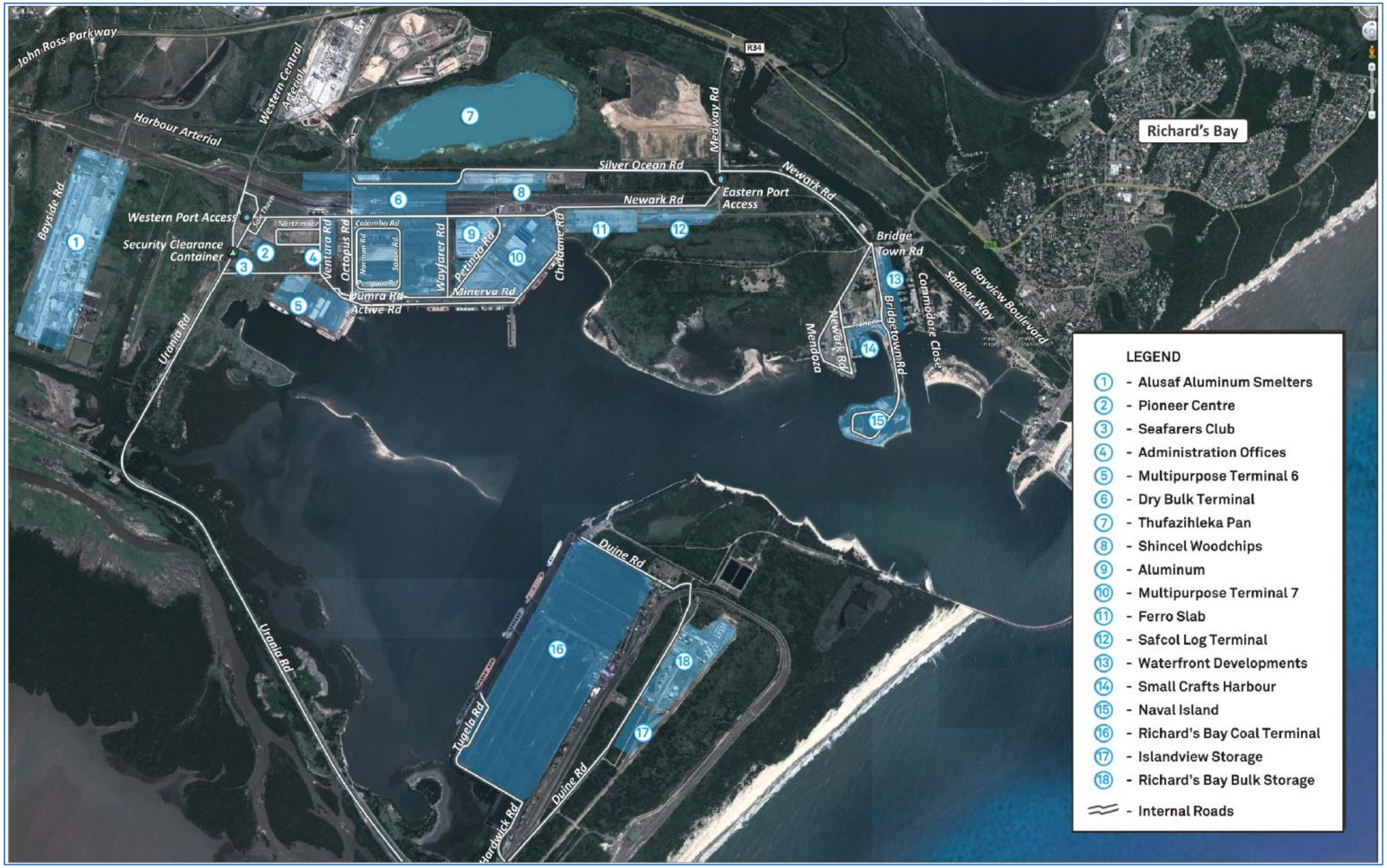


Figure 6-12:Internal Road Network

- **Other Internal Roads**: There are a number of additional roads providing access to the developments in the port operational area. These roads include: San Thom Road, Gordon Road, Colombo Road, Northmoor Road, Dumra Road, Active Road, and Tugela Road.

6.8.3 Access Arrangements

There are two main gates providing access to the industrial operations at the port of Richards Bay. These gates are manned and security clearance is required before access is granted.

These are:

- **The western port access**: This access is situated on the western end of Newark Road where it meets with the Western Central Arterial. The gate operates with two entry lanes and two exit lanes.
- **The eastern port access**: The eastern access is on Medway Road, just south of the intersection with the eastern part of Newark Road. The gate operates with one entry and one exit lane.

The Village is open to the public and can be accessed through the following roads:

- **Newark Road east**: The road can be accessed from Medway Road, just north of the eastern access.
- **Bridgetown Bridge Road**: The bridge in Bridgetown Road consists of only one lane and therefore operates with priority control, allowing one-way flow at a time on a first-come first-served basis.

6.9 BIOLOGICAL ENVIRONMENT

6.9.1 Description of the Harbour Habitats

The current situation in the Port of Richards Bay is completely different from the situation prior to the development of the port, for example the course of the uMhlathuze River has been moved and the river now discharges into the Sanctuary. Although the system has been drastically altered, it still provides valuable ecosystem services. Should any of these functions be lost as a result of the proposed development, it has to be considered an impact of high significance in view of the importance of the system in terms of its regional and local contribution of the off-shore coastal ecology.

Fossil remains have been found in the Richards Bay area in the Cretaceous sedimentary rock of the St Lucia Formation. These sedimentary rocks are rich in fossil remains including that of ammonites, bivalves, gastropods, echinoids and foraminifera (Acer Africa, 2008).

A number of sensitive habitats occur within the Port of Richards Bay and is illustrated in Figure 6-11. These include amongst others the following (CSIR (1996) in ACER Africa, 2008), namely:

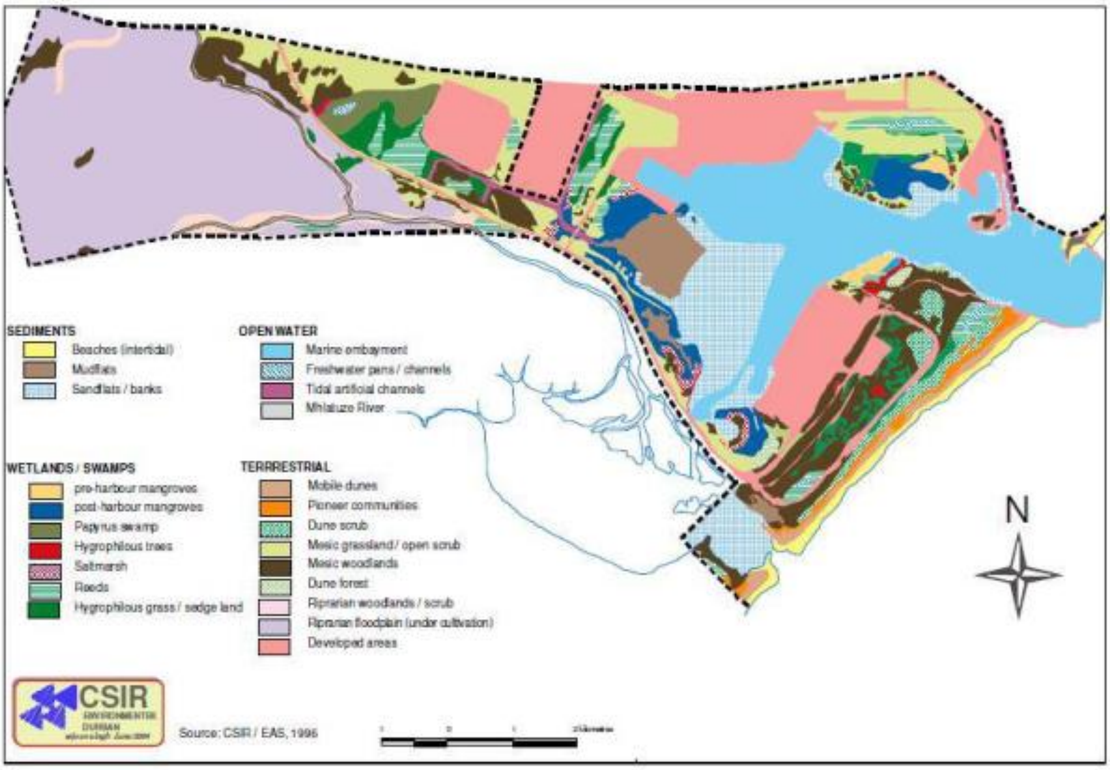


Figure 6-13: Sensitive habitats in the Port of Richards Bay (CSIR, 1996 in ACER (Africa), 2008)

6.9.2 Subtidal Mud Flats

The subtidal mud flats occur in the south-western side of the port at the outlet of the Bhizolo Canal and cover an area of some 125 ha (Acer Africa, 2008). The subtidal mudflats are characterised by high biodiversity and contain up to 53 fish species (Forbes et al, 1996) and serve as important nursery habitats for estuarine dependant species. They also play an important role in nutrient processing and support a complex food web.

The mudflats are important habitats in the functional estuarine ecosystem and support both estuarine species and avifauna species. Species found in this habitat include nematodes and crustaceans as well as various life cycle stages of a number of fish species.

The subtidal mudflats also harbour a relatively large number of bird species, which include species listed in the IUCN Red List of Threatened Species (2012). The area, which is sheltered from the general public, is considered an area of high regional importance as some of the avifauna species such as the *Numenius phaeopus* (Whimbrel), *Limosa lapponice* (Bartailed godwit) and *Pluvialis squatarola* (Grey plover) are listed in terms of the African - Eurasian Waterbird Agreement under the Convention on the Conservation of Migratory Species of

Wild Animals (also known as the CMS or Bonn Convention), which therefore lends an international obligation to the area.

6.9.3 Sand Flats

The sand flats occur mainly in the south-western area of the port as well as on the edges where no quay development has taken place, and covers an area of more than 400 ha.

The sand flats function as nutrient processing areas and also serve as important habitats to birds, particularly waders. The faunal component of the sand flats includes species across the size range from micro to macro faunal species.

One of the most conspicuous features of the port currently is the sand spit, which forms the northern boundary between the mud and sand flats in the south –western area of the port. The intertidal areas of the sand flats also serve as a refuge area for juvenile fish.

The sand spit serves as an important habitat for the roosting of birds, in particular waders, tern and gulls. The following species, listed in terms of the African–Eurasian Waterbird Agreement under the Bonn Convention, are regular occurrences:

- *Dromas ardeola* (Crab plover);
- *Tringa cinerea* (Terek sandpiper);
- *Sterna caspia* (Caspian tern);
- *Sterna bengalensis* (Lesser-crested tern);
- *Sterna albifrons* (Little tern); and
- *Charadrius mongolus* (Mongolian sandplover).

Along the KwaZulu-Natal coast, large sand flat and mud flat habitats occur only in the larger estuaries, such as for example St Lucia, Kosi Bay and Durban port. In view of the fact that many of the smaller similar habitats are under continuous threat from development, the importance of the sand and mud flats in Richards Bay, in the regional context cannot be over-estimated.

6.9.4 Fresh Water Environment

The Richards Bay Port receives fresh water through the following dredged canals, viz. Bhizolo Canal and Manzamnyama Canal, which flow into the port and disperse on the mud and sand flats in the south-western area. The Mzingazi Canal, which flows from Lake Mzingazi, is considered to be outside the port.

Nutrients from freshwater and mangrove swamps feed into these canals and are important nutrient processing areas, which feed into the marine environment along the coast. These canals also receive fresh water from the developed areas alongside Bayside Aluminium.

The Bhizolo and Manzamnyama Canals serve as important habitat for post larvae and juvenile prawn stages. These migrate, as adults, to the breeding grounds of the Thukela Bank.

The freshwater component of the port therefore plays an important role in the offshore production of prawns.

6.9.5 Mangroves

The mangroves are an important habitat for sea life, for birds and animals such as turtles and crocodiles. Sea life includes *Uca* species (Fiddler crabs), *Scylla serrate* (Mud crab), *Periophthalmus kalolo* (Mudskippers) and many species of sea snails and sea slugs. The mangroves are also visited by large numbers of migratory bird species. Fish also use this for mating grounds. As a result of intertidal inundation, fish and crustaceans are swept into this highly productive habitat to feed on the meio and macro faunal species in the muddy sediments.

The development of the port in the 1970's disturbed the distribution of mangroves in the area. However, the development of the port has also created new mangrove colonies, such as in the south-western corner of the port. The current area covered by mangroves in Richards Bay, including the uMhlathuze estuary, is approximately 450 ha and accounts for nearly 80% of the national area covered by mangroves in South Africa.

One of the last remaining stands of the original distribution of mangroves, the Echwebeni Site of Conversation Significance, is found on the southern bank of the mouth of the port. This stand of mangroves is important as all three mangrove species, *Avicennia marina* (White mangrove), *Briguiera gymnorhize* (Black mangrove) and *Rhizophora mucronata* (Red mangrove) occur here. This area has been proclaimed a Natural Heritage Site in terms of the defunct Natural Heritage Programme of the Department of Environmental Affairs. The site is, however, afforded a certain degree of protection in terms of the Ezemvelo KZN Wildlife's Site of Conservation Significance Programme.

The following plant communities were identified, described and mapped with the Rail Balloon/Casuarinas area (Site A):

- A1 - *Avicennia marina–Bruguiera gymnorrhiza* mangrove forests
- *A2 - Ficus trichopoda–Syzygium cordatum* swamp forests
- *A3 - Phragmites australis–Cyperus papyrus* freshwater wetlands
- *A4 - Juncus krausii–Phragmites australis* brackish wetlands
- A5 -Salt Pans
- *A6 - Imperata cylindrica* seasonal wetlands

- A7 - Wetlands covered with invasive alien species
- A8 -Secondary woodlands and shrublands
- *A9 -Stipagrostis zeyheri–Helichrysum kraussii* secondary grasslands
- A10 -Seashore vegetation.

6.9.6 Plant community A1 Avicennia marina–Bruguiera gymnorrhiza mangrove forests

Plant community A1 *Avicennia marina–Bruguiera gymnorrhiza* mangrove forests cover large sections towards the south of Site A. Vegetation structure can be described as tall closed forests with an average tree canopy cover of >80%, ranging from 20% to 95%. Tree height range from 4 m to 14 m depending on habitat suitability for the species involved. No herbaceous layer was recorded within the middle of most mangrove stands, with some herbaceous cover along ecotones with other ecosystems.

Species composition within this plant community is mostly dominated by large dense stands of the mangrove tree species *Avicennia marina*, with smaller stands of *Bruguiera gymnorrhiza* trees along the contact zones of fresh-water and salt-water bodies. Only a few individuals of *Rhizophora mucronata* mangrove trees were recorded along the southern edge of Site A, where surface and subsurface water drain into the harbour. Very few seedlings of the three mangrove tree species were recorded. Other species associated with the fringes of the mangroves include the woody species *Hibiscus tiliaceus* and fern species *Achrostichum aureum*.

6.9.7 Plant community A2 Ficus trichopoda–Syzygium cordatum Swamp forests

Plant community A2 *Ficus trichopoda–Syzygium cordatum* Swamp forests currently occur along the fringes of freshwater reed dominated wetlands of Site A. Historically these swamp forests occurred wider spread throughout the study area, with larger unfragmented stands along the eastern sections of Site A. Vegetation structure can be described as medium tall closed forests with an average canopy cover of >80%, ranging from 75% to 100%. Tree height range from 6 m to 8 m depending on habitat suitability for the species involved. Tree canopy cover is very high (90%). A well-developed shrub layer was recorded, with a dense herbaceous layer in most places. The grass layer is relatively sparse due to low light conditions at the forest floor. At the time of the surveys (late dry season), very little free surface water was recorded within the swamp forests.

Plant species dominating the floristic composition of this plant community include the tree species *Ficus trichopoda, Syzygium cordatum, Bridelia micrantha, Hibiscus tiliaceus*, the shrub species *Searsia nebulosa, Schinus terebinthifolius*, and the herbaceous species *Chromolaena odorata, Cyclosorus interruptus, Microsorum scolopendrium, Senecio rhomboideus, Blechnum attenuatum* and *Stenochlaena tenuifolia*.

6.9.8 Plant community A3 Phragmites australis–Cyperus papyrus freshwater wetlands

Plant community A3 *Phragmites australis–Cyperus papyrus* freshwater wetland is restricted to the northern half of Site A. It occupies a relatively large percentage of the surface area of the entire site. Vegetation structure can be described as a tall closed reed dominated wetland. No woody species were recorded as part of this plant community, with tall (0.75 to 3 m) reed and sedge species providing the main structure of this community. At the time of the field surveys the soils of this plant community were either inundated with water or waterlogged. Organic content of these sandy soils are very high, with peat formation in large sections.

The community is dominated by emergent species such as *Phragmites australis* and *Cyperus papyrus*, with dense stands of the wetland fern species *Cyclosorus interruptus* along the better drained fringes of the wetland. Like most wetlands, this community is relatively species poor. Although *Cyperus papyrus* as a species is not considered as being rare or endangered, the ecological function this species performs within wetland ecosystems place *Cyperus papyrus* dominated plant communities in a very high conservation priority category. More detail on the conservation importance of wetland plant communities are provided within “Section 8 Wetlands” of this report.

6.9.9 Plant community A4 Juncus krausii–Phragmites australis brackish wetlands

Plant community A4 *Juncus krausii–Phragmites australis* brackish wetlands occur along the northern and eastern edges of the mangrove forests of Site A. This plant community demarcates the main contact zone between tidal salt water and subsurface fresh water moving from the north into the estuary. The fresh water is inherently part of the same water body as that of Plant community A3 *Phragmites australis–Cyperus papyrus* freshwater wetland located towards the north. Before the extensive earthworks done on Site A as part of harbour construction and sediment dumping, plant community A4 extended further to the north, and was probably better connected to community A3, with water moving more freely from the north into the estuary and mangrove forests.

Vegetation structure can be described as a dense to closed sedge land with a sparse tall reed component. The structure is a direct reflection of the salinity of these wetlands, with *Juncus krausii* dominating in more saline conditions and *Phragmites australis* dominating in less saline conditions. Water drainage and hydrology is therefore of critical importance to the maintenance of this plant community.

Dominant species include the sedge *Juncus krausii* and the reed *Phragmites australis*, with large clumps of the mangrove fern *Acrostichum aureum*. This community is naturally extremely species poor due to the harsh natural conditions created by the high salinity and regular physiological drought stress plants have to deal with.

6.9.10 Plant community A5 Salt pans

Plant community A5 Salt pan occurs to the west of the mangrove forests, where salt water from spring tides is left behind on evaporation pans. Over time a hyper accumulation of sea salts have left this ecosystem extremely saline. Only a very small number of plants can tolerate such high salinity, especially in times when no free water is left on these evaporation pans. Vegetation structure can therefore be described as a very sparse low succulent herbland. Less than 5% of the salt pans are covered with plants, leaving more than 95% bare and salt crusted. The only prominent plant occupying small patches include the halophytic herb *Sarcocornia natalensis* and the halophytic grass *Odyssea paucinervis*. Along the ecotone numerous species from neighbouring plant communities can be recorded in very low numbers with very stunted growth forms.

6.9.11 Plant community A6 Imperata cylindrica seasonal wetlands

Plant community A6 *Imperata cylindrica* seasonal wetlands occur along the eastern most sections and northern most sections of Site A. These seasonal wetland plant communities are the result of seasonally waterlogged sandy soils. Waterlogged conditions develop due to the very shallow water table reaching the surface during the end of the wet season, when aquifer recharge is at its highest for the year. These temporary waterlogged sand soils create unique ecological conditions for which few plant species are well adapted. Vegetation is therefore dominated by a single grass species, the pyrophytic *Imperata cylindrica*. Vegetation structure can be described as medium tall closed grasslands. Grass cover is >95% and 1 m tall.

The regular hot fires that used to maintain the vegetation structure as grassland are currently being suppressed by the relevant land managers. This is leading to a steady invasion by fire sensitive shrub species such as *Chrysanthemoides monilifera* and *Helichrysum kraussii*.

6.9.12 Plant community A7 Wetlands covered with invasive alien species

Plant community A7 Wetlands covered with invasive alien species occurs mainly in three localities on Site A: east, central and west. However, at a finer scale, this tendency of invasive alien woody plant species invading drained and drying wetlands occurs throughout the study area along the fringes of remaining wetlands. The main reasons for these invasions are altered hydrology of wetlands and their surrounding landscapes, as well as fire suppression in the study area. The vegetation structure of these wetlands used to be grasslands, sedgelands and reedbeds. Current vegetation structure can be described as dense to closed low shrublands and woodlands. Dominant species include the invasive alien woody species *Schinus terebinthifolius*, *Lantana camara* and *Casuarina equisetifolia*. The herbaceous layer contains species such as the exotics *Chromolaena odorata*, *Sesbania sesban*, *Passiflora subpeltata*, *Ricinus communis* and *Rivina humilis*.

This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, which is protected by the National Water Act (No.36 of 1998).

6.9.13 Plant community A8 Secondary woodlands and shrublands

The Secondary woodlands and shrublands plant community is a mosaic of woodland and shrubland sub-communities which have a secondary origin. The primary vegetation in these areas was removed or severely disturbed in the recent past. Secondary succession followed, resulting in early seral stages of pioneer vegetation. They include Sub-community A8.1 *Acacia kosiensis* secondary woodlands, Sub-community A8.2 Mixed *Cassuarina equisetifolia* secondary woodlands and Sub-community A8.3 *Lantana camara–Schinus terebinthifolius* secondary shrublands. The locality and distribution of the various sub-communities are wide spread wherever severe vegetation disturbances occurred. Due to the mosaic distribution and mixture of these plant sub-communities, no effort was made to map them individually, but instead they were mapped as one vegetation unit.

This vegetation unit forms part of the national vegetation type AZs 3 Subtropical Dune Thicket classified as Least threatened.

6.9.14 Sub-community A8.1 Acacia kosiensis secondary woodlands

Sub-community A8.1 Acacia kosiensis secondary woodlands are dense tall woodlands dominated by *Acacia kosiensis*. The understory of woody species range from dense impenetrable thickets of young saplings and shrubs of *Acacia kosiensis*, to sparse and open secondary grasslands. The grass layer is dominated by *Stenotaphrum secundatum*, while wetter patches are dominated by *Imperata cylindrica*. The herbaceous layer is dominated by numerous pioneer species and invasive alien species such as *Desmodium incanum*, *Helichrysum rugulosum*, *Ricinus communis* and *Rivina humilis*.

6.9.15 Sub-community A8.2 Mixed Cassuarina equisetifolia secondary woodlands

Sub-community A8.2 Mixed *Cassuarina equisetifolia* secondary woodlands occur wherever old stands of *Cassuarina equisetifolia* have been removed, but no follow-up eradication measures were taken. These woodlands are a mixture of pioneer woody species in combination with relatively young *Cassuarina equisetifolia* trees and saplings. Depending on the age of these secondary woodlands, vegetation structure may range from species poor short dense shrublands to species rich tall sparse woodlands. Invariably they are dominated by *Cassuarina equisetifolia*, often with other invasive alien species as co-dominant species, such as *Schinus terebinthifolius*, *Lantana camara* and *Casuarina equisetifolia*. The herbaceous are dominated by exotic species such as *Chromolaena odorata*, *Sesbania sesban*, *Passiflora subpeltata, Ricinus communis* and *Rivina humilis*. The grass layer is often very sparse due to needle-fall from the *Casuarina equisetifolia* trees covering the ground.

6.9.16 Sub-community A8.3 Lantana camara–Schinus terebinthifolius secondary thickets

Sub-community A8.3 *Lantana camara–Schinus terebinthifolius* secondary thickets occur in the more mesic areas of Site A. These areas are all within the early seral stages of secondary succession after major recent disturbances to the vegetation and / or the underlying soils. The vegetation structure can be described as low closed thickets, ranging between 2 and 4 m in height. The herbaceous and grass layers are generally poorly developed due to low light conditions within the understory. Dominant woody species include *Lantana camara, Schinus terebinthifolius, Psidium guajava, Chrysanthemoides monilifera* and *Trema orientalis*. The herbaceous are dominated by exotic species such as *Chromolaena odorata* and *Rivina humilis*.

6.9.17 Plant community A9 Stipagrostis zeyheri–Helichrysum kraussii secondary grasslands

Plant community A9: *Stipagrostis zeyheri–Helichrysum kraussii* secondary grasslands occur in places where sand dredged from the harbour (Begg 1978) was dumped on Site A and levelled off. These artificially created plains of marine deposits resulted in vegetation similar to some of the grasslands occurring along the first dunes along the Zululand coast. Vegetation structure can be described as short sparse bunch grasslands, with very low cover (25–40%).

Dominant species include the grass *Stipagrostis zeyheri*, the herbaceous species *Helichrysum kraussii, Carpobrotus dimidiatus* and *Ipomoea pes-caprae*. Prominent, but sparsely distributed woody species include *Passerina rigida, Acacia kosiensis* and *Eugenia capensis.*

6.9.18 Plant community A10 Seashore vegetation

Plant community A10: Seashore vegetation occurs along the southern edge of Site A, where a small artificial dune separates part of the estuary from the seawater in the harbour. This plant community is a primary pioneer vegetation type associated with newly colonised coastal dunes of Zululand. Vegetation structure can be described as a low closed herbland, with average herb and grass height of 300 mm, and a canopy cover of >75%.

This species poor community is dominant by the herbaceous species *Canavalia rosea, Carpobrotus dimidiatus, Ipomoea pes-caprae* and the grasses *Dactyloctenium aegyptium* and *Stenotaphrum secundatum*. Some sections contain stands of the shrub species *Chrysanthemoides monilifera*, while other sections have been invaded by the alien tree species *Casuarina equisetifolia*.

Currently, these strips of vegetation help to stabilise the edge of the sand mass along the southern edge of the mangrove forests of Site A. Its ecological role is therefore regarded as relatively important, even though its species richness and uniqueness is relatively low. The conservation value of this plant community is regarded as low (i.t.o. species diversity) to medium (based on ecosystem services).

6.10 PLANT COMMUNITIES OF SITE B: THE 600 SERIES AREA

Unfortunately Site B east of Urania road burnt down shortly before the field surveys were conducted. Although the major components contributing to the structure and composition of the site's vegetation could still be identified and described, many of the less common and rarer species could not be recorded. Despite this limitation, the author is confident that all sensitive habitats as well as plant communities with high conservation value were accurately recorded and delineated.

The following plant communities were identified, described and mapped within the 600 series area (Site B):

- B1 - *Avicennia marina–Bruguiera gymnorrhiza* mangrove forests
- B2 - *Ficus trichopoda–Syzygium cordatum* Swamp forests
- B3 - *Phragmites australis–Cyperus papyrus* freshwater wetlands
- B4 - *Imperata cylindrica* seasonal wetlands
- B5 - Secondary woodlands and shrublands
- B6 - Secondary grasslands

6.10.1 Plant community B1 Avicennia marina–Phragmites australis mangrove swamps

Plant community B1 *Avicennia marina–Phragmites australis* mangrove swamps cover a small sections east of Urania road within Site B. Vegetation structure can be described as tall closed woodlands with an average tree canopy cover of 50%, ranging from 20% to 60%. Tree height ranges from 3 m to 8 m depending on habitat suitability for *Avicennia marina*. No herbaceous layer was recorded within the centre of most mangrove stands, with some herbaceous cover along ecotones with other ecosystems. There is a gradual change from a *Avicennia marina* dominated salt water mangrove forest in the west, to a *Phragmites australis* dominated freshwater wetland towards the east of this map unit. The eastern section is predominantly a freshwater system, fed by surface rainwater and subsurface drainage. The western section is connected to the harbour through a steel pipe that allows tidal inflow and outflow of sea water.

Species composition within this plant community is dominated by *Avicennia marina* and *Hibiscus tiliaceus* trees, the fern *Achrostichum aureum* and the sedge species *Juncus kraussii* within the mangrove sections towards the western sections of the map unit. This freshwater section is dominated by *Phragmites australis*, *Trema orientalis*, *Bulbostylis species*, *Eleocharis limosa*, *Pycreus polystachyos*, *Berkheya setifera* and *Imperata cylindrica*.

6.10.2 Plant community B2 Ficus trichopoda–Syzygium cordatum Swamp forests

Plant community B2 *Ficus trichopoda–Syzygium cordatum* Swamp forests currently occur along the fringes of freshwater reed dominated wetlands of Site B. Historically these swamp forests occurred wider spread throughout the study area, with larger unfragmented stands. Vegetation structure can be described as medium tall closed forests with an average canopy cover of >95%, ranging from 85% to 100%. Tree height range from 6 m to 8 m depending on habitat suitability for the species involved. A poorly well-developed shrub layer was recorded, with an absent herbaceous layer in most places. The grass layer is relatively sparse due to low light conditions at the forest floor. At the time of the surveys (late dry season), very little free surface water was recorded within the swamp forests. Clear indications were recorded of extensive flooding during the wet season.

Plant species dominating the floristic composition of this plant community include the tree species *Ficus trichopoda*, *Ficus sur*, *Ficus natalensis*, Syzygium cordatum, *Bridelia micrantha*, *Hibiscus tiliaceus*, the grass species *Setaria megaphylla* and the herbaceous species *Cyclosorus interruptus*, *Microsorum scolopendrium*, *Senecio rhomboideus*, *Blechnum attenuatum* and *Stenochlaena tenuifolia*.

6.10.3 Plant community B3 Phragmites australis–Cyperus papyrus freshwater wetlands

Plant community B3 *Phragmites australis–Cyperus papyrus* freshwater wetland is restricted to the north-western section of Site B. It occupies a relatively small percentage of the surface area of the entire site. Vegetation structure can be described as a tall closed reed dominated wetland. No woody species were recorded as part of this plant community, with tall (0.75 to 3 m) reed and sedge species providing the main structure of this community. At the time of the field surveys the soils of this plant community were either inundated with water or waterlogged. Organic content of these sandy soils are very high, with peat formation in some sections.

The community is dominated by emergent species such as *Phragmites australis* and *Cyperus papyrus*, with dense stands of the wetland fern species *Cyclosorus interruptus* along the better drained fringes of the wetland. Like most wetlands, this community is relatively species poor.

6.10.4 Plant community B4 Imperata cylindrica seasonal wetlands

Plant community B4 *Imperata cylindrica* seasonal wetlands occur along the southern edge of Plant community B2 *Ficus trichopoda–Syzygium* cordatum Swamp forests and Plant community B3 *Phragmites australis–Cyperus papyrus* freshwater wetland of Site A. These seasonal wetland plant communities are the result of seasonally waterlogged sandy soils. Waterlogged conditions develop due to the very shallow water table reaching the surface during the end of the wet season, when aquifer recharge is at its highest for the year. These temporary waterlogged sand soils create unique ecological conditions for which few plant species are well adapted, such as hydrophilic plant species. Vegetation is therefore dominated by a single grass species, the *pyrophytic* and hydrophilic *Imperata cylindrica*. Vegetation structure can be described as medium tall closed grasslands. Grass cover is >95% and 1 m tall.

6.10.5 Plant community B5 Secondary woodlands and shrublands

Plant community B5: Secondary woodlands and shrublands occur east of Urania road and mostly west of Plant community B1 *Avicennia marina–Phragmites australis* mangrove swamps of Site B. The landscape associated with this map unit is high altered, disturbed and landscaped by harbour activities. Large quantities of marine and other sediments have been dumped on this map unit. The natural drainage patterns have been altered completely. All vegetation of this map unit can be regarded as secondary shrublands resulting from the total removal of the original vegetation and the total disturbance of the natural soils and wetlands.

6.10.6 Reed Swamps

Similar to the occurrence of mangroves, the presence of reed swamps was also impacted on by the development of the port.

The reed swamps consist of *Phragmites australis* (Common reed) and support a high diversity of aquatic fauna such as dragonflies and mayflies, as well as small mammals such as *Aonyx capensis* (Otter), *Atilax paludinosis* (Water mongoose) and *Otomys* spp (Water rats and birds. The reed swamps also act as sinks for pollutants such as heavy metals, which, when adsorbed into the mud that is present in these habitats, are rendered biologically unavailable (Acer, 2008).

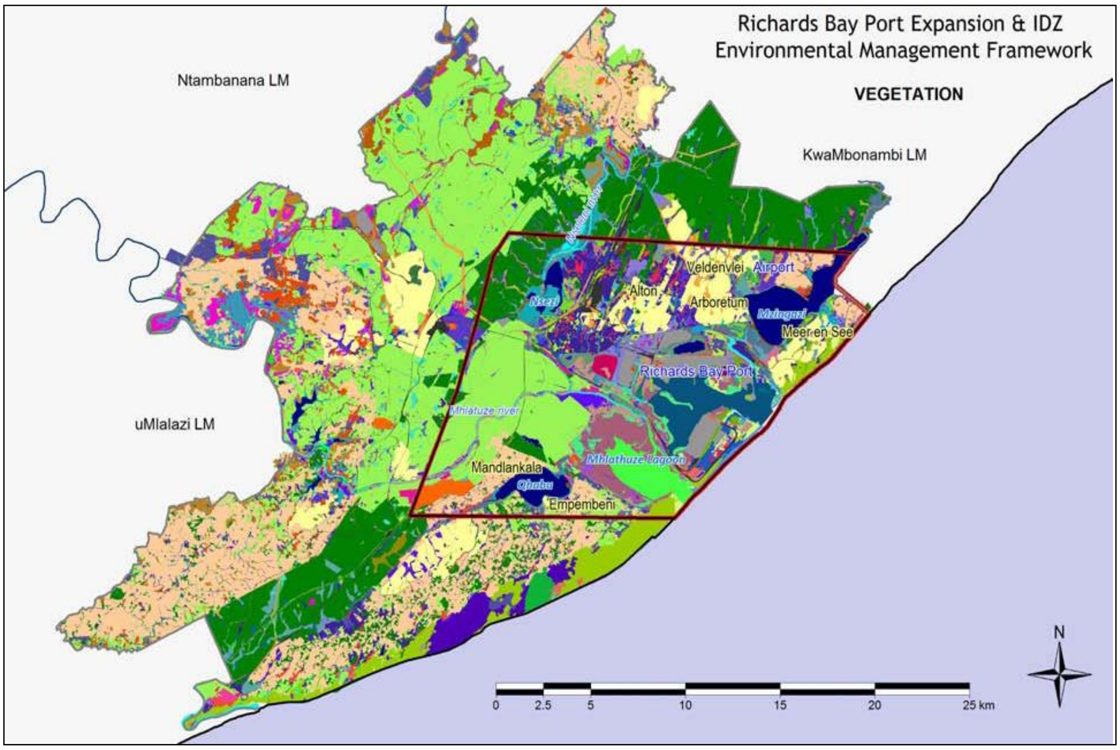
6.10.7 Undeveloped Terrestrial Habitat

The area west of the Mzingazi Canal is an undeveloped terrestrial habitat, which comprises of primary woodlands and secondary grasslands with large areas of alien species, *Casuarina equisetifolia* (Beef wood), which has also been used to stabilise the southern part of this area and sometimes surround existing mangrove communities. Although certain elements of coastal vegetation occur, invasion by alien species is common.

Any development in this area would be a green field development and would therefore increase the disturbed areas in the Richards Bay Port area.

6.10.8 Fauna and Flora

At a regional level, Richards Bay falls within the 'Maputaland-Pondoland-Albany Biodiversity Hotspot' which is recognised as the "second richest floristic region in Africa" containing approximately 80% of South Africa's remaining forests, rich bird life and many other significant flora and fauna species. A large proportion of this hotspot is being transformed and degraded by human activities, resulting in many vegetation types being vulnerable to further disturbances. The Port of Richards Bay and surrounds are situated within the Maputaland Coastal Belt vegetation type as described by Mucina and Rutherford 2006. The vegetation type is classified as Vulnerable and has a conservation target of 25%, of which 15% is contained within the iSimangaliso Wetland Park. The vegetation type is under severe pressure from development. An environmental sensitivity analysis was carried out as part of the EMF to identify areas which are more susceptible to change than others and to give an indication of the type of development control that may be needed in certain areas as illustrated in Figure 6-12.



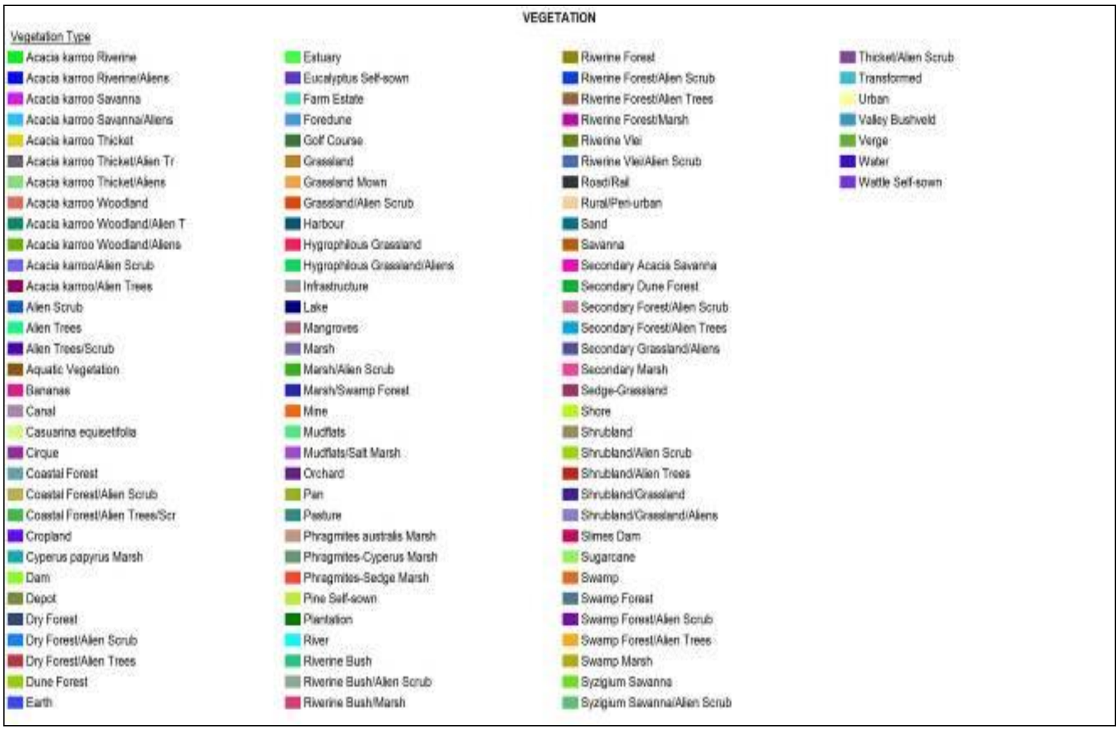


Figure 6-14: Vegetation in the study area

6.11 AVI FAUNA

6.11.1 Birds

Richards Bay has been ranked the second most important habitat for birds along the entire KwaZulu-Natal coastline, while the Thulazihleka Pan is ranked third (BirdLife International; 2009). There are 350 known species of birds in the area, and 66 internationally significant waterbird species. These species utilises the wetlands, tidal flats and sand pits in the Port Estuary and the uMhlathuze Sanctuary Estuary. The abundance of particular species in dependent in the water levels in these habitats. A total of 44 Red Data bird species have been listed for the broader municipality area (Table: 6-2: Red Listed Bird Species).

Table 6-2: Red Listed Bird Species

RED LISTED BIRD SPECIES	
RED LISTED CATEGORIES	**NUMBER LISTED**
Critically Endangered	1
Endangered	3
Vulnerable	15
Near Threatened	25
TOTAL	**44**

6.12 Terrestrial Fauna

6.12.1 Reptiles and Mammals

The study area is considered to be of significance as a bio-geographical corridor for many species. Extensive loss and fragmentation of wetlands and other habitat types in the study area has restricted population of species. Nineteen species of mammal occur in the municipal area in special habitats.

6.12.2 Frogs

Hyperolius pickersgilli is a high priority frog species (Endangered) because of its narrow distribution. It occurs in wetlands. Amphibians are good indicators for assessing ecosystem health as they are generally sensitive to environmental change.

Eleven species of reptiles are of significance in the study area, occurring in wetlands, forests and grasslands. Two of these species are classified as Vulnerable, one as Rare, while three are KwaZulu-Natal endemics and six are peripheral in South Africa, but rare.

Based on published literature Carruthers & Du Preez (2009) conducted a thorough desk top study and identified a list of 48 frog species in twenty genera that have been collected around Richards Bay. Based on predictive modelling both threatened species known from the area, mottled Shovel Nosed Frog and the Pickersgill Reed Frog could occur in the study area.

The wetland to the North of the access road will most likely sustain a population of Painted Reed frogs (*Hyperolius marmoratus*), Tinker Reed Frogs (*Hyperolius tuberilinguis*) and possibly Argus Reed Frogs (*H.* argus) but it is not the type of wetland where I would expect Pickersgill Reed Frogs. The list of frogs historically detected in the Richards Bay area, those that are likely to occur at the study site and those that have been detected at the site are listed in Table 6-3.

Table 6-3: List of frogs that have been detected in the Richards Bay area with an indication of the likeliness of finding it at the study site. (1=highly unlikely; 2=unlikely; 3=possibly; 4=most likely and 5=documented at the site)

Species	Likeliness that species will occur at the study site
Family Artrhroleptidae	
Arthroleptis	
Arthroleptis stenodactylus	2
Arthroleptis wahlbergi	5
Leptopelis	

Leptopelis mossambicus	3
Leptopelis natalensis	5
Family Breviceptidae	
Breviceps	
Breviceps adspersus	3
Breviceps mossambicus	3
Breviceps sopranus	1
Breviceps verrucosus	1
Family Bufonidae	
Amietophrynus	
Amietophrynus garmani	5
Amietophrynus gutturalis	5
Amietophrynus rangeri	4
Schismaderma	
Schismaderma carens	3
Family Hemisotidae	
Hemisus	
Hemisus guttatus	1
Hemisus martmoratus	2
Family Hyperoliidae	
Afrixalus	
Afrixalus aureus	3
Afrixalus delicates	3
Afrixalus fornasinii	3
Afrixalus spinifrons	2
Hyperolius	
Hyperolius poweri	2
Hyperolius argus	3
Hyperolius marmoratus	4
Hyperolius pickersgilli	1
Hyperolius pusillus	2
Hyperolius semidiscus	2

Hyperolius tuberilinguis	3
Kassina	
Kassina maculate	1
Kassina senegalensis	1
Family Microhylidae	
Phrynomantis	
Phrynomantis bifasciatus	1
Phrynobatrachus	
Phrynobatrachus mababiensis	2
Phrynobatrachus natalensis	2
Family Ptychadenidae	
Ptychadena anchietae	1
Ptychadena mascareniensis	1
Ptychadena mossambica	1
Ptychadena oxyrhynchus	1
Ptychadena porosissima	1
Ptychadena taenioscelis	1
Family Pipidae	
Xenopus	
Xenopus laevis	4
Family Pyxicephalidae	
Anhydrophryne	
Anhydrophryne hewitti	1
Cacosternum	
Cacosternum boettgeri	2
Cacosternum nanum	2
Cacosternum striatum	1
Amietia	
Amietia quecketti	2
Pyxicephalus	
Pyxicephalus edulis	2
Strongylopus	

Strongylopus fasciatus	2
Strongylopus grayii	2
Tomopterna	
Tomopterna cryptotis	2
Tomopterna natalensis	2
Family Rhacophoridae	
Chiromantis	
Chiromantis xerampelina	1

6.13 Marine/ Estuary Environment

6.13.1 Fish

Table 6-4 below is a list of fish species occurring in Mangrove, Sandflats and *Zosetera capenesis* environments within the study area.

Table 6-4: Species of fish at three localities within the TCP Capacity7 Expansion Option 3A

Species composition
Acanthopagrus vagus
Ambassis ambassis
Ambassis dussumieri
Amblyrhynchotes honckenii
Arothron hispidus
Gerres filamentosus
Goby Lavae
Liza dumerilli
Liza macrolepis
Lutjanus argentimaculatus
Monodactylus falciformes
Mugil cephalus
Mullet Larvae
Oreochromis mossambicus
Platycephalus indicus
Plectorhynchus gibbossus

Pomadasys commersonnii
Pseudorhombius arsius
Redigobius batteatops
Rhabdosargus sarba
Sillago sihamma
Sphyraena jello
Strongylura leiura
Terapon jarbua
Valamugil buchanani
Valamugil cunnesius
Valamugil seheli

6.13.2 Benthic

The Benthic Invertebrate Fauna associated with the proposed extension of the Finger Jetty, were identified as an important ecological component in the development of the TCP Richards Bay Harbour Expansion project. The port of Richards Bay still serves as a fully functional estuary and contains ecologically highly important habitats for aquatic fauna. Richards Bay and the Mhlathuze Estuary have been shown to offer almost the complete range of habitat types found in tidal reaches of subtropical South African estuaries and as such comprise estuarine habitat of particular regional importance (Begg 1978).

These habitats have retained much of their regional functioning, contributing importantly to the ecology of both port and nearshore marine waters. These include intertidal and shallow subtidal mudflats and sandbaks, deepwater basins and channels, reed and mangrove swamps. The port contains aquatic habitats which have been recognised as having national conservation importance (Turpie et al. 2002). The port plays an important role in the life histories of many marine fish and invertebrate. These marine fish and invertebrate species show varying degrees of dependence on estuarine habitat at some stage in their life, be it as a nursery area for juveniles of these species or as a rich feeding ground (Cyrus & Vivier 200 & MER 2013). Table 6-5 below shows a list of the zoobenthic macroinvertebrayes occurring in the Intertidal Mangroves and adjacent Intertidal Sandflats associated with the Rail Balloon Area.

Table 6-5: Zoobenthic macroinvertebrate taxa CPUE, mean CPUE per area and percentage contribution per area as recorded in the Intertidal Mangroves and Intertidal Sandflats in Richards Bay Harbour.

Taxa	Intertidal Mangroves				Intertidal Sandflats						Total CPUE	
	IM1	IM2	Mean	% Contr	ISF1	ISF2	ISF3	ISF4	Mean	% Contr	Total	% Contr
NEMERTEA						50.8		8.5	14.8	1.3	14.8	0.85
TURBULARIA		67.8	33.9	**5.6**							33.9	1.94
ANNELIDA												
Armandia intermedia					8.5			16.9	6.4	0.6	6.4	0.36
Ancistrocylis parva						110.2			27.5	2.4	27.5	1.58
Capitella capitata						8.5	8.5		4.2	0.4	4.2	0.24
Desdemona ornata	8.5	8.5	8.5	1.4							8.5	0.49
Euchone sp		8.5	4.2	0.7				8.5	2.1	0.2	6.4	0.36
Glycera subaena		25.4	12.7	2.1			8.5	25.4	8.5	0.7	21.2	1.22
Heteromastus filiformis		8.5	4.2	0.7							4.2	0.24
Lumbrinereis latrelli						8.5			2.1	0.2	2.1	0.12
Magelona cincta						50.8		16.9	16.9	1.5	16.9	0.97
Nephtyes sp					42.4		42.4	8.5	23.3	2.0	23.3	1.34
Nereid sp						16.9			4.2	0.4	4.2	0.24
Nephtys sphearocirrata						33.9		8.5	10.6	0.9	10.6	0.61
Owenia fusiformis					25.4	144.1	33.9	33.9	59.3	**5.2**	59.3	3.40
Polychaete sp1							8.5		2.1	0.2	2.1	0.12
Polychaete sp2					8.5				2.1	0.2	2.1	0.12
Polychaete sp3						8.5			2.1	0.2	2.1	0.12
Polychaete sp4						16.9			4.2	0.4	4.2	0.24
Prionospio sp							8.5		2.1	0.2	2.1	0.12
Prionospio sexoculata	8.5		4.2	0.7							4.2	0.24
Tharyx marioni	16.9	8.5	12.7	2.1							12.7	0.73
MOLLUSCA												
Dosinia hepatica	398.3	406.8	402.5	**66.4**	33.9		101.7	313.6	112.3	**9.9**	514.8	29.53
Eumarcia paupercula	25.4	76.3	50.8	**8.4**	16.9	33.9			12.7	1.1	63.6	3.65
Hiathula linulata	8.5		4.2	0.7							4.2	0.24
Assimnea ovata	50.8	8.5	29.7	**4.9**			8.5	25.4	8.5	0.7	38.1	2.19
Gastropod sp 1		8.5	4.2	0.7							4.2	0.24
CRUSTACEA												
Lyssianasidae sp					186.4	152.5			84.7	**7.4**	84.7	4.86
Cirolana sp							8.5		2.1	0.2	2.1	0.12
Ipinoe truncata	8.5	25.4	16.9	2.8		16.9		8.5	6.4	0.6	23.3	1.34
Mesopodopsis africanus							16.9	8.5	6.4	0.6	6.4	0.36
Urothoe		33.9	16.9	2.8			466.1	2381.4	711.9	**62.6**	728.8	41.80
Total CPUE	525.4	686.4	605.9		322.0	652.5	711.9	2864.4	1137.7		1743.6	
No of taxa	8	11	13		7	12	11	12	24		32	

6.13.3 Aquatic vegetation and Fish

Historically, the area that comprises Richards Bay Harbour formed part of the Richards Bay Estuary which was classified as sub-tropical estuary of the Lagoon type by Millard & Harrison (1954) who undertook the first faunal investigations of the system. They recorded large beds of *Zostera capensis* within the system, particularly near the mouth at what was known as the Mermaid's Folly. The construction of the habour in the 1970's resulted in the southern section of Richards Bay Estuary being cut off from the northern part of the system. The former now known as the Mhlathuze Estuary whilst the latter was developed into the Port of

Richards Bay (Begg 1978). Since then *Zostera capensis* has led a chequered existence within the two systems.

6.14 SOCIO ECONOMICS

6.14.1 Demographics

The study area is located in Richards Bay on the east coast of South Africa within the KwaZulu-Natal province. Richards Bay is situated in the City of uMhlathuze LM which falls under the jurisdiction of the uThungulu District Municipality (DM). Richards Bay has developed into an industrial city with several large-scale industries. The town is surrounded by agricultural activities and is interspersed with rural settlements with small-scale agriculture, much of which take places on traditional authority land. The City of uMhlathuze is strategically placed along the N2 national route, and is linked to the economic hub of South Africa, Gauteng, via railway and road, and is in close proximity to the King Shaka International Airport and the Dube Trade Port. In addition, the City of uMhlathuze is home to the largest deep-water port in Africa with an Industrial Development Zone in close proximity to the port.

6.14.2 Population

Data from the 2011 national census show that the population within the City of uMhlathuze LM is 334,459 persons. The growth rate experienced is reportedly higher than that experienced by the uThungulu DM and the province. In 2011, 67% of the population in the City of uMhlathuze LM were reported to be between the ages of 15 and 64, which is noticeably higher than the uThungulu DM and the province. An increase in the population within the ages of 15 – 64 can be seen as a positive development as it indicates that there are a higher number of people within the potentially economically active sector of the population.

6.14.3 Education

Between 2001 and 2011, there has been a significant decrease in the percentage of the population over the age of 20 within the City of uMhlathuze LM reporting no access to formal education while there has been in an increase in the percentage of this sector of the population reporting a Grade 12 level of education. Access to education in the City of uMhlathuze LM is overall better than the district and provincial averages.

6.14.4 Unemployment

Despite improvements between 2001 and 2011, unemployment within the City of uMhlathuze LM remains high at 31%. This, however, is below the level of unemployment reported for the uThungulu DM and KwaZulu-Natal, but higher than the national average.

6.14.5 Economic indicators

- ***Income and expenditure patterns***

Richards Bay had an average monthly income of R 23,130 (higher than the national, provincial and district levels) with a significantly smaller portion of households living on less than R 3,200 per month. The relatively high average income is likely attributable to the high level of industrialisation in Richards Bay.

- ***The economy and its structure***

Economic production and Gross Domestic Product per Region (GDP-R)

The GDP-R of the City of uMhlathuze LM was valued to be R 23,946 million in 2013 current prices. This is equal to a per capita GDP-R of R 70,310, which is significantly higher than the national and provincial economies. Another important indicator of the well-being of a region's economy is the rate at which it is growing. Between 2003 and 2013, the City of uMhlathuze LM's economy grew on average 3% per year. This is lower than the national CAGR of 3.4% per annum.

Sectoral employment structure

Sectoral employment patterns are similar across all sectors with the only difference being the relatively high importance of the agricultural sector in the DM; 7.19% compared with 3.89% and 4.3% in the LM and province, respectively. Within the City of uMhlathuze LM, the greatest contributor towards employment creation is the utilities sector, creating almost a quarter of employment opportunities within the local economy. The manufacturing sector; which comprises 20% of the economy, creates 7.74% of the employment opportunities within the LM's economy.

6.14.6 Access to basic services

- ***Access to water***

Access to piped water improved significantly within the City of uMhlathuze LM between 2001 and 2011, with 92% of all households reported to have access to piped water either within their household or within their yard.

- ***Access to sanitation***

Improvements to sanitation have been experienced by households throughout KwaZulu-Natal, within the uThungulu DM and within the City of uMhlathuze LM. This is evident in the reduction in the number of households without access (16% to 7% (KZN), 30% to 13% (uThungulu) and 9% to 4% (City of uMhlathuze)).

- ***Access to electricity***

Access to electricity for lighting (the most basic level of access) within the City of uMhlathuze LM is better than access on a district and provincial level. However, noticeable improvements have been seen throughout KwaZulu-Natal between 2001 and 2011.

- ***Access to healthcare***

Primary healthcare within the municipality is provided from two main clinics, one in Richards Bay and one in Empangeni, supported by satellite clinics. The main healthcare conditions reported are hypertension, diabetes and tuberculosis. Sexually transmitted infections are reported to remain a growing concern within the municipality.

6.14.7 Health & HIV/AIDS

It is difficult to estimate the population due to the HIV/AIDS pandemic. The City of uMhlathuze is one of the major provincial nodes and attracts people to employment opportunities. The update of land is also dependent on the rather uncertain impact of the HIV/Aids pandemic on the municipal population growth rate.

It is a known fact that there is a lack of clear and reliable data regarding HIV at a local municipal level. However, it is nonetheless clear that it is a very serious issue and should be incorporated into whatever strategies or developments undertaken in the study area. Typical impacts of AIDS include decreased productivity of workers, increased absenteeism and additional costs of training of new workers. It also represents a greater demand and pressure on health facilities and as the statistics gathered from antenatal clinics indicate a very real problem of AIDS orphans and child (minor) headed households. These factors must be taken cognizance of when devising local economic development strategies.

The concerns regarding the impact of HIV on uMhlathuze need to be reiterated as KwaZulu-Natal has the highest HIV prevalence rate of all the provinces. The uMhlathuze municipal clinic sets aside approximately R35 000 for provision for HIV and AIDS. The City of uMhlathuze's Clinic Services launched an HIV testing campaign as part of President Jacob Zuma's mass HIV testing campaign, which aimed to test 15 million people between April 2010 and June 2011. uMhlathuze Clinic Services encourages all people in the community to know their HIV status. The objective of the ministerial initiative was to expand access to HIV counselling, testing (HCT) and treatment.

6.14.8 Socio-Economics of the Port of Richards Bay

The Richards Bay harbour has 81 tenants. See Appendix 1 in Addendum B for more details on the types of tenants.

6.15 HERITAGE

Richards Bay is located on the north coast of KwaZulu-Natal about 180 kilometres north of Durban, on a 30 km² lagoon of the Mhlathuze River. The town began as a makeshift harbour that was set up by the Commodore of the Cape, Sir Frederick Richards during the Anglo-Zulu War of 1879. In 1935 the Richards Bay Game Sanctuary was created to protect the ecology around the lagoon and later by 1943 it expanded into the Richards Bay Park. The town was laid out on the shores of the lagoon in 1954 and proclaimed a town in 1969.

By the early 1950s, in the wake of burgeoning South African industrial expansion, the need for new port facilities had become ever more pressing. The South African Government decided in 1965 to build a deepsea harbour at Richards Bay. Construction work began 1972 and four years later, on 1 April 1976, the new harbour was opened. The residential area of Richards Bay developed north of the harbour. Meerensee, started in 1970, was the first suburb. It was followed by Arboretum in 1975 and VeldenVlei in 1980.

Richards Bay is South Africa's premier bulk port. The port occupies 2157 ha of land and 1495 ha of water area at present. The port has become a popular call for international cruise ships because of the close proximity to game parks and the iSimangaliso Lucia World Heritage Site.

The formally protected landscape of the Richards Bay Nature Reserve is located on the northern banks of the Mhlatuze River Estuary. The nature reserve is located south of the proposed development and it is a proclaimed Nature Reserve.

6.15.1 Palaeontological Sites

The significance of the palaeontological content of the study area has been highlighted recently. The St Lucia Fm. is known to be exceptionally rich in high – quality fossils. The study area is located in the region where unique fossils like mammalian or cephalopod remains were found, or can be found once development starts.

In the area around and south of Richards Bay, the Neogene sediments generally include the Holocence KwaMbonambi formation, Middle to late Pleistocene Kosi Bay and Isispingo formations, Early – Middle Pleistocene Port Durnford Formation, Early Pliocene Umkwelane Formation and Miocene Uloa Formation (see Figure 6-15 below). The Uloa Fm. lies below the Richards Bay coastal plain (Roberts *et al.*, 2006). The deposits of the Port Durnford Formation are exposed in outcrops along the shoreline.

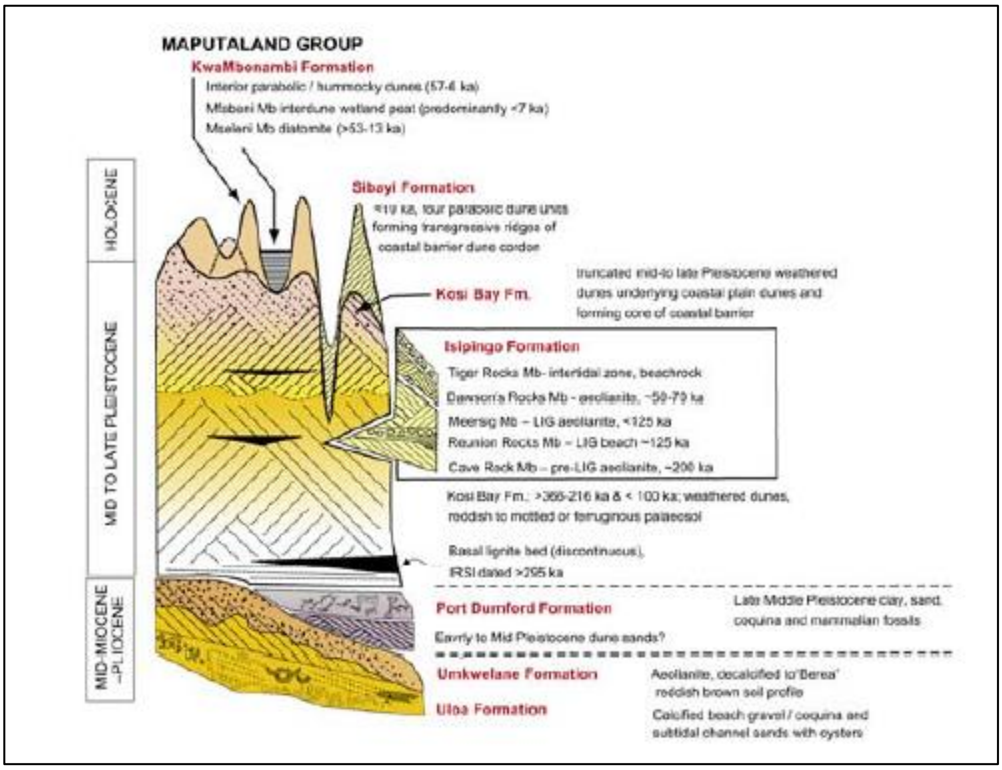


Figure 6-15: Schematic representation of the Maputalnd Group lithostratigraphic units. Not to Scale. (Porat & Botha, 2008)

6.16 DREDGE DISPOSAL

The assessment of the potential environmental impacts associated with the proposed capital dredging required that:

- The suitability of sediments for potential (offshore) disposal needs to be assessed against accepted sediment quality guidelines;
- The potential impacts of dredging and dredge spoil disposal activities need to be predicted and assessed. The primary concern is the potential environmental impacts associated with the elevation of water column turbidity and potential inundation/smothering effects on benthic biota, however other potential effects such as aesthetic and noise impacts also need to be assessed;
- The potential impacts of offshore dredge spoil disposal activities on offshore ecosystems and the adjacent shoreline be assessed and, where relevant, mitigation measures introduced.

The assessment of the quality of sediments to be dredged has been undertaken in a companion report (CSIR, 2013a). This information has been used to screen dredge spoil disposal options as well as inform this dredging and dredge spoil disposal modelling study. The requisite baseline reports on the water quality (CSIR, 2013b) and specifically the water column turbidity (CSIR, 2013c) observed in the port in its present layout have been produced and provide a context for this modelling study.

This specialist study comprises a specialist modelling study to inform the assessment of the potential environmental impacts associated with dredging and dredge spoil disposal activities and is focussed on the prediction of potential turbidity, smothering and shoreline impacts associated with dredging and dredge spoil disposal activities.

The assessment of water quality and smothering impacts has been achieved by the set-up and calibration of a three dimensional model that is then used to predict the extent, severity and duration of changes in turbidity, water quality and smothering associated with dredging and dredge spoil disposal activities. Specifically, this requires a characterisation of the extent of dispersal of dredge spoil from the proposed offshore dredge spoil disposal site. The model results are summarised in terms of exceedance of dredging (water quality) guidelines as well as and other relevant guidelines that have been determined in consultation with other specialists assessing potential impacts in the marine environment.

6.17 TURBIDITY MODELLING

The objective of the modelling is to simulate the transport and fate of the predominantly the fine component of the dredged material, both at the site of dredging inside the port and at the dredge spoil disposal site. Accordingly the model needs to account for the following dominant physical processes:

- Refraction of deepwater waves to determine the wave conditions throughout the model domain, particularly at the dredge spoil disposal site and in the surf zone;
- Generation of wind-waves inside the port and the estuary;
- The effect of waves on currents via forcing, enhanced turbulence and enhanced bed shear stress;
- Generation of tidal currents in the port and in the estuary;
- Generation of wind-driven currents in the port, estuary and offshore;
- Vertical mixing processes and possibly water column stratification;
- The introduction of a source of suspended sediment and the advection-dispersion of the resulting turbid plume;
- The settling-deposition-resuspension of the sediment particles and the evolution of the dredge spoil mound over time.

All these processes are accounted for by the relevant models forming part of the DELFT3D modelling system, developed by WL|Delft Hydraulics in the Netherlands. These comprise the wave model (DELFT3D-WAVE), the hydrodynamic model (DELFTD-FLOW) and the suspended sediment model (DELFT3D-SED), as described below.

The core of the modelling has been undertaken using the DELFT3D-SED model that comprises an extended capability of the DELFT3D-FLOW model. The DELFT3D-SED model can be run in two modes. The first mode is one where there is no feedback between the hydrodynamics and the evolving seabed. The second mode is one where there is feedback between the changes in the seabed and the hydrodynamics. In the present study that is focussed on the transport and fate of the fine dredge spoil only, DELFT3D-SED is used without feedback from the changes in the seabed.

6.18 EXISTING AND PROPOSED NEW INFRASTRUCTURE

A brief description of the existing port infrastructure and layout is provided below, followed by a more detailed description of the proposed new infrastructure and associated changed layout(s) for development Option 3A.

6.18.1 Existing Infrastructure

The existing catchment drains into two major systems; the one catchment includes everything south of the rail yard, draining into a pipe network, directly into the sea, while the other system drains everything north of and including the rail yard up to the port boundary, into a channel that discharges into the sea (Refer to Figure 6-14).

The existing pipes that discharge runoff into the sea range from 1050 mm to 1350 mm diameter concrete pipes. The channel north of the Bayview Yard is lined with armorflex and has a bottom width of approximately 2.75 m, a depth of 2.7 m and side slopes of 1:2.3. This channel is built to accommodate a 1:50 year storm event and with reference to as-built information, has almost no longitudinal slope. The underground drainage system is approximately 3 m under sea level where it discharges into the marine environment.

Figure 6-14: Storm water as-built and flow directions

The layout of the existing Port of Richards Bay is as indicated in Figure 6-14 below. The entrance channel is maintained to a depth -23.9 m CD offshore of the breakwaters, -21.9 m CD just inshore of the breakwaters and -19.4 m CD along most of the entrance channel. The main basin areas of the port (bulk cargo quay and the bulk coal quay) are maintained at a depth of -18.9 m CD. The smaller basins, Inner Basins 1 and 2 (Figure 6-14) are maintained at depths of -14.4 m CD and -14.6 m CD, respectively. The small craft harbour and the approach channel and reclamation berth near the port entrance are maintained to a depth of -7.9 m CD.

An extended sandspit separates these inner basins from a shallow mudflat area to the south. The mudflats depths typically range between 0.2 and 0.5 m CD, deepening to approximately -1.5 m CD on the eastern edge of the mudflat towards the Richards Bay Coal Terminal Basin.

North of the entrance channel lies the repair quay, the small craft harbour and the dredger berth just inside the port entrance. To the south of the entrance channel lies a changing shoreline along which has been built a number of stabilising structures and groins to protect existing infrastructure (roads, *etc*). The ecologically important Echwebeni Natural Heritage site is located adjacent to the Richards Bay Coal Terminal on the southern side of the inner extremity of the entrance channel (see Figure 6-14).

Figure 6-14: The existing layout of the Port of Richards Bay (Source: GoogleEarth, 2015).

6.18.2 Proposed New Infrastructure

➢ **Hydraulic Infrastructure**

The proposed storm water solution for the site is to prevent further dirty water discharge into the marine environment as well as to accommodate proposed and future expansion within the port boundary. Refer to drawings:

- 4653710-0-000-C-LA-0040-01 to -06 (Proposed Stormwater Layout Option 3A)
- 4653710-0-000-C-LA-0006 (Typical Channel Details)
- 4653710-0-000-C-DE-0001 Sheet 1 and 2 (Typical Sump Details)
- 4653710-0-000-G-PF-0003 (Industrial Water System, PFD's)

➢ **Conduits: Culverts, Drains and Channels**

General Drainage

A surface drainage system is proposed to catch and convey the 10 mm first flush generated by each catchment. Concrete trapezoidal channels with side slopes of 1:1.5 are proposed to cut the dirty water off and convey it to a collection sump (refer to section 9.7.2.3). Due to the flat area a required minimum slope of 0.4% will not suffice. It was necessary to implement a lesser slope of 0.3% to ensure that the channel depths that reach the sumps do not increase to an insufficient level. The overall channel depths range from 0.15 m to 0.6 m deep.

In the occurrence of a single rainfall event of more than 10 mm precipitation, the dirty water will first be contained and pumped to the surge dam (refer to Bulk Earthworks, Buildings, Utilities and Associated Infrastructure Report 14 January 2013 4653710-RPT-0071 FEL2 Bulk Earth Build Utilities Associated Infrastructure), while any excess runoff thereafter is assumed to be clean which can overflow into a 1:2 year storm water system that discharges into the sea. Runoff greater than a 1:2 year storm event will not be accommodated by the proposed underground pipe or channel system.

- **Bayview Yard**

The existing channel north of the Bayview yard poses a major clash with regards to the expansion of the proposed rail infrastructure. With reference to the Stormwater Masterplan for Bayview and Southdunes, May 2007, the 2 592m channel needs to convey a 1:50 year storm event. The channel will be lined with armorflex with a bottom width of 2.75 m, a depth of 5 m and side slopes of 1:2.3. Runoff within the rail yard currently drains into an underground system that discharges into this channel. It will be necessary to extend these 600 mm dia. outlet pipes to connect with the new channel. Refer to DWG 4653710-0-000-C-LA-0006 for channel details.

The option to replace the armorflex-lined channel with a concrete lined channel was investigated. A cost estimate of the two options indicate that the concrete lined option will cost R 72mil compared to R 27mil for the armorflex option. This is a 166% increase in construction cost, which seems to be an unfeasible option.

The reconstructed channel will intercept flow from the west and east and discharge dirty runoff into collection sumps (refer to section 9.7.2.3) which will be pumped into the surge dam. Any excess runoff above the 10 mm first flush will be conveyed via the channel and discharged into the sea as it currently does.

Culverts will be extended at the far west side of the extended rail crossing. Four box culverts of 3.6 m x 3 m should be incorporated at a length of 30 m. It is advised that these culverts be cast in situ as the construction rate for precast is considerably more due to transportation costs involved. Refer to DWG 4653710-0-000-C-LA-0040-01.

- **Collection Sumps**

After the dirty runoff for a catchment has been collected, it is conveyed via a channel system that discharges the dirty water into a collection sump. A submersible pump, pumps the dirty runoff into a surge dam within 24 hours. Any excess runoff above the 10 mm first flush will overflow from the sump into a minor drainage system and discharge into the sea.

A total of 36 sumps are proposed with capacities ranging from 322 m³ to 6 383 m³. The sumps are reinforced concrete covered with a mentis grid. To be able to contain these volumes and with the limited space available, the sump depths range between 5 m to 8 m deep. Refer to DWG 4653710-0-000-C-DE-0001 for a typical sump detail and DWG 4653710-0-000-G-PF-0003 for the process flow diagrams to see which catchment flows into which sump.

- **Storm Water Surge Dam**

6.18.3 Spatial Design

The first most important factor to consider when designing a dam is to find the required space. According to Regulation 704, a 1:50 year storm should be attenuated on site, which turned out to be a major obstacle in FEL-1. After re-evaluating the design criteria, it was concluded that the surge dam should at least have enough capacity to attenuate ten 10 mm first flush events. This amounts to 100 mm precipitation over the entire dirty catchment area.

The best available location for the surge dam is within the rail balloon. The dam is 5 m deep and has a capacity of 610 000 m³. Subsoil drains are located under the dam to detect any leakage and the floor slab and side slopes are lined with protective liners as shown in DWG 4653710-0-000-C-LA-0040-04. A 6 m wide silt trap with two overflows is proposed in front of the surge dam to catch most of the incoming silt in the water. After the silt has settled in the silt traps, the cleaner water can overflow into the surge dam to be pumped to a treatment plant.

Seeing that the dam cannot contain a 1:50 year storm it raises a potential flooding risk within the rail balloon. Thus, six 1.5 m x 0.6 m culverts are proposed under the rail to ensure that the rail balloon does not flood in major storm events.

- **Buildings**

With the expanded operations, the port terminal would require additional buildings to house various services, as well as refurbishment and removal of existing buildings. Refer to Table 6-3 for a summary of the new buildings required, as well as the existing buildings that will be impacted by the Port Expansion Project.

Table 6-3: New and Existing Buildings

New Buildings	Existing Buildings
Access Gate House	Bulk Steel and Cargo Warehouses 1 -4

Western Security Gate House	Rail Bulk Materials Load and Off-load Shelter
Stock yard Control / Electrical Room	Bulk Paper Store
Tippler Control Electrical Room	Bulk Store Offices
Generator Room	LDV and Maintenance Workshops
UC 2 Substation Building (Medium Layout)	Occupational Health Facility
UC 3 Substation Building (Large Layout)	Canteen and Dining Building
Tippler 1 Substation Building	CPO Control Room
Tippler 2 Substation Building	Existing Substation
RBPE Substations 01 -08	LDV Maintenance Workshop
	Contractor Offices 1 -3

- **Waste Disposal Bin/Receptacles**

Different types of waste containers are used on site for handling and disposal of waste:

- Skips;
- Drums;
- Liquid Bins; and
- Tubes for hazardous chemicals/ liquid waste.

Skips are available on site to dispose scrap metal for metal recycling

Figure 6-16: Skips placed at selective points in the port.

Figure 6-17: Empty Oil Drums.

Figure 6-18: Hazardous Waste Bins.

Figure 6-19: Skip placed next to the cargo line

6.19 LOGISTICS

6.19.1 Ship Loading

Most dry bulk cargoes are dusty and therefore a potential of wind-borne dust pollution. They can easily be blown by wind over a long distance from the immediate vicinity of loading. The dust from different dry commodities settles and creates different waste streams.

6.19.2 Ship Off-loading

Discharging of bulk cargo from vessels is a complex task as it raises a variety of environmental concerns which include dust pollution, cargo spillage, high energy consumption and unacceptable high levels of noise. Waste streams are generated from the dust pollution when it settles and cargo spillages. At Berth 609 a new pneumatic ship un-loader is used at the port. It is developed to enhance the environment.

Figure 6-20: Ship Loading

Figure 6-21: Ship Off-loading

7 SUMMARY OF SPECIALIST STUDIES

7.1 INTRODUCTION

The methodologies for the specialist studies undertaken are presented below under the relevant headings. The results of the various studies are presented and the implications considered, along with presentation of the mitigation measures proposed (where required and viable).

The following specialist studies have been included in the EIA Phase:

a) Vegetation and Wetland Assessment by THC Mostert from CRUZ-E Consultants (**Error! Reference source not found.**).
b) Bird Fauna of Priority Habitats by DP Cyrus from CRUZ-E Consultants (Appendix 4-2).
c) Frog fauna Assessment by LH du Preez from CRUZ-E Consultants (Appendix 4-3).
d) Fish and Benthic Inverts – Intertidal Mangroves and Sandflats by L Vivier and DP Cyrus from CRUZ-E Consultants (Appendix 4-4).
e) Macrobenthic Fauna – Finger Jetty by L Vivier and DP Cyrus from CRUZ-E Consultants (Appendix 8).
f) Aquatic Vegetation and Fish – Berth 600 Extension by DP Cyrus and L Vivier from CRUZ-E Consultants (Error! Reference source not found.).
g) Air Quality Assessment by Simon Gear from Kijani Green (Appendix 9).
h) Noise Impact Assessment by Mornè de Jager from Enviro-Acoustic Research CC. (**Error! Reference source not found.**).
i) Paleontological Assessment by Umlando: Archaeological Tourism and Resource Management (Appendix 7).
j) Turbidity Modelling Study by Mr Roy van Ballegooyen from the CSIR (Appendix 8).
k) Socio Economic Assessment by Acer Africa (Appendix 9).

7.2 VEGETATION AND WETLAND ASSESSMENT

A vegetation assessment and wetland delineation of the remaining natural ecosystem of the Rail Balloon/Casuarinas area and the 600 series area was carried out by THC Mostert of Karos Environmental Services CC and was sub-commissioned by CRUZ Environmental in November 2014. The specialist study is presented in Appendix 4-1.

The study is aimed at providing, through a once off sampling in spring 2014, an assessment of the ecological importance and status of terrestrial and wetland vegetation in view of the proposed expansion of the Port of Richards Bay.

The study is aimed at providing, through a once-off sampling in the spring of 2014, an assessment of the ecological importance and status of terrestrial and wetland vegetation in view of the proposed expansion of the Port of Richards Bay.

7.2.1 Methods

Schamineé et al. (1995) emphasized the importance of standardized sampling and data analysis for comparative reasons. According to Werger (1974), the following are important requirements to be fulfilled by any ecological classification method concerning total floristic composition:

- The method should be scientifically sound.
- It should fulfil the necessity of classification at an appropriate level or scale.
- It should be efficient and versatile amongst comparable approaches.

For these reasons, it was decided to use the Braun-Blanquet method (Braun-Blanquet 1932; Werger 1973; Mueller-Dombois & Ellenberg 1974; Westhoff and Van Der Maarel 1978) in order to classify and describe the vegetation of the study area.

7.2.1.1 PHASE 1 – DESKTOP & LITERATURE REVIEW

During this phase, the specialists involved updated their existing knowledge of the area, using available scientific and popular literature, available datasets from government and academic institutions, the Internet and their extensive network, to ensure that they are aware, which are the current species of concern in terms of international, national and provincial legislation. This information was then used to create a profile of the species of concern with regards to their habitat preference and known areas of distribution. Once the profiles had been generated, this information was used to populate the landscape model derived from small scale datasets with a maximum scale resolution of 1: 50 000 and a pixel or grain resolution of 100 m. using this information a sensitivity map was created for all plant species and vegetation types of conservation concern. The following small-scale data sets were used:

- Geology – 1: 250 000 scale, Council for Geoscience
- Landforms – 1: 250 000 scale, SANBI, BGIS
- Land types (soil properties) – 1: 250 000 scale, Institute for Soil, Climate & Water
- Regional vegetation – 1: 250 000 scale, VEGMAP – SANBI
- Wetlands – 1: 250 000, National Wetland Inventory – SANBI, BGIS
- Land Cover – 1: 50 000 scale: 1995, 2000, 2009 – CSIR, DEA, SANBI
- Topocadastral – 1: 50 000 scale, Surveyor – General

- EKZNW SEA GIS Datasets (MinSet)

The vegetation of the study area was stratified into homogeneous physiographic–physiognomic units, using aerial photographs (scale 1: 10 000), as well as maps on the topography, geology, soils and Land Types of the study area. Sample plots were placed within each of these stratified units in such a way that habitat was as uniform as possible within each vegetation stand.

7.2.1.2 PHASE 2 – FIELDWORK AND DATA COLLECTION

Due to the nature and scale of this study, all emphasis was kept on plants, plant communities and ecosystems, with special emphasis on wetland ecosystems. Data were therefore gathered at landscape and ecosystem scale in order to aid in the description and identification of plant communities and ecosystems of concern. Site A was visited on 25 September, 27 September and 4 October, while Site B was visited on 30 September.

The vegetation structure at each plot was described according to the structural classification system of Edwards (1983). All releves are stored in the TURBOVEG database (Hennekens 1996) and managed by the Department of Botany, University of Zululand. The taxon names of identified species conform to those of Germishuizen & Meyer (2003) as well as updates from SANBI. Environmental data include soil type, aspect, slope, surface rock cover and disturbance to the soil and vegetation.

The cover-abundance for every species present in a sample plot was assessed according to the Braun-Blanquet cover-abundance scale (Werger 1974, Mueller-Dombois & Ellenberg 1974):

- Very rare and with a negligible cover (usually a single individual).
- Present but not abundant, with a small cover value (<1% of the quadrat).
- Numerous but covering less than 1% of the quadrat, or not so abundant but covering 1–5% of the quadrat.
- Covering between 5–12% of the quadrat, independent of abundance.
- Covering between 13–25% of the quadrat, independent of abundance.
- Covering 25–50% of the quadrat area, independent of abundance.
- Covering 50–75% of the quadrat area, independent of abundance.
- Covering 75–100 % of the quadrat area, independent of abundance.

Due to the small sample size of releves per phytososiological unit obtained in this study, no formal numeric classifications or ordinations were attempted. Instead, all the releves of a given map unit were converted to a synreleve. The synreleves were then used to aid with the floristic descriptions of each plant community. The resulting vegetation units were mapped and described based on their floristic composition, structural composition, ecological functionality and integrity.

A list of red data plant species for the study area and its surroundings was obtained from the South African Biodiversity Institute (SANBI). This list, as well as other listed plants protected and regulated under various provincial ordinances, was used to create a priority species list for the study area.

As stated earlier in this document, the study area is divided into two areas, namely the Rail Balloon/Casuarinas area (Figure 1.2) and the 600 Series area (Figure 1.3) as stipulated by Transnet Capital Projects (TCP). These two areas are referred to as Site A and Site B respectively throughout this document. For clarity and ease of interpretation by the reader, the plant communities of each site will be discussed separately, even when some communities may occur on both Site A and Site B.

7.2.2 Findings

The following plant communities were identified, described and mapped within the Rail Balloon/Casuarinas area (Site A):

7.2.3 Plant community A1 Avicennia marina–Bruguiera gymnorrhiza mangrove forests

Disturbances recorded within this plant community included illegal cutting of *Avicennia marina* and *Bruguiera gymnorrhiza* trees, artificial changes to the natural hydrology of the mangroves and surrounding landscape, siltation, illegal gill net fishing operations, oil pollution and plastic pollution. Very few invasive alien species were noted within this plant community, probably due to the specialised nature of these ecosystems. A number of recently used hippopotamus paths were recorded throughout the area.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type FOa 3 Mangrove Forests classified as Critically Endangered. Although the *Avicennia marina–Bruguiera gymnorrhiza* mangrove forest plant community is relatively species poor with low species diversity levels, it is a highly specialised ecosystem with extremely high functionality value within the surrounding landscape. The low species diversity and richness recorded within the study area is normal for mangrove forests.

7.2.4 Plant community A2 Ficus trichopoda–Syzygium cordatum Swamp forests

Disturbances recorded within this plant community included illegal planting of subsistence crops such as *Colocasia esculenta*, illegal cutting of trees, invasive alien plant species such as *Psidium guajava, Schinus terebinthifolius, Washingtonia robusta, Chromolaena odorata, Casuarina equisetifolia,* historical plantations and stands of *Casuarina equisetifolia*, artificial changes in the drainage of the landscape. Many of the original stands of *Casuarina* *equisetifolia* have been removed over time, but due to the lack of rehabilitation some of these areas have now become heavily invaded by alien plant species.

Ecosystem functionality is still relatively high. The conservation value of this plant community is therefore regarded as very high. It is highly recommended that this plant community be cleared of all invasive alien species and protected against the disturbances listed above. Special efforts should be made to restore original drainage patterns and to allow stagnant swamp areas to form and persist on site.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type FOa 2 Swamp Forest classified as Critically Endangered.

7.2.5 Plant community A3 Phragmites australis–Cyperus papyrus freshwater wetlands

Disturbances recorded include invasion by the alien species *Schinus terebinthifolius* along the fringes of the wetland. It is recommended that this species be removed from the study area, and that subsequent resprouting and reinfestation be controlled. The surrounding roads and railways have altered the natural drainage into this wetland slightly. It is recommended that drainage culverts be installed and maintained to insure the free influx of surface and subsurface water into the wetland.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, with is protected under the NWA.

7.2.6 Plant community A4 Juncus krausii–Phragmites australis brackish wetlands

Disturbances recorded during the site visits include cutting of *Juncus krausii* by local communities for the weaving industry, numerous foot paths to and from fishnets and wood harvesting sites within the mangroves, pollution from littering by people passing through, as well as artificial changes to the natural drainage patterns of the landscape directly to the north. Historically planted stands of *Casuarina equisetifolia* have mostly been cut down, but subsequent germination and resprouting cause persistent problems for the natural drainage of the landscape and its wetlands. The surrounding roads and railways have altered the natural drainage into this wetland slightly. It is recommended that drainage culverts be installed and maintained to insure the free influx of surface and subsurface water into the wetland.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type AZe 3 Subtropical Estuarine Salt Marshes

7.2.7 Plant community A5 Salt pans

Disturbances recorded on the salt pans during the site visits include motor vehicle tracks and illegal cutting of mangrove species along the ecotone. This vegetation unit forms part of the national vegetation type AZe 3 Subtropical Estuarine Salt marshes classified as Least threatened.

7.2.8 Plant community A6 Imperata cylindrica seasonal wetlands

The regular hot fires that used to maintain the vegetation structure as a grassland are currently being suppressed by the uMhlatuze Municipality. This is leading to a steady invasion by fire sensitive shrub species such as *Chrysanthemoides monilifera* and *Helichrysum kraussii*. It is highly recommended that these grasslands be treated with hot burns in order to suppress bush encroachment and thickening. Invasive alien species such as *Schinus terebinthifolius*, *Psidium guajava, Lantana camara, Chromolaena odorata* and *Pinus* species are becoming a serious threat to these seasonal wetlands and should be eradicated and controlled. Other disturbances recorded during the site visits include rubble dumping and rubbish dumping. The surrounding roads and railways have altered the natural drainage into this wetland slightly. It is recommended that drainage culverts be installed and maintained to insure the free influx of surface and subsurface water into the wetland.

These stands of extremely dense stands of grass create habitat for many rodent and bird species (such as the Vulnerable African Grass-Owl). Based on its classification as a wetland and the relatively high ecosystem integrity and functionality, as well as providing habitat for many animals, the conservation value of this plant community should be regarded as high. This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, which is protected by the National Water Act.

7.2.9 Plant community A7 Wetlands covered with invasive alien species

Wetlands covered with invasive alien species occur mainly in three localities on Site A: east, central and west. However, at finer scale, this tendency of invasive alien woody plant species invading drained and drying wetlands occurs throughout the study area along the fringes of remaining wetlands. The main reasons for these invasions are altered hydrology of wetlands and their surrounding landscapes, as well as fire suppression in the study area. The vegetation structure of these wetlands used to be grasslands, sedge lands and reed beds.

This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, which is protected by the National Water Act.

7.2.10 Plant community A8 Secondary woodlands and shrub lands

The Secondary woodlands and shrub lands plant community is a mosaic of woodland and shrub land sub-communities which have a secondary origin. The primary vegetation in these areas was removed or severely disturbed in the recent past. Secondary succession followed, resulting in early seral stages of pioneer vegetation. The locality and distribution of the various sub-communities are widespread wherever severe vegetation disturbances occurred. Due to the mosaic distribution and mixture of these plant sub-communities, no effort was made to map them individually, but instead they were mapped as one vegetation unit.

This vegetation unit forms part of the national vegetation type AZs 3 Subtropical Dune Thicket classified as Least threatened.

7.2.11 Plant community A9 Stipagrostis zeyheri–Helichrysum kraussii secondary grasslands

Stipagrostis zeyheri–Helichrysum kraussii secondary grasslands occur in places where sand dredged from the harbour was dumped on Site A and levelled off. These artificially created plains of marine deposits resulted in vegetation similar to some of the grasslands occurring along the first dunes along the Zululand coast. Vegetation structure can be described as short sparse bunch grasslands, with very low cover (25–40%). Species richness and diversity is relatively low.

Due to its artificial nature and secondary status, the conservation value of this plant community is regarded as low. Some areas have been invaded by the alien species *Casuarina equisetifolia*. Before transformation, this vegetation unit used to form part of the national vegetation type CB 1 Maputaland Coastal Belt classified as Vulnerable.

7.2.12 Plant community A10 Seashore vegetation

Seashore vegetation occurs along the southern edge of Site A, where a small artificial dune separates part of the estuary from the seawater in the harbour.

Currently, these strips of vegetation help to stabilise the edge of the sand mass along the southern edge of the mangrove forests of Site A. Its ecological role is therefore regarded as relatively important, even though its species richness and uniqueness is relatively low. The conservation value of this plant community is regarded as low (i.t.o. species diversity) to medium (based on ecosystem services).

Disturbances recorded during the field surveys include invasive alien species such as *Casuarina equisetifolia*, vehicle tracks and clearings made by fishermen. This vegetation unit forms part of the national vegetation type AZd 4 Subtropical Seashore Vegetation classified as Least threatened.

7.3 PLANT COMMUNITIES OF SITE B: THE 600 SERIES AREA

Unfortunately Site B east of Urania road burnt down shortly before the field surveys were conducted. Although the major components contributing to the structure and composition of the site's vegetation could still be identified and described, many of the less common and rarer species could not be recorded. Despite this limitation, the specialist is confident that all sensitive habitats as well as plant communities with high conservation value were accurately recorded and delineated.

7.3.1 Plant community B1 Avicennia marina–Phragmites australis mangrove swamps

Disturbances recorded within this plant community included severe artificial changes to the landscape and natural hydrology of the landscape

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This specific area contains large numbers of juvenile fish and seems to be an important nursery area for fish populations of the bay. This vegetation unit forms part of the national vegetation type FOa 3 Mangrove Forests classified as Critically Endangered.

- ***Significant Result***

A special note for this ecosystem is the incidental find of a *Zostera capensis* population within permanently inundated sections of Plant community B1 *Avicennia marina–Phragmites australis* mangrove swamps at 28° 47’ 31.39” S and 32° 01’ 29.99” E. This seagrass species (Cape Eelgrass) is classified by the IUCN as vulnerable to extinction and has not been recorded within the Richards Bay Harbour for three decades (AECOM 2014). Extensive seagrass beds were recorded in the Richards Bay estuary system during the early estuarine surveys of the 1940’s (Millard and Harrison 1954). These surveys reported that these habitats supported a rich diversity of marine and estuarine fauna and were believed to be vital to the nursery function of the estuary.

Zostera capensis is a more temperate species that extends into a tropical zone. In South Africa, *Z. capensis* occurs in 17 estuaries in southeast South Africa Coast. The population is severely fragmented and there is also a continuing decline in habitat quality. Major threats are coastal development, flooding, sedimentation and pollution as well as destructive shellfish harvesting for bivalves (Green and Short 2003). Although it is fast growing, it does not colonize quickly. This species has a fluctuating population. The area of occupancy is less than 2 000 km² and therefore meets the threshold for criterion B2 and is therefore listed as Vulnerable.

7.3.2 Plant community B2 Ficus trichopoda–Syzygium cordatum Swamp forests

Disturbances recorded within this plant community included invasive alien plant species such as *Psidium guajava, Schinus terebinthifolius, Washingtonia robusta, Chromolaena odorata, Casuarina equisetifolia,* and artificial changes in the drainage of the landscape.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. It is highly recommended that this plant community be cleared of all invasive alien species and protected against the disturbances listed above.

Special efforts should be made to restore original drainage patterns and to allow stagnant swamp areas to form and persist on site.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type FOa 2 Swamp Forest classified as Critically Endangered

7.3.3 Plant community B3 Phragmites australis–Cyperus papyrus freshwater wetlands

Disturbances recorded include invasion by the alien species *Schinus terebinthifolius* along the fringes of the wetland. It is recommended that this species be removed from the study area, and that subsequent resprouting and reinfestation be controlled. The surrounding embankments, roads and railways have altered the natural drainage into this wetland slightly. It is recommended that drainage culverts be installed and maintained to insure the free influx of surface and subsurface water into the wetland across human made embankments and infrastructure.

Ecosystem functionality is still very high. The conservation value of this plant community is therefore regarded as very high. This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, which is protected by the National Water Act.

7.3.4 Plant community B4 Imperata cylindrica seasonal wetlands

The regular hot fires that used to maintain the vegetation structure as a grassland are currently being suppressed. This is leading to a steady invasion by fire sensitive shrub species such as *Chrysanthemoides monilifera* and *Helichrysum kraussii*. It is highly recommended that these grasslands be treated with hot burns in order to suppress bush encroachment and thickening. Invasive alien species such as *Schinus terebinthifolius*, *Psidium guajava, Lantana camara* and *Chromolaena odorata* are becoming a serious threat to these seasonal wetlands and should be eradicated and controlled. Other disturbances recorded during the site visits include historical dumping of marine sediments from dredging operations in the harbour. Such dumping and some roads and railways have altered the natural drainage into this wetland dramatically.

These stands of extremely dense stands of grass create habitat for many rodent and bird species (such as the Vulnerable African Grass-Owl). Three different family groups of Banded Mongoose were counted, each more than 15 family members strong. Based on its classification as a wetland and the relatively high ecosystem integrity and functionality, as well as providing habitat for many animals, the conservation value of this plant community should be regarded as high. This vegetation unit forms part of the national vegetation type AZf 6 Subtropical Freshwater Wetlands, which is protected by the National Water Act.

7.3.5 Plant community B5 Secondary woodlands and shrublands

Disturbances include the above mentioned landscape alterations and a relatively severe invasion by invasive alien species. It is recommended that these species be eradicated and controlled as stipulated by law. Before transformation, this vegetation unit used to form part of the national vegetation type CB 1 Maputaland Coastal Belt classified as Vulnerable.

7.3.6 Plant community B6: Secondary grasslands

Sub-community B6.1 *Stipagrostis zeyheri–Helichrysum kraussii* secondary grasslands

Due to its artificial nature and secondary status, the conservation value of this plant community is regarded as low. Before transformation, this vegetation unit used to form part of the national vegetation type CB 1 Maputaland Coastal Belt classified as Vulnerable.

Sub-community B6.2 *Cynodon nlemfuensis* secondary grasslands

Disturbances recorded during the site visit include the above mentioned soil disturbances, as well as a steady invasion by the invasive alien species *Lantana camara*. Before transformation, this vegetation unit used to form part of the national vegetation type CB 1 Maputaland Coastal Belt classified as Vulnerable.

Specific disturbances to the various plant communities and wetland ecosystems recorded within the study area have been discussed in detail under the heading of each individual community. The main disturbances can be summarised as the major alterations to the topography and hydrology of both Site A and Site B, as well as the impact caused by invasive alien species.

Mangrove species are highly susceptible to changes in hydrology and salinity (Kathiresan & Bingham 2001). Human induced hydrological changes within the Richards Bay Harbour have altered salinity levels and flooding cycles dramatically. This is most probably the leading cause of the decline of *Bruguiera gymnorrhiza* stands and *Rhizophora mucronata* stands recorded by numerous authors (Begg 1978) within the Richards Bay Harbour. Hydrological changes also include the channelling of basically all major rivers and streams, speeding up drainage, containing floodwater behind earth embankments and preventing the formation of swamps. The very few seedlings of the three mangrove tree species recorded may pose problems for future colonisation and maintenance of the mangrove structure and functionality. This population decline and inability to regenerate are symptoms of the declining health of the harbour's mangroves and wetlands.

<u>Recommendation</u>

In an attempt to retain the remaining ecosystem processes and to ensure the continuation of current biodiversity patterns, every effort should be made to conserve the remaining wetlands within the study area. This includes managing local and regional catchments.

Historical water flow patterns should be reinstated as part of a rehabilitation programme for the wetlands of the study area.

7.4 BIRD FAUNA OF PRIORITY HABITATS

A Bird Fauna assessment was conducted by CRUZ Environmental Consultants in October 2014 (Appendix 4-2).

7.4.1 Method

Fieldwork for this investigation was undertaken during three days over the period 29th September to 22nd October. Due to the fact that the time allocated for the survey was limited it was decided, after reviewing a Google Earth photo of the sites, that for the Rail Balloon area strip counts using the tracks present in the area would be used to obtain a list of species and maximum numbers present in the Secondary Woodland (Habitat 1 on Figure 2.1). For the Freshwater Wetlands (Habitat 2 on Figure 2.1) selected points on the edge of the habitat would be accessed and records collected from there, while for the Intertidal Mangroves and Sandflats (Habitat 3 on Figure 2.1) the area would be walked and counts of birds present recorded. Species recorded in flight over the area were noted in a separate column as Ariel. Random transects were walked in the Berth 600 Series Extension, covering the four broad habitat types.

7.4.2 Findings

HABITAT DISTURBANCE AT SITE A – RAIL BALLOON AREA

Given that 80 species were recorded during this brief once-off survey indicates that the fauna is well established and sustainable. The illegal driving of quad bikes in the intertidal areas of the mangroves and sand flats as well as on the beach is currently impacting on these habitats.

HABITAT DISTURBANCE AT SITE C – BERTH 600 SERIES EXTENSION AREA

Given that only 25 species were recorded during this brief one off survey indicates that the fauna has been severely affected by habitat disturbance. However the impacts occurred many years ago and with the bulk of the area covered Secondary Scrub which has recently been burnt out it does not provide prime habitat for birds.

7.4.3 Discussion

7.4.4 Site A – Rail Balloon Area

- **Secondary Woodland (Habitat 1 on Figure 2.1)**

Whist the species diversity and abundance is fairly high within this habitat, the habitat itself has been severely disturbed in the past and now consists effectively of Secondary Woodland interspersed with Grassland. Suitable habitat housing this faunal composition is fairly wide spread within the uMhlathuze City area and the loss of this in the Rail Balloon Area would not have any significant consequences.

- **Freshwater Wetlands (Habitat 2 on Figure 2.1)**

It is unfortunate that this study was carried out when the Wetland was at its driest for many years as it is considered that it may have been found to hold an important species composition. The nearby Thulazihleka Pan which lies less than a kilometre away has been recorded as holding an extremely diverse wetland bird fauna. Of the 193 species recorded at the pan, 107 are water associated. This includes a number of Red Data Species (D.P.Cyrus *pers obs*). Regular counts of 79 water bird species were undertaken as part of the Coordinated Waterbird Counts (Taylor *et al.* 1999) and revealed a mean count of 1,941 individuals over 10 counts with a maximum count of 4,415 from one summer count. While Thulazihleka is some three to four times larger than the Wetland in the study area it's fauna does give some indication as to the diversity and density of species that may be present under normal rainfall conditions.

- **Intertidal Mangroves & Sandflats, Coastal Shoreline (Habitat 3 on Figure 2.1)**

Only one Red Data species was recorded in this habitat, this was the Caspian Tern a species considered by Barnes (2000) to be Near-threatened. Whilst this limited one off study has indicated that the bird fauna is limited, it should be noted that it was not possible to gain access to the interior of the Mangroves. Added to this, is the fact that this habitat is not known for its high species diversity or density. However it is an important habitat for particularly the Mangrove Kingfisher which is a winter visitor to the Mangrove stands on the Zululand Coastal Plain. This Red Data Species is listed as Vulnerable by Barnes (2000) and many well occur in the study area during the winter months.

Further indications of the importance of this habitat are clearly shown by the wader, tern and gull community that utilizes the area. Whilst this study was conducted as far into the summer a time constraints would allow it was clear from observations that the Palearctic waders had only just started to arrive in the area as those present were still showing some signs of breeding plumage. These birds moult into their winter plumage shortly after their arrival in southern Africa. In addition only one Common Tern was present in the area which at times supports 30 to 50 birds (D.P.Cyrus *pers obs.*), indicating that they had not yet arrived from the northern Hemisphere.

The loss of this habitat from a bird perspective would probably be significant given that intertidal areas within the harbour and the Mhlathuze Estuary have already been lost. In the former case it has been due to harbour development and in the latter due to Mangrove expansion resulting from the creation of the 'new' mouth for the Mhlathuze at the start of harbour development in 1976. This matter is discussed further in the Overall Findings and Assessment Report (Cyrus & Vivier 2014).

- **SITE C – BERTH 600 SERIES EXTENSION**

It was found that the bird fauna in general was depauperate and the habitat severely disturbed, in the past and recently due to a fire. The focus as per the brief was to investigate the bird fauna of the areas designated on Figure 1.2. However, the boundaries of this site only encompass the new quays and the area to be dredged to a depth of -15.5m CD. It did not cover the area to the South of the channel indicated on Figure 5.1 (from AECOM 2014) also to be dredged to -15.5m CD or else to form the angled slope from the dredge channel to the shore. As can be seen on Figure 5.1, this activity, be it channel or channel slope will impact directly on the Sand Spit that forms the northern border of the Kabeljous Flats. Furthermore it did not include the area around the western end of the new quay that will presumably form part of the infrastructure of the new facility or the area to be affected by the re-routing of the access road from the entrance gate to the Coal Terminal at the Berth 300 Series which will be severed due to the westwards extension of the Berth 600 Series. An extension of the impact of the development further to the west than the boundary indicated for Area C on Figure 1.2 would have a far greater impact on Swamp Forest (Habitat 3 on Figure 2.3).

The exclusion of these areas from the study and particularly the area of the sand spit to be dredged raises a potential Red Flag from a bird point of view as it is known that this area is also used by waders, terns and gull as a feeding and roosting area. In addition the cutting of the Sand Spit could have serious repercussions for the ecological sustainability of the Kabeljous Flats.

7.4.5 Conclusion

In terms of the bird fauna present in the three broad based habitats identified in the Rail Balloon Area (Site A – attached in the specialist report – Appendix 4-2) it is concluded as follows;

1. Despite the Secondary Woodland habitat having a well-established bird fauna the loss of this area to development would have no major effects on the fauna of the greater uMhlathuze area.
2. Due to the current low water levels in the area no data of any substance was obtained from the Freshwater Wetland habitat. However, this type of habitat is ecologically important and declining across KwaZulu-Natal. It is considered that the implementation of some form of Offset related to the nearby Thulazihleka Pan might be an option for the loss of this area to development.
3. The Intertidal Mangrove and Sandflats was the only area where Red Data were present or considered to potentially occur. The intertidal areas are of importance to waders, terns and gulls and the loss of this habitat could be of some significance from a bird perspective.

In terms of the bird fauna present in the Berth 600 Series Extension (Site C – Figure 2.1 attached in the specialist report – Appendix 4-2) it is concluded as follows:

1. The loss of the habitat within the designated area of Site C – Figure 2.1 attached in the specialist report – Appendix 4-2 - would have no significant effect on the bird fauna of the greater uMhlathuze area.
2. Two Red Flags are raised in relation to the area surrounding the designated study site.
3. Red Flag 1: No assessment has been done on the potential impact of the development on the bird fauna associated with the Swamp Forest to the West of the designated site. However it is considered that infrastructure development and road re-routing will impact on the habitat.
4. Red Flag 2: No assessment has been done on the potential impact of the dredging required for the development on the bird fauna associated with the Sandspit or the Kabejous Flats. The Final Scoping Report for the project (AECOM 2014) indicates that dredging associated with the extension of the Berth 600 Series Extension will impact on this area which is utilised by waders, terns and gulls.

7.5 FROG FAUNA OF PRIORITY HABITATS

A Frog Fauna assessment was conducted by Mr LH du Preez from CRUZ Environmental Consultants in October 2014 (Appendix 4-3)

7.5.1 Method

- **ON SITE VISITS**

The Rail Balloon study area was visited for the period 29 September – 2 October 2014. The study area was visits during different times of the day to ensure that all species be covered as some frogs only start calling late at night. In addition a visit during the day was made to the Berth 600 Series Extension site.

- **SURVEY METHODS**

In order to ensure that all frog species present at the time of the survey were encountered a combination of different survey methods were followed and surveys were conducted during daytime and at night. Fixed point acoustic surveys were conducted using sophisticated programmed call recorders. These were placed out and programmed to record continuous from 18h00 – 06h00 the following morning and were placed at different representative habitats.

Transect acoustic surveys were undertaken by driving at night through the study area, stopping every 200 m to listen for a period of three minutes. As each species has a species specific call, this method provides an accurate way of determining which frogs are calling. However only male frogs call and males only call when reproductively active. For this reason acoustic surveys have to be combined with other survey methods. Visual encounter surveys were undertaken at night by driving on all roads in the study area and documented all frogs spotted on the road.

7.5.2 Findings

Based on published literature Carruthers & Du Preez (2009) conducted a thorough desk top study and identified a list of 48 frog species in twenty genera that have been collected around Richards Bay. Based on predictive modelling both threatened species known from the area, mottled Shovel Nosed Frog and the Pickersgill Reed Frog could occur in the study area. However, based on my experience with both these species I am of the opinion that neither of them will occur at the study site. The wetland to the North of the access road will most likely sustain a population of Painted Reed frogs (*Hyperolius marmoratus*), Tinker Reed Frogs (*Hyperolius tuberilinguis*) and possibly Argus Reed Frogs (*H.* argus) but it is not the type of wetland where I would expect Pickersgill Reed Frogs. The list of frogs historically detected in the Richards Bay area, those that are likely to occur at the study site and those that have been detected at the site are listed in Table 2

LIMITATIONS OF THE STUDY

In spite of the rain that did fall prior to the visit no open water suitable for frogs to breed was present at the site.

Based on sophisticated recording equipment and scientific experience with the group of organisms:

1. The study area is not a particularly good site for frogs.
2. After prolonged rains the wetland indicated by C in Figure 2 of the specialist report will most likely gather water and will provide suitable breeding habitat for several species including Painted Reed Frogs (*H. marmoratus*), Tinker Reed Frogs (*H. tuberilinguis*) and Water Lily Frogs (*H. pusillus*).
3. None of the threatened frog species known to occur in the Richards Bay area would be expected to occur in the area studied.
4. Loosing this site will not affect the population of frogs in the greater Richards Bay.

7.6 Fish and Benthic Invertebrate Fauna associated with Intertidal Mangroves and Sandflats

A Fish and Benthic Invertebrate assessment was conducted by Mr L Vivier and Mr DP Cyrus from CRUZ Environmental Consultants in November 2014 (Appendix 4-4)

By their very nature intertidal areas are exposed on a twice daily basis with considerable variability due to tidal ebb and flood. Both the Mangrove substrata and the Sandflats are covered with water and then almost entirely exposed as the tide recedes. This is clearly seen by comparing Figure 2.1 of the specialist report, which was taken near high tide, with Figure 2.2 of the specialist report which was taken at low tide. Under the latter state large areas of sandflats are exposed and can be exploited by the wading birds for the food source it provides (Refer to the Fish & Benthic Invertebrate Fauna Report associated with Intertidal Mangroves and Sandflats in TCP Richards Bay Port Expansion Project in Appendix 4-4).

7.6.1 Methods

Benthic Invertebrate Sampling

Samples of the benthic fauna were collected at two sites (IM1-IM2) in the intertidal zone adjacent to in the Mangroves and at four sites (ISF1-ISF4) in the intertidal Sandflats zone (Figure 7-1). A Zabalocki-type Eckman grab, which samples 0.0236 m2 to a minimum depth of 50 mm, was used to collect five replicate benthic samples from each site, i.e. samples of the bottom substrate of the system. Samples were decanted five times through a 0.5 mm sieve to ensure extraction of at least 95% of the animals. Samples were preserved in a 10% formalin solution, and stained with the vital dye Phloxine B to aid sorting in the laboratory. Animals were identified to species level where possible, enumerated and densities calculated as no.m-2. Sediment samples were also collected and analysed for grain size and organic content using standard techniques.

Fish Sampling

Fish were sampled using three types of sampling gear. A Small (10 m x 1.5 m, 6mm bar mesh) and Large Seine net (70 m x 1.5 m, 10mm bar mesh) were used to sample both the Intertidal Mangroves and Sand Flats. In addition a Beam Trawl (1.5m wide with 5mm stretch mesh bag) was used to sample the Intertidal Sandflats and this was aimed at sampling benthic macrocrustacea (prawns & crabs) and benthic associated fish species. All fish were measured to Standard Length (SL) and most were identified on site and returned to the water. In the laboratory identification of unknowns was undertaken and densities calculated as a Catch per Unit Effort (CPUE) where one net haul equals one unit of effort.

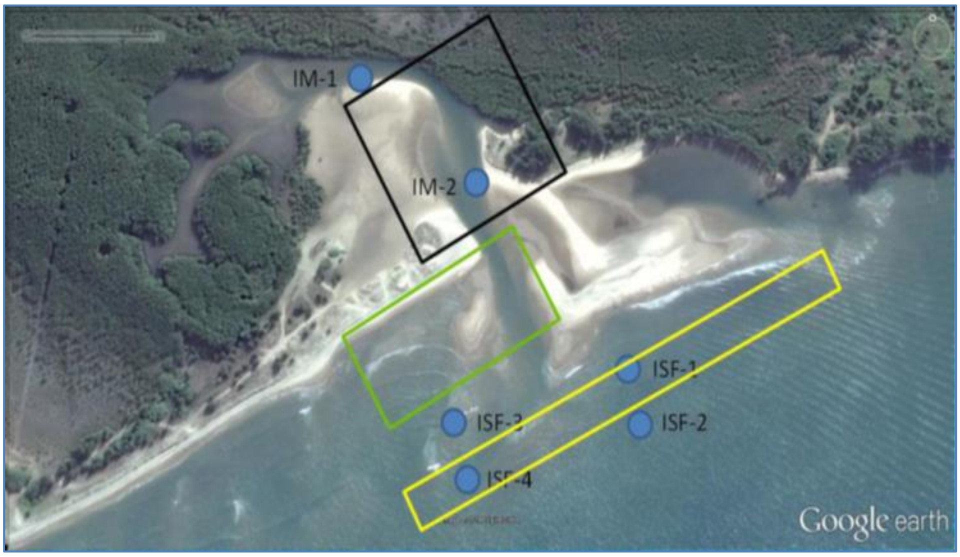


Figure 7-1: The intertidal areas of the Rail Balloon area covered by marine water at high tide (Google Earth 2014-05-08). Benthic sampling sites indicated as IM & ISF, Black Box demarcates fish sampling sites in the Mangrove Intertidal Zone, Green Box demarcates fish sampling sites in the Intertidal Sandflats Zone (Large and Small Seine used in both zones) & Yellow Box demarcates Beam Trawl sampling sites in the Intertidal.

Figure 7-2: The intertidal Zone of the Rail Balloon area exposed at low tide (Google Earth 2004-10-03).

Sediment Grain Size & Organic Content

Bottom sediment was collected from each of the benthic sampling sites and sent to Environmental Management Service in Durban for Grain Size range and Organic Content determination.

Physico-chemical Parameters

Physical water quality parameters (water temperature, turbidity, salinity, pH, dissolved oxygen concentration, % oxygen saturation and depth) were measured at each site using a YSI 6920 Sonde (YSI Incorporated).

7.6.2 Findings

- **SEDIMENT ANALYSIS & PHYSICO-CHEMICAL WATER QUALITY**

The physico-chemical water quality parameters and sediment characteristics recorded in the Intertidal Mangroves and adjacent Intertidal Sandflats associated with the Rail Balloon Area are presented in Table 4.1 of the in the Fish & Benthic Invertebrate Fauna associated with Intertidal Mangroves and Sandflats in TCP Richards Bay Port Expansion Project Report that is attached to Appendix 4-4. Turbidity's in both areas were very low, reflecting inflow of relatively clear marine waters. Oxygen concentrations at the intertidal mangrove sites were relatively low, given the regular tidal inundation. Although very different habitat types in terms of wave exposure and water movement and proximity to mangroves, both areas were generally sandy, being characterised by medium to fine sand sediments that were moderately to well sort. The relatively coarse sand at the intertidal mangrove was surprising given the close proximity to a well-developed mangrove stand. The percentage mud in the sediment of this area was similarly very low, ranging between 1.3-3.7%. The relatively coarse sediment was also reflected in the low organic content recorded at all sites, ranging between 0.1-0.4percent.

- **MACROBENTHIC INVERTEBRATE FAUNA**

The zoobenthic macro invertebrates recorded in the Intertidal Mangroves and adjacent Intertidal Sandflats associated with the Rail Balloon Area are presented in Table 4.2 in the Fish & Benthic Invertebrate Fauna associated with Intertidal Mangroves and Sandflats in TCP Richards Bay Port Expansion Project that is attached in Appendix 4-4.

A total of 32 zoobenthic taxa were recorded, 13 from the Intertidal Mangroves and 24 from the Intertidal Sandflats. Mean zoobenthic densities per site were generally low, being much lower in the Intertidal Mangroves (mean CPUE = 606 organisms per m^{-2}) compared to the Intertidal Sandflats (mean CPUE = 1138 organisms per m^{-2}). The intertidal mangrove area was dominated by the bivalves *Dosinia hepatica* and *Eumarcia paupercula*, with the two taxa comprising 75% of the zoobenthic organisms in this area. The intertidal sand flat area had a very different species composition and was dominated by amphipod crustaceans, notably *Urothoe* sp. These burrowing amphipods often form an important component of intertidal and shallow subtidal sandy areas. The abundance of the tube dwelling polychaete *Owenia fusiformis* in the intertidal sandy area also reflects the sandy substrate characteristic of this area, as these polychaetes generally avoid muddy or muddy sand areas.

- **MACROCRUSTACEA FAUNA**

No species of macrocrustacea were caught during beam trawling or seine netting.

- **FISH FAUNA**

A total of 486 individual comprising 20 species were caught during sampling in the Intertidal areas of the Balloon Rail site (Table 4.3). The majority were caught in the Large Seine net. No fish or macrocrustacea were caught in the three Beam Trawl hauls that were undertaken.

By far the majority of the fish caught by seine netting were juveniles. Large and small seine catches in the Intertidal Zone adjacent to the mangroves (Figure 7-1) averaged between 17 and 28 fish per haul and comprised 19 species (Table 4.3). In the Intertidal Sandflats almost no fish were caught in the small seine (CPUE = 1.5), however one large seine haul netted 200 fish comprising 10 species.

Whitfield (1994) produced an estuary-association classification for the fishes of southern Africa which allows one to determine the origin of any group of fish caught in an estuary as well as the importance of the estuarine environment to the fish. This classification comprises five categories, with three of these being divided into subcategories (Table 4.4). Of the 20 fish species recorded in the Intertidal Mangroves and Sandflats, 15% are marine species which are not dependent on an estuaries environment for any specific part of their life cycle (Category III) and 75% are euryhaline marine species which breed at sea with their juveniles showing varying degrees of dependence on estuaries environments as part of their life cycle (Category II). Five percent are estuarine species which breed in these systems (Category I) and 5% euryhaline freshwater species some of which may breed in estuarine as well as freshwater (Category IV). No obligate catadromous species which use estuaries as transit routes between the marine and freshwater environments were recorded (Category V).

Whilst the overall contribution of species to each of these groups provides an indication of the dominance of the Category II species within the study area (Table 4.3), this needs to be interrogated further as these species all enter the estuary from the sea as post larvae or early juveniles and completion of their life cycle depends on getting into and surviving in an estuary. Richards Bay Harbour acts as a nursery area for members of this group providing numerous advantages for successful growth and survival (Blaber & Blaber, 1980; Wallace, 1975; Wallace & van der Elst, 1975). The Category II species may occur in extremely high numbers, to the extent that they dominate in terms of biomass. Of the 20 taxa occurring that fall into Category II, the juveniles of six are entirely dependent on Richards Bay Harbour as a nursery ground in order to complete their life cycle (Category IIa – Table 4.3), three occur as juveniles, mainly in estuaries which they utilize as a nursery but are also found at sea (Category IIb) and the remaining six species occur as juveniles in estuaries, again utilizing them as nurseries, but are usually more abundant at sea (Category IIc). Individuals from the bulk of species from all three sub-groups remain within the estuary until reaching sexual maturity for the first time, at which point they leave for the marine environment where they join the adult spawning stocks, with the majority never returning to the estuarine environment.

7.6.3 Recommendations

Results of the limited study that was undertaken have identified both habitats as important for fish, particularly juveniles of marine associated species which need to enter an estuarine environment to be able to complete their life cycle. Estuarine dependent fish species such as *Liza dumerilli* were present in large numbers, suggesting that the area is of importance as a nursery habitat for marine breeding fish. Of the fish species recorded, 75% belonged to the estuarine dependent category.

In terms of the Intertidal Sandflats this habitat and its associated fauna are considered of ecological significance. MER (2014) has noted that the total area in South African estuaries was limited and that much of it has been lost to development already, particularly in KwaZulu-Natal where there have been substantial losses already from both Durban and Richards Bay Harbours.

7.7 BENTHIC INVERTEBRATE FAUNA ASSOCIATED WITH THE FINGER JETTY

The aim of the study was to determine the status of the macrobenthic fauna in the area around the proposed Finger Jetty expansion site and to assess any potential risks associated with the development on the macroinvertebrate faunal community.

The study area incorporates two different habitat types in the port:

1. deepwater in-channel areas in close proximity to the proposed Finger Jetty expansion site.
2. off-channel shallow water areas adjacent to the Sand Spit and the Kabeljous mudflat.

7.7.1 Methods

Samples of the macrobenthic invertebrate fauna were collected at six sites (FJ1-6) in selected deepwater channel and shallow off-channel areas (Figure 7-3). The sites were selected to be representative of the development area and the ecologically important areas that could potentially be affected by the development. Site FJ6 on the Kabeljous mudflat was selected as a reference subtidal mudflat site.

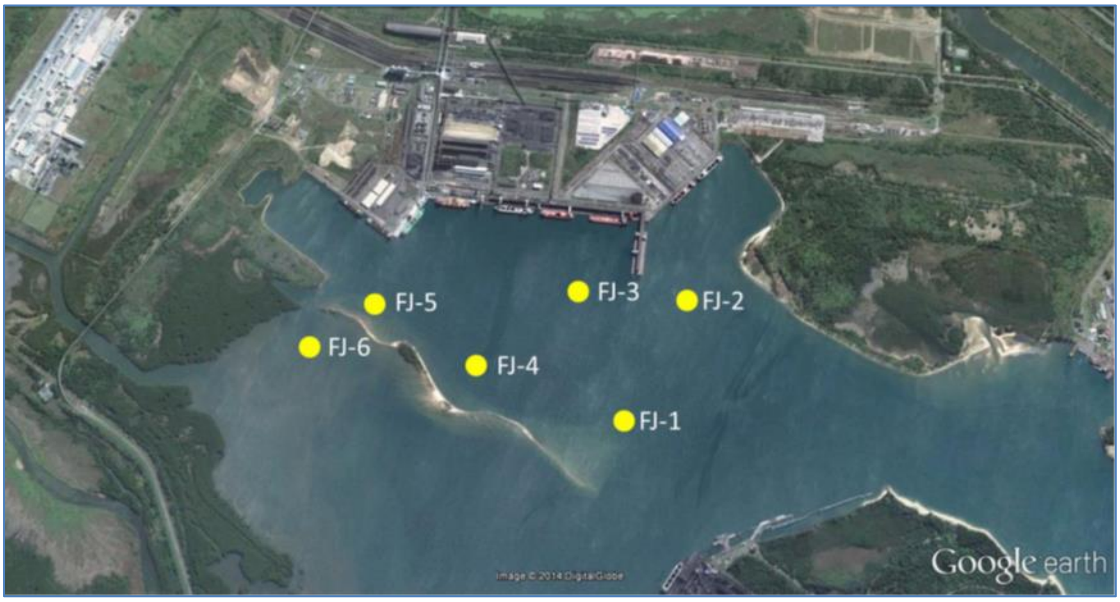


Figure 7-3: Macrobenthic sampling sites in the vicinity of the Finger Jetty in Richards Bay Harbour

- **Benthic Invertebrate Sampling**

Samples of the benthic fauna were collected at six sites (Sites 1-6) in the subtidal and intertidal zone adjacent to the Finger Jetty in the port (Figure 7-3). Two sets of sampling gear were used, depending water depth. A Zabalocki-type Eckman grab, which samples 0.0236 m2 to a minimum depth of 50 mm, was used to collect five replicate benthic samples from shallow sites, < 3m water depth. Deeper sites were sampled with a Van Veen grab. Samples were decanted five times through a 0.5 mm sieve to ensure extraction of at least 95% of the animals. Samples were preserved in a 10% formalin solution, and stained with the vital dye Phloxine B to aid sorting in the laboratory. Animals were identified to species level where possible, enumerated and densities calculated as no.m^{-2}. Sediment samples were also collected and analysed for grain size and organic content using standard techniques.

- **Sediment Grain Size & Organic Content**

Bottom sediment was collected from each of the benthic sampling sites and sent Environmental Management Service in Durban for Grain Size range and Organic Content determination.

- **Physico-chemical Parameters**

Physical water quality parameters (water temperature, turbidity, salinity, pH, dissolved oxygen concentration, % oxygen saturation and depth) were measured at each site using an YSI 6920 Sonde (YSI Incorporated).

7.7.2 Findings

- **SEDIMENT & PHYSICO-CHEMICAL WATER QUALITY**

The area sampled was strongly marine dominated, given the marine salinities and conductivities recorded. Dissolved oxygen (mg/l) and oxygen saturation (%) were relatively high at all sites at the top and bottom of the water column. There was no sign of oxygen stratification in the water column and bottom oxygen concentrations were > 7mg/l at all sites, suggesting no anoxic conditions at any of the sites sampled. This was supported by pH level ranging between 7.65 and 8.00, suggesting a strong marine influence. Water clarity was good throughout at the top and bottom of the water column, with the highest turbidity of 4.1NTU being recorded on the shallow mudflat at Site 5. Even on the Kabeljous mudflat, a low turbidity of 3.3 NTU was recorded.

Sites 1 and 4 were characterised by fine sandy substrate with a very low organic content. In contrast, silty sediment occurred in the deep water areas of Sites 2 and 3, which also contained higher organic material in the sediment. Sites 5 and 6 were on the subtidal mudflat, with both sites showing silty sediment with relatively high organic content.

- **MACROBENTHIC FAUNA**

A total of 28 zoobenthic macroinvertebrates were recorded at six sampling sites in Richards Bay Harbour in the vicinity of the Finger Jetty. Polychaetes and molluscs were found to dominate in terms of the number of taxa in the vicinity of the Finger Jetty area. Highest benthic densities were recorded in muddy sand at Sites 1 and 6, whereas very low densities were recorded in the silty substrate at Sites 2 and 3. Site 6, the site chosen as a reference site on the Kabeljous mudflat, showed the highest densities. Similarly, highest number of taxa was recorded at Site 6 on the Kabeljous mudflat and in the muddy sand at Sites 1, 4 and 5, whereas the lowest number of taxa were recorded in the silty substrate at Sites 2 and 3.

Mean zoobenthic densities per site were generally low, with a mean CPUE = 662 organisms per m^{-2}, which can be regarded as low for a permanently open estuarine environment. This is particularly the case for Sites 2-3, as these low densities are very low for muddy estuarine habitat.

The macrobenthos was numerically dominated by small polychaetes e.g. *Mediomastus capensis* and *Ancistrocylis parva* and the bivalves *Dosinia hepatica* and *Tellina sp*, with these four taxa comprising 46% of the zoobenthic organisms in this area. It is noteworthy that the mud crab, *Paratylodiplax blephariskios*, was absent from the deep channel sites (Sites 1-4), but relatively abundant in in shallower areas, notably on the Kabeljous Flats. These crabs are relatively large bodied compared to most other macrobenthic taxa and as such contribute substantially to the benthic biomass where they occur in abundance. The abundance of small spionid polychaetes is characteristic of muddy or silty areas where they feed on the abundant detritus and organic material.

- **MACROCRUSTACEA FAUNA**

No species of macrocrustacea were caught during the study.

7.7.3 Conclusion

In terms of the macrobenthic faunal composition, it can be concluded that:

The extension of the Finger Jetty will have limited direct risk associated with the macroinvertebrate fauna in the deep-water environment other than the direct loss of the habitat under the footprint of the extended quay. The deepwater habitat was found to typically host a low diversity of macrobenthic fauna.

The off-channel muddy sand habitat to the south of the shipping channel revealed higher benthic densities and a higher number of taxa. Although not directly impacted on by construction of the Finger Jetty extension, the benthic fauna in these areas could be subjected to indirect toxicological impacts related to re-suspension of contaminated fine sediments during dredging.

Highest macrobenthic diversity was observed in the subtidal Kabeljous mudflats. Intertidal mudflats are regarded as of high conservation importance and should be the focus of concerted efforts to avoid any impacts during the development.

It is recommended that monitoring of the macrobenthic fauna at the sampling sites used in this study be continued before, during and after construction of the Finger Jetty.

7.7.4 Recommendations

From a marine and terrestrial point of view the proposed development is recommended to continue, on condition of acceptance of the following:

It is recommended that monitoring of the macrobenthic fauna at the sampling sites used in this study be continued before, during and after construction of the Finger Jetty.

7.8 AQUATIC VEGETATION & FISH ASSOCIATED WITH BERTH 600 SERIES EXTENSION

An aquatic vegetation and fish assessment was undertaken by Mr DP Cyrus and L Vivier from CRUZ- Environmental Consultants in October 2014. The specialist study is presented in Appendix 4-5.

The aim of the study was to determine the importance of the shallow intertidal area within the Berth 600 Series Extension area using the fish and *Z. capensis* as indicators.

7.8.1 Methods

- **Fish Sampling**

Fish were sampled using Small Seine (10 m x 1.5 m, 6mm bar mesh), all fish were measure to Standard Length (SL), and most were identified on site and returned to the water. In the laboratory identification of unknowns was undertaken and densities calculated as a Catch per Unit Effort (CPUE) where one net haul equals one unit of effort.

- ***Zostera capensis***

A visual assessment was made of the extent and coverage of *Z.capensis* at the site using elevated points around the site as visual vantage points.

7.8.2 Findings

- **FISH FAUNA**

One specimen identified as *Redigobius batteatops* appears to be a new record for South Africa which as far as is known has only previously been recorded as far south as Maputo Bay in Mozambique. The specimen will however have to be sent to the South African Institute for Biodiversity in Grahamstown for verification of the identification.

Of the nine fish species recorded in the Shallow Intertidal area, 11% are marine species which are not dependent on an estuaries environment for any specific part of their life cycle (Category III) and 33% are euryhaline marine species which breed at sea with their juveniles showing varying degrees of dependence on estuaries as part of their life cycle (Category II). Fifty six percent are estuarine species which breed in these systems (Category I). No euryhaline freshwater species, some of which may breed in estuaries as well as freshwater (Category IV), or obligate catadromous species, which use estuaries as transit routes between the marine and freshwater environments (Category V), were recorded.

The overall contribution of species to each of these groups provides an indication of the dominance of the Category I species within the study area (Table 4.1). However despite the fact that Category II species only made up 33% of the catch visual observations indicated that the Intertidal Shallows area is of greater importance to this group. Category II species enter estuarine environments from the sea as post larvae or early juveniles and their survival depends on them getting into such a habitat. Richards Bay Harbour acts as a nursery area for members of this latter group providing numerous advantages for successful growth and survival (Blaber & Blaber, 1980; Wallace, 1975; Wallace & van der Elst, 1975; Forbes *et al.* 1997). Individuals from the bulk of Category II species remain within the estuary until reaching sexual maturity for the first time, at which point they leave for the marine environment where they join the adult spawning stocks, with the majority never returning to the estuarine environment.

- **MACROCRUSTACEAN FAUNA**

A large number of very small juvenile prawns (around 5 to 10 mm Carapace Length) were also netted when netting for fish was undertaken however neither the time nor the manpower required to identify and enumerate the specimens collected. In addition it was noted that the intertidal zone supported a well-established population of Fiddler Crabs.

- ***ZOSTERA CAPENSIS***

The stands of *Z. capensis* in the Shallow Intertidal area were well established and extensive covering approximately 40% of the surface area of this habitat. At high tide all stands were entirely submerged whilst at low tide the bulk were exposed as the water receded. The Intertidal Shallows were fringed by a developing stand of mangroves which comprised two species, *Avicennia marina* and *Bruguiera gymnorrhiza.*

7.8.3 Conclusions

- **FISH FAUNA**

Results from the limited scope of this study has clearly indicate that the Shallow Intertidal area present within the Berth 600 Series Extension area provides the necessary requirements for both small to medium sized juvenile fish of estuarine as well as estuarine associated marine species. The fact that a possibly new species for South Africa was recorded (verification pending) from the limited sampling that was undertaken, indicates possible further importance of this site. The attraction to this area is almost certainly the substrata but more importantly the habitat created by the presence of *Z.capensis* which is known to be an important habitat for a wide range of species, including fish and prawn and particularly for the nursery habitat it provides.

- **MACROCRUSTACEAN FAUNA**

No direct sampling of this group was undertaken however the number of very small juvenile prawns, most likely of the genus *Penaeus*, is of significance. Members of this genus also have an obligatory requirement for an estuarine environment during their juvenile stage in order to complete their life cycle (Weerts *et al.* 2003). Forbes & Demetriades (2005) reported that Richards Bay Harbour and Lake St Lucia are the two most important nursery areas in South Africa for this group which are of economic importance as they are major contributors to the off shore commercial fisheries on the Thukela Banks.

- ***ZOSTERA CAPENSIS***

The discovery of a sustainable population of *Z.capensis* within Richards Bay Harbour is ecologically of great significance as this is the first record of its presences for more than 30 years. Koch *et al.* (2007) considered seagrasses as keystone species in many shallow lagoons and estuaries, where they provide complex habitats and high rates of primary production for ecologically and economically important higher consumers.

This species is now listed on the IUCN Red List of Threatened Species as Vulnerable which means it is considered to be facing a high risk of extinction in the wild (Short *et al.* 2010).

7.8.4 Conclusion

In terms of the fish fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area (Site A - Figure 1.1 of the Fish & Benthic Invertebrate Fauna associated with Intertidal

Mangroves and Sandflats in TCP Richards Bay Port Expansion Project) it is concluded as follows;

1. The loss of these Intertidal Mangrove and Sand Bank habitats could have a significant effect on the fish fauna as intertidal sand banks are limited in their occurrence in Richards Bay Harbour.

2. The loss of the Intertidal Mangroves will also have an impact on the fish fauna, however this habitat is of far greater significance in the broader sense of ecosystem functioning than just to the fish fauna.

In terms of the macrobenthic fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area (Site A - Figure 1.1 of the Fish & Benthic Invertebrate Fauna associated with Intertidal Mangroves and Sandflats in TCP Richards Bay Port Expansion Project) it is concluded as follows;

1. The area is characterised by relatively low macrobenthic diversity which is related to the sandy substrate and low organic content in both areas.

2. The low macrobenthic diversity in the intertidal mangroves area was related to the unusually sandy, low organic content substrate in the area, which support primary suspension feeding macrobenthic organisms.

3. Despite the relatively low benthic diversity and other issues mentioned in 1 and 2 above, this habitat is ecologically important in an estuarine intertidal context and the loss of which will affect the functioning of intertidal habitat in Richards Bay Harbour.

The importance of Richards Bay Harbour as a functioning ecosystem has been highlighted on several occasions in the past (Cyrus & Forbes 1994 & 1996; Forbes *et al*. 1997) and more recently by CSIR (2005), Cyrus & Vivier (2009), Vivier & Cyrus (2009) and MER (2013).

7.9 HERITAGE IMPACT ASSESSMENT

A heritage impact assessment was undertaken by Elizabeth Wahl and Len van Schalkwyk from eThembeni Cultural Heritage in February 2013 and a Heritage Survey of the Proposed Expansion to the Transnet National Ports Authority, Richards Bay was conducted in 2009 by Mr Gavin Anderson. The specialist studies are presented in **Appendix 7**.

A heritage assessment includes a study on various cultural and heritage resources that may be located in the area intended for development, such as possible archaeological resources, structures older than 60 years, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict and cultural landscapes.

7.9.1 Methods

The method for Heritage assessment consists of several steps. The first step forms part of the desktop assessment. Here we would consult the databases from both Umlando and the Natal Museum. These databases contain most of the known heritage sites in KwaZulu-Natal. This database does; however, tend to be restricted to archaeological and palaeontological sites. Consulting with the relevant authorities will also cover known battlefields and historical sites. We also consult with an historical architect, palaeontologist, and an historian where necessary. A web search on the early harbour construction as well as aerial photographs dating to 1937 was also consulted.

The initial archaeological survey (i.e. fieldwork) consists of a foot survey where the selected area was covered. The survey results will define the significance of each recorded site, as well as a management plan. The main problem with the survey was the poor archaeological visibility.

All sites are grouped according to low, medium and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips and decorated sherds are sampled, while bone, stone and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

7.9.2 Findings

Several sites are noted in the survey report. Most of these have low significance, while one site has high significance. The results can be divided into a desktop analyses and the field survey.

DESKTOP SURVEY

Archaeology

The desktop survey noted that ~40 archaeological have been recorded within a 10km radius of the study area (Anderson 1995 – 2003; Anderson & Anderson. 2004 – 2009a/b; Anderson & Anderson. 2006; Anderson & Anderson. 2007a/b; Anderson 2008a/b; Van Jaarsveld 2006). If the radius were increase to a 20km, then over 100 archaeological sites would occur in the area. There are no favoured areas for the archaeological sites; however, most are concentrated along the dune cordon. These sites have been recorded as a result of impact assessments, and not systematic research surveys. That is the mining lease for RBM has an abundance of sites as a direct result of it requiring a heritage survey (Anderson & Anderson 2004-2008b). Most of the sites along the Eastern Seaboard tend to date to the Iron Age, or the last 1 700 years. Several Stone Age sites exist outside of the dune cordon, and these date to the last ~one million years.

No archaeological sites have been previously recorded in the study area.

Palaeontology

A palaeontological monitoring program was set up during the construction of Berth 306 in 2006. Umlando and Mr A. van Jaarsveld were involved in the project. Several Cretaceous period fossils were excavated, sampled and rescued during this program. In addition to this Palaeocene, Miocene and Pleistocene sediments were also noted, and these contained diverse macrofaunal assemblages. The Cretaceous layers began at ~10m below the current surface at Berth 306. Just over 100 fossils were sampled from this excavation.

Significance: The palaeontological remains are of high significance.

Mitigation: Any excavations into the sand for the expansion of the harbour will probably impact on the palaeontological remains. While these remains were observed at ~10m below surface, the levels will change across the harbour, since areas have become spoil heaps or have been cleared. This will increase or decrease the depth of the palaeontological layers. The geological survey results should be assessed by a palaeontologist to estimate the depth of the palaeontological sediments across the harbour development area.

Conclusion

The survey recorded nine archaeological sites of varying significance, and the potential for palaeontological remains that are of high significance. Out of these nine sites, three areas will need to be monitored, sampled and/or excavated if they are effected in any manner. We suggested a detailed monitoring and sampling program for the palaeontological remains. This management program has the potential for “advertising” the project in terms of heritage management and thus public relations for Richards Bay. The excavations at Berth 306 received negative publicity due to a foreign (alleged) palaeontologist who brought in newspapers claiming that the HIA was not undertaken. If Richards Bay ever builds a museum, then some of these remains can be used for display purposes.

The port expansion project will need to obtain a permit from Amafa KZN for the destruction of archaeological sites. All sites within the admiralty reserve fall under the South African Heritage Resources Agency, and they will need to issue a permit for the destruction of these sites.

Based on the Report by Mr Gavin Anderson, eThembeni Heritage Consultant have submitted a letter to AMAFA dated the 1 May 2015 (Refer to Appendix 8) that they request that a Record of Decision please be issued on the basis of the Mlando Report 2009.

7.9.3 Recommendations

From a heritage point of view the proposed development is recommended to continue, on condition of acceptance of the following:

If archaeological sites or graves are exposed during construction work, it should immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

7.10 Noise Impact Assessment

Enviro-Acoustic Research (EARES) conducted an Environmental Noise Impact Assessment (ENIA) which investigated the potential noise impact from the proposed Richards Bay Port Expansion, of which a railway loop is the only source of noise to be investigated within 1,000 m of the nearest sensitive receptor. Refer to **Appendix 5** for the Specialist Report.

The report describes the Noise Rating Levels and potential noise impact that the operation of the development may have on the surrounding receptors' sound environment, highlighting the methods used, potential issues identified, findings and recommendations. This report only briefly discusses the basic principles of potential noise impacts on wildlife.

The Terms of Reference (TOR) for this study are based on the National/International guidelines and regulations such as GN R154 Noise Control Regulations 1992, United Kingdom Department of Transport - Calculation of Railway Noise (CRN), SANS 10328 and SANS 10103 guidelines.

The Transnet rail operations ideal envisage consolidation of loads into the maximum lengths for a single siding. Currently loads can vary in length from 40 wagon block loads through 50 and 60 up to 75/80 and 100 wagon general freight trains. The upgrading and implementation of the proposed railway section will enable freight loads to exceed the current capacities up to 150/160 and 200 wagon trains. A rail loop will be implemented at the Richards Bay port for the reverse (de-consolidation) traffic.

7.10.1 Methods

Ambient (background) noise levels were measured at appropriate times in accordance with the South African National Standard SANS 10103:2008 "The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication". The standard specifies the acceptable techniques for sound measurements including:

- Type of equipment (Class 1);
- Minimum duration of measurement;
- Microphone positions and height above ground level;

- Calibration procedures and instrument checks; and
- Supplementary weather measurements and observations.

7.10.2 Findings

The resulting future noise projections indicated that the operations of the project as modelled for representation would comply with the Noise Control Regulations (GN R154), SANS 10103:2008 and International Finance Corporation guidelines. Subsequently there is a low significance for a noise impact to occur during operations. There is always the likelihood that a degree of over-engineering or precautionary principles are adhered to in EIAs. However there is a high confidence level in the consecutive calculated Noise Rating Level and assessment. It should be noted, while a low significance of a noise impact was identified, it is definite that the train operations will be audible during quiet times. This may cause a noise annoyance and people may complain about these sounds at times.

With a risk of a noise impact developing during the night-time hours of low significance, mitigation options are included for evaluation by Transnet to ensure a low rating. The Noise Rating Level for the area must consider the land use as proclaimed by the uMhlatuze Local Municipality, as well as acoustical legislation and guidelines. With the uMhlatuze Local Municipality demarcating the project footprint as industrial, the corresponding Noise Rating Level as per GN R154 and SANS10103:2008 would likely be high (industrial rating level). This may not be relevant with the surrounding properties in relation to the project. However, such situations could pose problems when a receptor/dwelling or community is based adjacent to or bordering within close approximation to industrial land zoning. As the project boundary is within close proximity to the receptors identified, Transnet has confirmed that the rail loop is based within a commercial zoning to ensure the acceptable noise levels from the development in a controlled area.

7.10.3 Recommendations

Mitigation options are included in the Noise Impact Assessment that was conducted for the Richards Bay Port Expansion by De Jager, M (2014) of EARES and is attached in Appendix 6. Mitigation options will enable the developer to ensure acceptable Rating at receptors in the study area. Commercial railway line activities are exempted from certain requirements of Government Notice R154 of 1992 (Noise Control Regulations) – Regulation 2. (c) - "Provided that the provisions of this paragraph (in reference to noise emanating from a development) shall not apply in respect of a disturbing noise or noise nuisance caused by rail vehicles or aircraft which are not used as recreational vehicles". Furthermore the locomotive horns is exempted from the Government Notice R154 of 1992 (Noise Control Regulations) – Clause 7. (1) – "the emission of sound is for the purposes of warning people of a dangerous situation".

As such mitigation options are supplied for the developer's consideration only, with no Environmental Management Programme supplied due to the clause above. At the request of the main consultant and developer a monitoring programme has been supplied by the author for the developer to consider implementing. It is recommended that the developer consider a Monitoring and Audit Report to be conducted by an independent acoustical consultant on an annual basis. Measurements should be collected in 10-minute bins over a 48 hour measurement period. Variables and measurement recommended settings to be analysed include LAMin, LAeq,I, LAeq,f, LAeq, LCeq, LAMax, LA10, LA90 and spectral analysis. Monitoring should be conducted at the receptors NSD01 – NSD02, namely Waterways Estate within Meer-en-See, and Mzingazi Waterfront Village Estate.

Feedback regarding noise measurements will be presented to all stakeholders and other I&APs in the area during the focus group meeting which will take place during the public review period of the Draft EIA Report . The feedback platform and interval periods should be defined by the developer, with an annual feedback period recommended.

Due to economic advantages, railway systems do provide valuable employment, local taxes and foreign currency. It must be noted when projects are near to potential noise-sensitive receptors, consideration must be given to ensuring a compatible co-existence. The potential sensitive receptors should not be adversely affected and yet, at the same time mining need to reach an optimal scale in terms of layout and production. It should be noted that this does not suggest that the sound from the development should not be inaudible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source, but rather that the sound due to the mining activities should be at a reasonable level in relation to the ambient sound levels as per regulations.

If the layout of the project changes significantly (or assumptions change) that has been used in the Noise Impact Assessment Study, this Noise Impact Assessment Study needs to be reviewed with the appropriate new information supplied by the project team, including:

- Locality of the noise source (Layout);
- Operational time of the noise source; and
- If possible specifications regarding the noise source.

7.11 AIR QUALITY IMPACT ASSESSMENT

An air quality impact assessment was undertaken by Simon Gear from Kijani Green Energy. The specialist study is presented in **Appendix 6**.

7.11.1 Methods

A baseline study in which dust and the current environmental *status quo* as pertains to air quality was conducted in March 2013 and included in the Final Scoping Report submitted to the DEA. This Air Quality Impact Assessment (AQIA) report should be read in conjunction with the baseline study. A potential emissions source that was identified in the baseline study was the pollution that could be expected to be added to the Richards Bay airshed by the increase in shipping that would result from the proposed harbour expansion. This report tackles that aspect of this development.

Emissions to air from ships engines include a wide range of substances typically associated with the burning of fuel. This study focusses on the three most common, namely nitrogen dioxide, particulates and sulphur dioxide (SO_2).

- **Meteorological data**

Following discussions with the South African Weather Services (SAWS), the nearest available hourly sequential dataset was identified as being that of Richards Bay Airport for the year 2011. This is considered to be a reasonable proxy for the region's climate.

- **Pollutants**

Emissions for shipping are typically considered to me made up of five key pollutants: NO_x, SO_2, unburned hydrocarbons, particulate matter (PM) and CO_2. Emissions vary by engine type, size of vessel and activity (at sea (or cruising), in port (includes time spent hoteling, loading and unloading) and manoeuvring).

Irrespective of ship category (container, passenger ferry, etc), the installed engine type on board a ship and the fuel used largely dictates the ship's emission. For the purposes of this study, all ships were assumed to be dry bulk carriers with diesel engines and emission factors for 'in port' and 'manoeuvring' activities were considered (Entec, 2002).

- **Dispersion Modelling of increased ships' emissions**

Potential emission modelling is undertaken using Cambridge Environmental Research Consultants (CERC)'s latest generation model, the Atmospheric Dispersion Modelling System (ADMS 5). Input data is a combination of estimates generated using the Entec Quantification of ship emissions (2002). Ship fuel use data as well as the approximate dimensions of ships' funnels (0.8m diameter by 55m height (Panamax) and 60m height (Capesize)) is estimated using Alderton's Lloyd's Practical Shipping Guides: Port Management and Operations (2000).

Meteorological data is sourced from the South African Weather Services (SAWS).

- **Emission factors**

When modelling emissions from a site where real data is not available, it is possible to estimate the emissions that will be generated by using a series of equations to determine the likely emission of each process. These are called emission factors. An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant.

The emission factors used for this study were taken from the Entec Quantification of ship emissions (2002). The emission factors contained therein are mostly based on those developed by Entec in a study on shipping in European waters but are equally applicable to this project, given the international nature of Panamax and Capesize craft. South Africa has yet to develop its own set of emission factors.

A broad overview of potential emissions likely to be emitted can be obtained through the use of the general equation:

$$E_{kpy,i} = [A * OpHrs] * EF_i * [1 - (CE_i/100)]$$

where:

Ekpy,i = emission rate of pollutant i, kg/yr

A = activity rate, tonnes of fuel burnt/h

OpHrs = operating hours, h/yr

EFi = uncontrolled emission factor of pollutant i, kg/t

CEi = overall control efficiency for pollutant i, %

The bulk of the shipping activity in the harbour is likely to be in the form of stationary ships being loaded or offloaded, or hoteling. The breakdown of likely ship activity per visit is estimated as per Table 7-1 below (Alderton, 2000).

Table 7-1: Expected activity rates for dry-bulk ships at Richards Bay harbour.

	Manoeuvring	Loading	Hoteling	Total
Average time in port for Richards Bay (hours)	1	72	22	95

The expected increase in shipping is determined by assuming that the berths are used constantly at capacity. With an average turnaround time of 95 hours (likely an underestimation), the capacity of the harbour is expected to increase by approximately 368 ships per year, or a little more than one ship per day. Taking the forecast increase in capacity (36mtpa by 2040), this would mean an average ship load of a little under 100 000t, well within the 150 000t typically carried by a Capesize vessel. Average fuel use is estimated at 44 tons per day (Alderton, 2000). This is likely to be an overestimation, including, as it does, the fuel typically burnt while out at sea. However, Entec (2002) are explicit that there are ship emissions associated with loading, offloading and hoteling. Manoeuvring includes the addition above current levels of one additional ship movement in or out of the harbour per day, averaged over 24 hours. All of this serves to attempt to maximise the potential emissions and so to model a worst case scenario with the harbour operating at its maximum capacity. Thus, the emissions listed in Table 7-2 can be anticipated.

Table 7-2: Estimated Emissions per Activity

Operation/Activity	**NO_x**	**SO_2**	**PM_{10}**
Stationary (hoteling/loading, offloading) (g/s)	8.5	6.9	1.4
Manoeuvring	0.008	0.007	0.001

Background data for SO_2 is available but the model has been run to determine the possible additional contribution of shipping to local air quality and so baseline pollutants were not included in the model. Thus, the plots below should be seen as the amount of additional pollution that is expected in the air, as a result of the increase in shipping. To this end, exceedances of just 25% of the recommended standards were determined, to address the potential for cumulative emissions pushing the area's pollution load over the national standards.

7.11.2 Findings

- **Sulphur Dioxide**

The expected increase in local average SO_2 levels as a result of the increase in shipping is marginal and the effect is unlikely to be felt outside of the harbour. A modelled representation of SO_2 dispersion from proposed increased in shipping is represented in Figure 7-4 below.

The 100^{th} percentile plot (shown in Figure 7-5 below) represents the highest modelled value for each point that was achieved through the model run. In essence, it shows the single worst incidence of pollution that can be expected. Again, the bulk of increases in SO_2 remain within the confines of the harbour, with ships manoeuvring in and out of the harbour mouth resulting in periodic spikes in pollution along that path. Occasional exceedances of the 70 $\mu g/m^3$ may be experienced adjacent to the berths although this is still well short of the 500 $\mu g/m^3$ which would constitute an infringement.

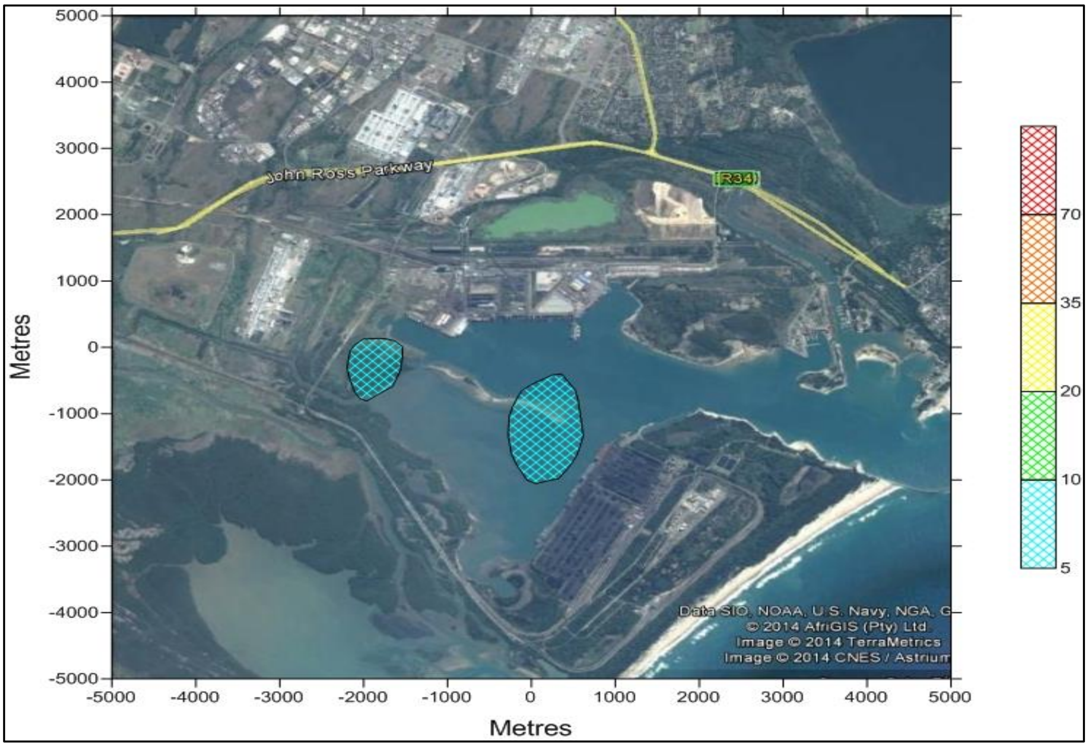


Figure 7-4: Modelled Representation of SO_2 Dispersion from Proposed Increased in Shipping (Long Term Averages, 1 hour Averaging Period, levels indicated in µg/m^3)

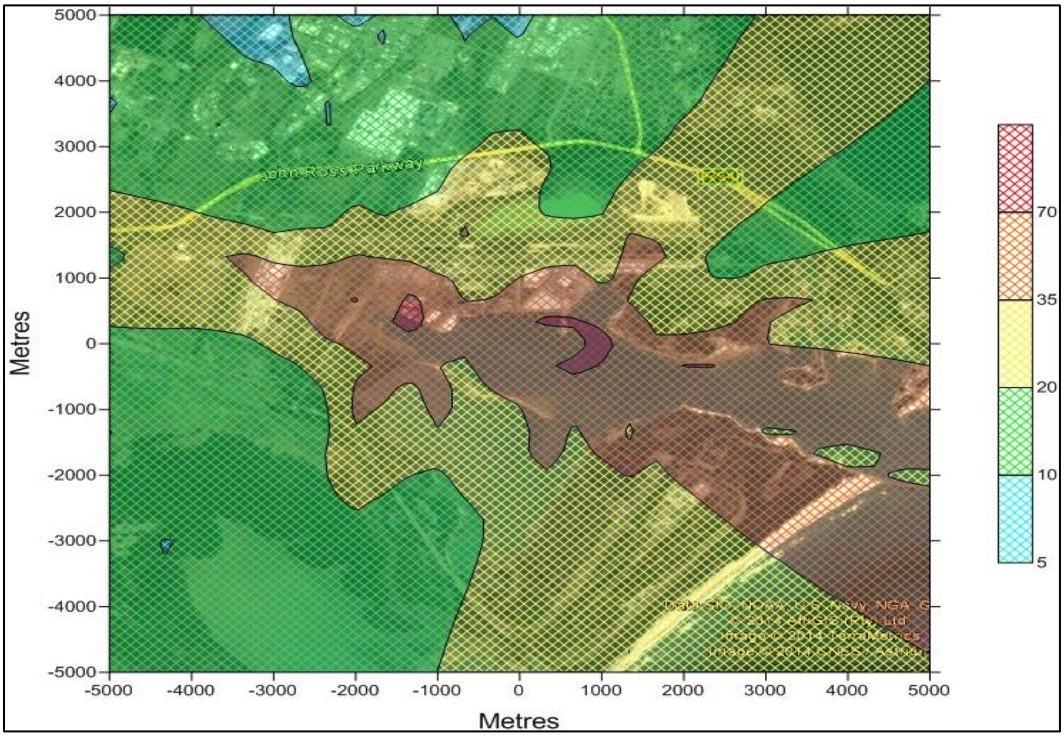


Figure 7-5: Modelled Representation of SO_2 Dispersion from Proposed Increased in Shipping (100th Percentile, 24 hour Averaging Period, Levels Indicated in µg/m^3)

Figure 7-6 below indicates the number of times that the 31.75 µg/m^3 level (25% of ambient standard) was exceeded in the year of the model run. In this case, this level was exceeded less than once a month, with exceedances most likely to happen to the west of the harbour.

Figure 7-6: Modelled Representation of Incidences of Ambient SO_2 Levels (24 hour average) from the proposed Increased in Shipping Exceeding 31.75 µg/m^3 Level (25% of ambient standard)

Figure 7-7: Modelled Representation of Incidences of Ambient SO_2 Levels (1 hour average) from Proposed Increased in Shipping Exceeding 87.5 μg/m^3 Level (25% of ambient standard)

Figure 7-7 above indicates the number of times that the 87.5 μg/m^3 level (25% of 1 hour average ambient standard) was exceeded in the year of the model run. In this case, this level was exceeded less than once a month, with exceedances most likely to happen in the vicinity of the new berths. Monthly exceedances could be expected in the immediate vicinity of the ships.

- **Particulate Matter**

The expected increase in local average PM_{10} levels as indicated in Figure 7-8 below as a result of the increase in shipping is marginal and the effect is unlikely to be felt outside of the harbour.

Figure 7-8: Modelled Representation of PM_{10} Dispersion from Proposed Increased in Shipping (Long Term Averages, 24 hour Averaging Period, Levels Indicated in µg/m^3)

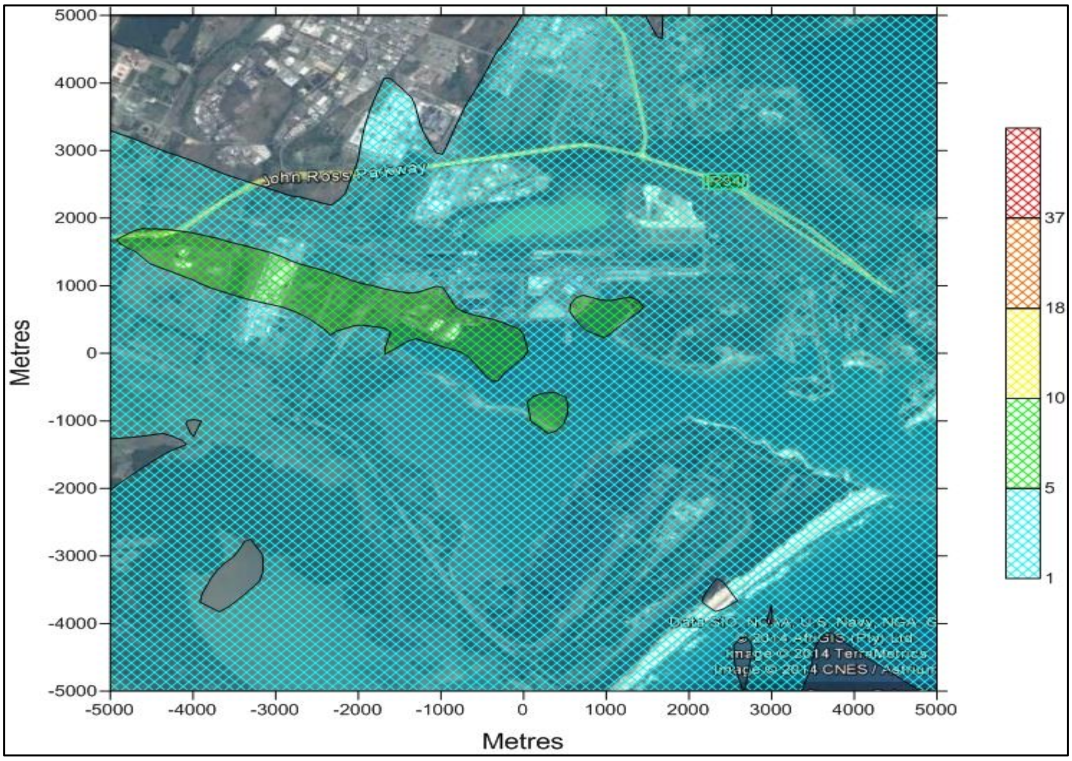


Figure 7-9: Modelled Representation of PM_{10} Dispersion from Proposed Increased in Shipping (100th Percentile, 24 hour Averaging Period, Levels Indicated in µg/m^3)

As indicated in Figure 7-9 above; the 100th percentile plot indicates a diffuse impact of additional particulates over the area with a marginally more concentrated plume to the west. Particulates never exceeded the 18.75 µg/m^3 level (25% of ambient standard).

- **Nitrogen Dioxide**

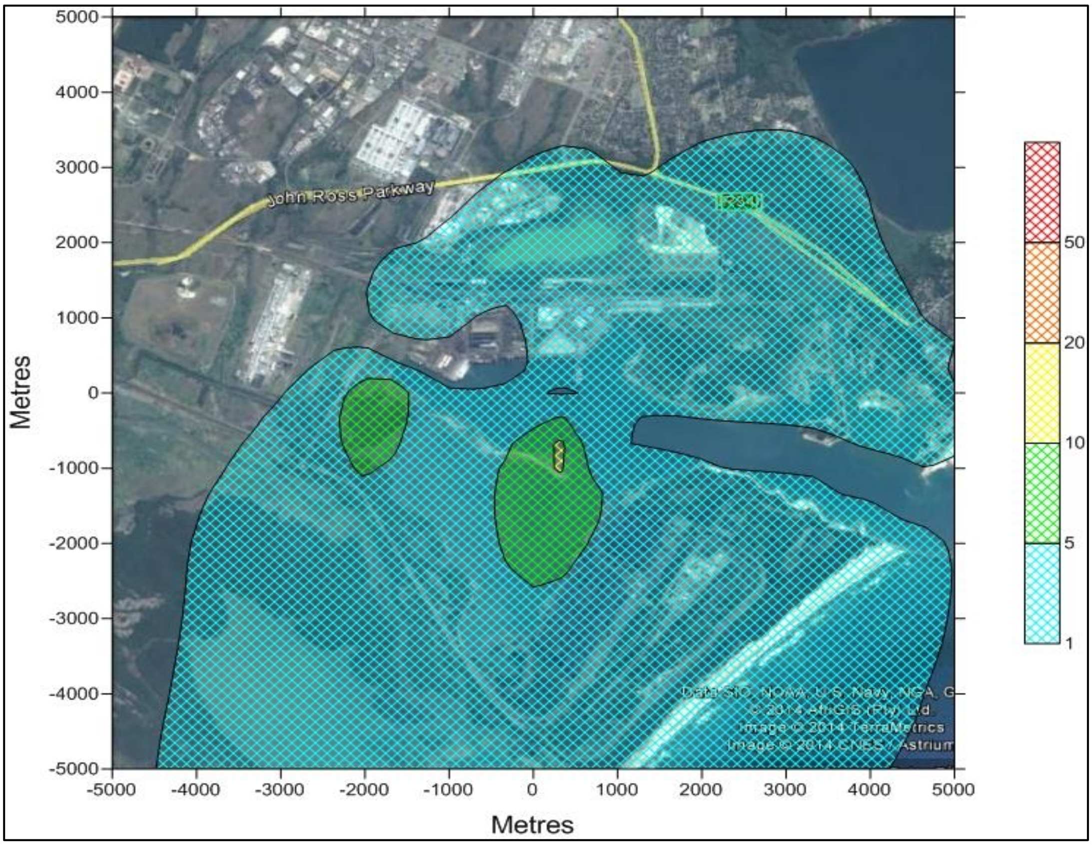


Figure 7-10: Modelled Representation of NOx Dispersion from proposed increased in shipping. Long term averages, 1 hour averaging period, levels indicated in µg/m^3)

The expected increase in local average NO_x levels as a result of the increase in shipping is marginal and diffuse over a wide area with some concentration immediately adjacent to the new berths.

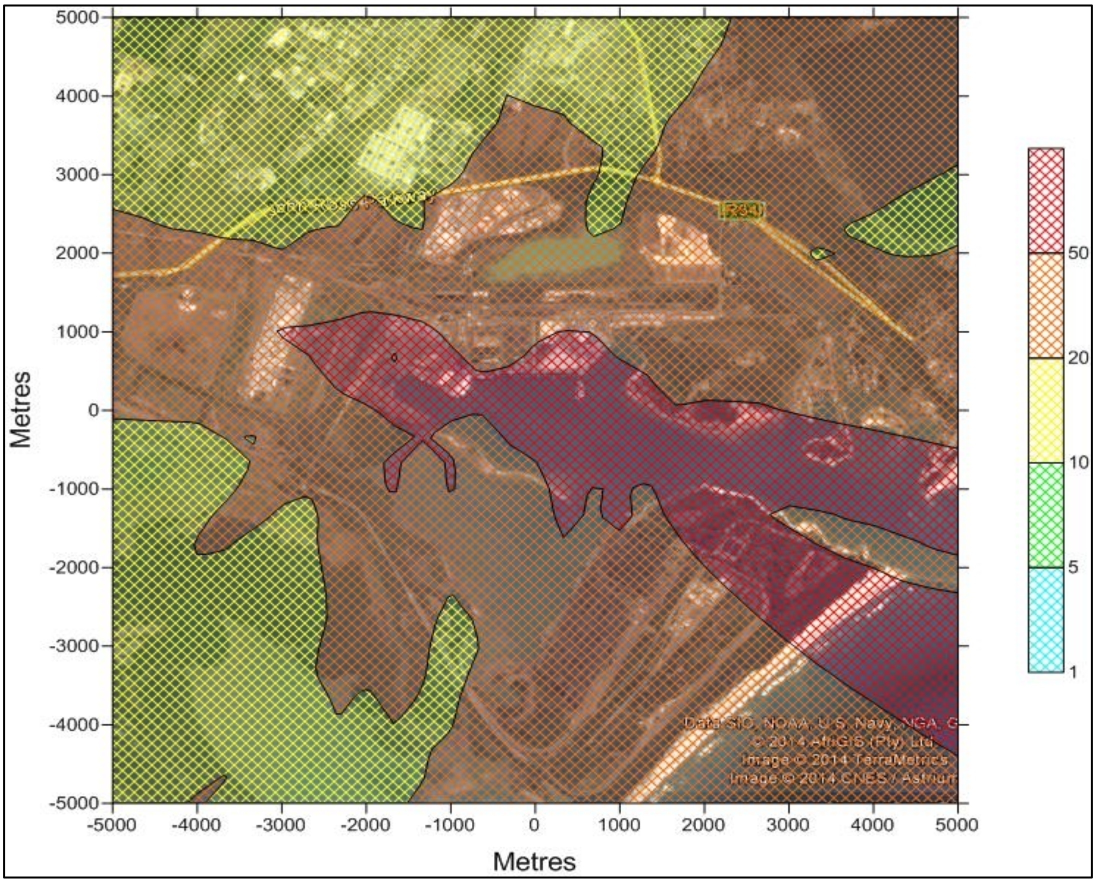


Figure 7-11: Modelled Representation of NO_x Dispersion from Proposed Increased in Shipping (100th Percentile, 1 hour Averaging Period, Levels Indicated in µg/m^3)

The 100th percentile shows spikes in NO_x for the surrounding area, with ships manoeuvring in and out of the harbour mouth resulting in periodic spikes in pollution along that path. Occasional exceedances of the 50 µg/m^3 level (25% of the national standard) may be experienced adjacent to the berths and along the entrance to the harbour mouth.

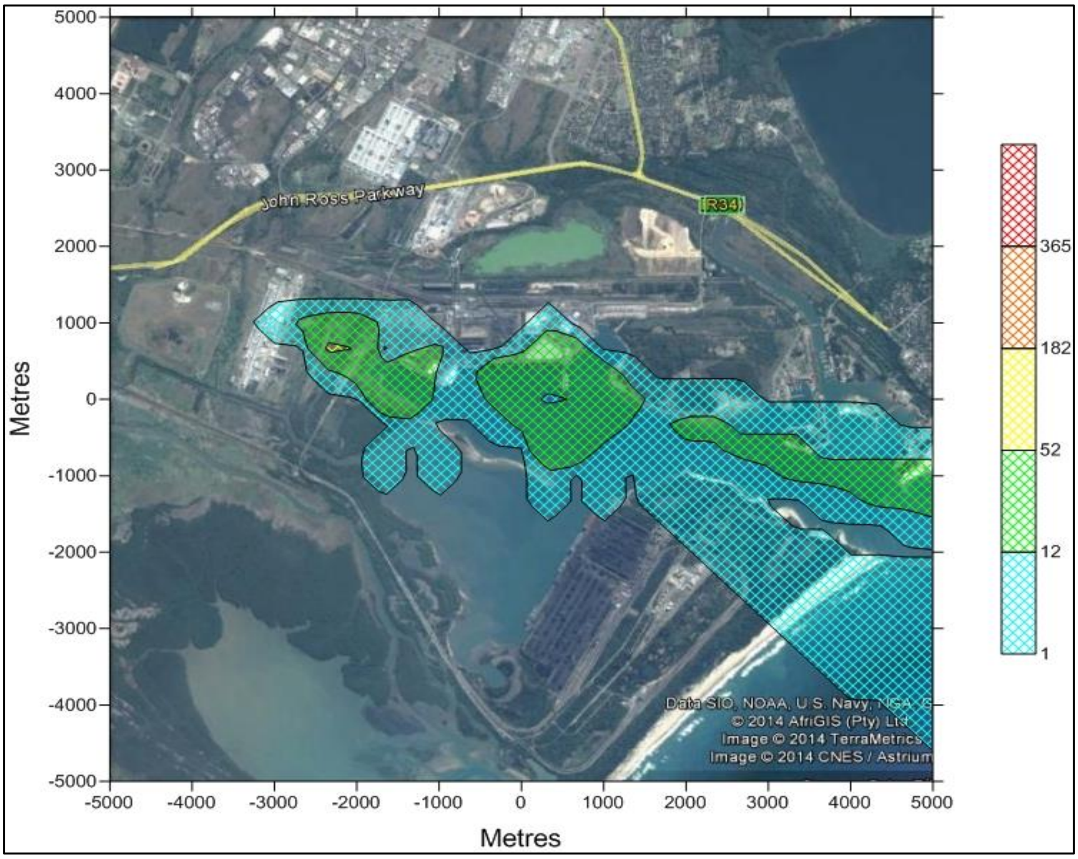


Figure 7-12: Modelled Representation of Incidences of Ambient NO_x Levels (1 hour Average) from Proposed Increased in Shipping Exceeding 50µg/m^3 Level (25% of Ambient Standard)

As indicated in Figure 7-12, the 50µg/m^3 level may be exceeded at least once a month around the new berths and along the path to the mouth, dispersed to the northern edge of the mouth. Weekly exceedances may result in the west of the harbour, adjacent to the new berths.

7.11.3 Conclusion

The dispersion plots above indicate that the expected increase in shipping should have a marginal impact on the particulate load of the area, with slightly more serious increases expected in SO_2 and NO_x levels. Without a comprehensive understanding of all emissions sources in the area, it is difficult to accurately predict the expected impact that the additional ship traffic will have but it does appear that, although some impact will be felt, that impact is unlikely to be significant in the context of the general pollution profile of an industrial area like Richards Bay.

Areas that are likely to experience increases and occasional spikes in pollution are the area immediately to the west of the harbour (fortuitously, where the Bayside SO_2 monitoring station is already situated) and along the northern edge of the harbour mouth. These spikes may be exacerbated by the periodic nature of real ship emissions rather than the long term steady emissions that can be modelled here.

7.11.4 Recommendations

It is recommended that the current dust mitigation methods and monitoring remain in place throughout the course of the harbour extension and operations.

7.12 DREDGING AND DREDGE SPOIL DISPOSAL MODELLING SPECIALIST STUDY

The Dredging and Dredge Spoil Disposal Modelling Specialist Study was conducted by Mr Roy van Ballegooyen, Mr Brent Newman, Mr Patrick Shabangu and Mr Gert Jacobs in a Joint

WSP/CSIR Report.

The specialist study is presented in **Appendix 8**.

7.12.1 Methods

The assessment of the potential environmental impacts associated with the proposed capital dredging required that:

- The suitability of sediments for potential (offshore) disposal needs to be assessed against accepted sediment quality guidelines;
- The potential impacts of dredging and dredge spoil disposal activities need to be predicted and assessed. The primary concern is the potential environmental impacts associated with the elevation of water column turbidity and potential inundation/smothering effects on benthic biota, however other potential effects such as aesthetic and noise impacts also need to be assessed;
- The potential impacts of offshore dredge spoil disposal activities on offshore ecosystems and the adjacent shoreline be assessed and, where relevant, mitigation measures introduced.

The assessment of the quality of sediments to be dredged has been undertaken in a companion report (CSIR, 2013a). This information has been used to screen dredge spoil disposal options as well as inform this dredging and dredge spoil disposal modelling study. The requisite baseline reports on the water quality (CSIR, 2013b) and specifically the water column turbidity (CSIR, 2013c) observed in the port in its present layout have been produced and provide a context for this modelling study.

This specialist study comprises a specialist modelling study to inform the assessment of the potential environmental impacts associated with dredging and dredge spoil disposal activities and is focussed on the prediction of potential turbidity, smothering and shoreline impacts associated with dredging and dredge spoil disposal activities.

The assessment of water quality and smothering impacts has been achieved by the set-up and calibration of a three dimensional model that is then used to predict the extent, severity and duration of changes in turbidity, water quality and smothering associated with dredging and dredge spoil disposal activities. Specifically, this requires a characterisation of the extent of dispersal of dredge spoil from the proposed offshore dredge spoil disposal site. The model results are summarised in terms of exceedance of dredging (water quality) guidelines as well as and other relevant guidelines that have been determined in consultation with other specialists assessing potential impacts in the marine environment.

7.12.2 Description of Dredging Activities

There are a number of options for the removal of material for the development of the berths and approach channels. These are all described in Aurecon (2012a,b) and BKS (2013), the former providing a description of possible dredge technologies and the latter a description of possible dredge spoil disposal options.

It is not clear whether the dredging will take place in phases or not, consequently it has been assumed in this study that, once commenced, the dredging will continue uninterrupted until completed. This constitutes a conservative assumption in terms of the likelihood of elevated turbidity levels as it assumes the maximum dredge rates and consequently the maximum sediment loading in the water column both at the dredging location and at the dredge spoil disposal site. However, this assumption may not be conservative in terms of the duration of impacts should the dredging occur over a significantly longer period.

Presently it is not clear when dredging will commence or whether it will be constrained to any particular season. For the purpose of assessing impacts a single dredge duration has been assumed that commences in a late winter/early spring period and extends into summer. This is a similar period to the last major capital dredging operation undertaken in the Port of Richards Bay, namely the development of Berth 306 at the Richards Bay Coal terminal. This assumption is largely an expedience driven by the limited data available to the modelling study but is considered sufficiently representative of the conditions under which dredging operations are likely to occur.

Although seasonality exists in terms of wind and wave driven flows and turbulence (higher wind speeds and higher wave conditions in winter compared to summer), the flows in the vicinity of the dredge spoil disposal site are predominantly due to the influence of the large-scale offshore flows associated with the Agulhas Current that displays no clear seasonality. The selection of different start date for the dredging, while likely to have some influence on the modelling outcomes1, is unlikely to change the conclusions of the modelling study or any ecological assessments based on the modelling study.

7.12.2.1 Quantities to be dredged

It is difficult to estimate the total in-situ volume of material to be dredged for the Option 3A development from existing documentation supplied to the specialist team (Aurecon, 2012a,b, 2013; BKS, 2013). There exist a number of reasons for this uncertainty. First, the proposed developments have been broadly characterised in many of the FEL-2 documents as the "Port Expansion Project" that includes all possible development options (Options 1A, 1D and Option 3A) for the 500, 600 and 800 series of berths.

It is estimated that up to 9.718 million m3 of material will need to be dredged depending on the development option selected (BKS, 2013). Further it is noted in Aurecon (2013) that Option 3A will required the least dredging due to the fact that only Panamax vessels are planned to be accommodated for this option resulting in the proposed dredge depths of -15.5m CD as opposed to the greater depths (-19.0 m CD) required for the other preferred options (Options 1A and 1D). Consequently the anticipated dredge volumes for Option 3A are expected to be less than the maximum of 9.7 million m3 suggested in the above reports as a maximum for all of the preferred options under consideration.

Dredge volumes assuming no excavation "in the dry"

In the absence of more detailed available information, the dredge quantities for the narrow and wide basin layout options have been estimated from expected differences between the proposed new dredged depths and the existing water depths in the port as well as elevations of terrestrial areas to be dredged (and excavated). For the purposes of estimating the dredge volumes an average terrestrial land elevation of 5m above mean sea level (MSL) has been assumed. This corresponds to an elevation of the terrestrial areas to be dredged (and excavated) of just under 6m above CD. Included in the dredge volumes is the narrow area to the north of the sand spit that needs to be dredged to a water depth of -19.0 m CD.

Based on these assumptions the estimated dredge volumes are 4.695 million m3 and 8.850 million m3 for the narrow and wide basin layouts, respectively (see Figure 7-13, Figure 7-14 and Table 7-3). To provide a conservative estimate of the material to be dredged (and excavated), an allowance of approximately 5% has been made for possible "over-dredging" or excavation of additional material. The assumed dredge quantities are therefore assumed to be approximately 4.930 million m3 for the narrow basin option and 9.293 million m3 for the wide basin option.

Dredge volumes assuming excavation of some of the material "in the dry"

How much of the total material to be removed (to create the berths) that will be dredged and how much that will be excavated "in the dry" is uncertain. The extent to which excavation "in the dry" occurs will be determined by practicalities such as the disposal or re-use of these excavated sediments.

If the present terrestrial areas are to be excavated to a depth of MSL (+1.09 m CD) then the volumes of material to be excavated will be approximately 0.715 million m3 and 1.168 million m3 for the narrow and wide basin options, respectively. The amount of material to be dredged accordingly will be reduced to 3.980 million m3 and 7.682 million m3 for narrow and wide basin options, respectively. If a 5% allowance is made for over-dredging or unexpected additional material to be dredged, then these dredge volumes increase to 4.179 million m3 and 8.807 million m3, respectively.

Similarly if the terrestrial areas are to be excavated to a depth of -5m CD then the volumes to be excavated “in the dry” will be approximately 0.858 million m3 and 1.402 million m3, for the narrow and wide berth layout options, respectively. This leaves volumes remaining to be dredged of 3.122 million m3 or 6 .280 million m3 for the narrow and wide berth layout options, respectively. If a 5% allowance is made for over-dredging or unexpected additional material to be dredged, then these dredge volumes increase to of 3.278 million m3 and 6.594 million m3 for the narrow and wide berth layout options respectively.

The above estimated dredge volumes are summarised in Table 7-3 below.

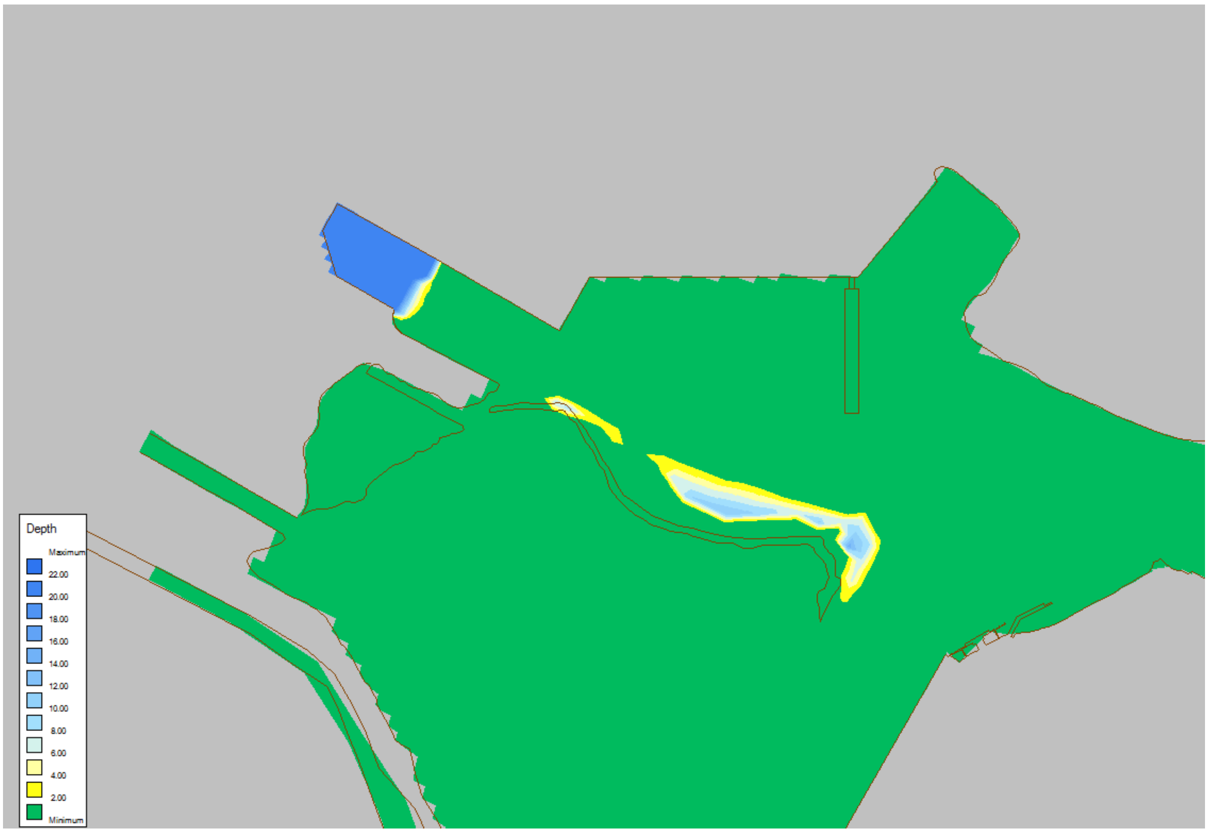


Figure 7-13: Estimated depth of sediment that needs to be dredged or excavated for the Option 3A narrow basin layout

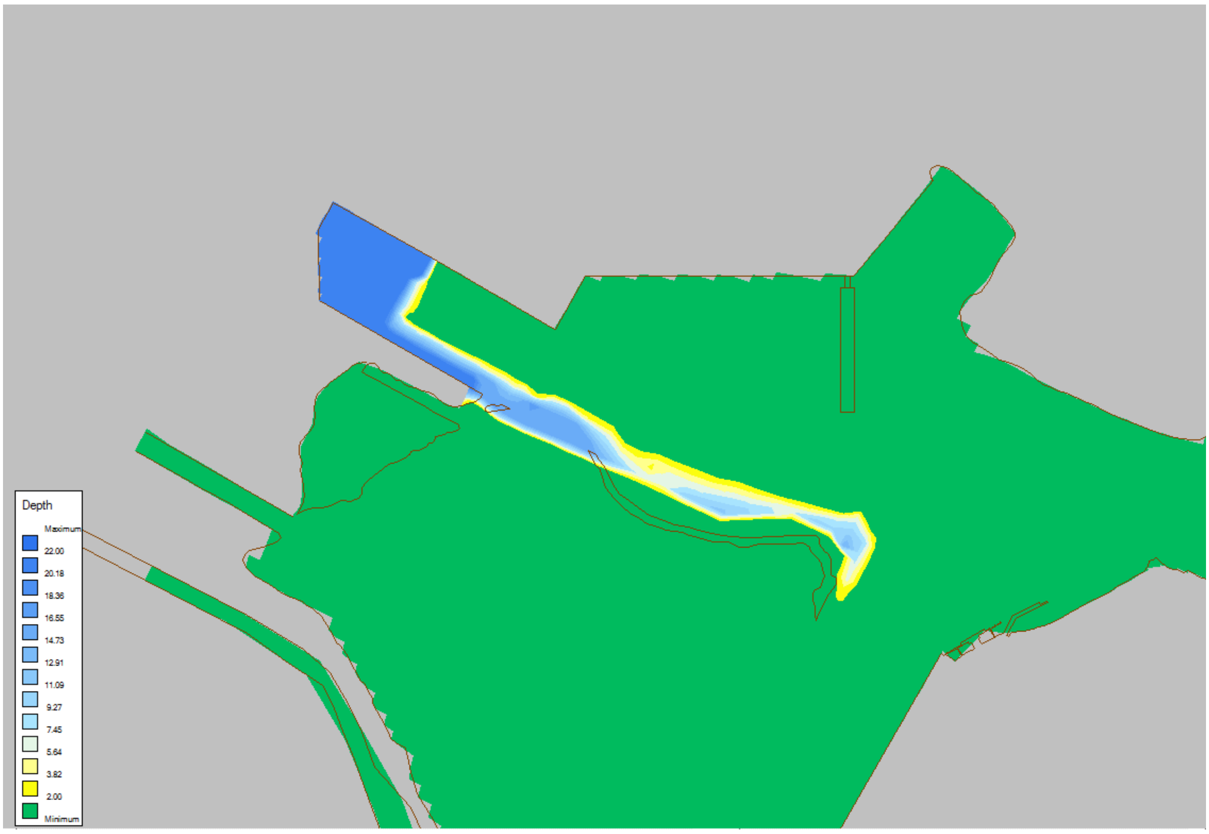


Figure 7-14: Estimated depth of sediment that needs to be dredged or excavated for the Option 3A wide basin layout

Table 7-3: Grain size distribution and sediment volumes for the material to be dredged during the Port Capacity Expansion project (BKS, 2013).

	Estimated volumes (million m^3)		Estimated volumes + 5% (million m^3)	
	Narrow layout	Wide Layout	Narrow layout	Wide Layout
Total material to be removed	4 695 000	8 850 000	4 929 750	9 292 500
Option 1 (No material excavated in the dry thus all material to be dredged)				
"In the dry"	-	-	-	-
Dredged	4 695 000	8 850 000	**4 929 750**	**9 292 500**
Option 2 (Material up to MSL excavated "in the dry" and the remainder to be dredged)				
"In the dry"	715 000	1 168 000	750 750	1 226 400
Dredged	3 980 000	7 682 000	4 179 000	8 066 100
Option 2 (Material up to -5m CD excavated "in the dry" and the remainder to be dredged)				
"In the dry"	858 000	1 401 600	900 900	1 471 680
Dredged	3 122 000	6 280 400	3 278 100	6 594 420

As this study is intended to assess the potential impacts of dredging and dredge spoil disposal, we have taken the most conservative approach and assumed that all of the material to be removed to develop the berths and ensure safe navigation within the port will be removed by dredger (*i.e.* it is assumed that no excavation and removal of material will occur "in the dry"). If a 5% allowance is made for potential over-dredging or unexpected additional material that may need to be dredged, the dredge volumes to be assessed are approximately 9.293 million m^3 for the wide basin or 4.930 million m^3 for the narrow basin option.

It is likely for both environmental and cost regions that the preferred basin width will be the narrower layout option; consequently we have assessed only this "most likely" option. Thus the assumed dredge volume for this study therefore is approximately 4.930 million m^3.

7.12.2.2 Physical characteristic of the Material to be Dredged

It is important that the physical characteristics of the material to be dredged is known as it largely determines what dredging technology is best suited to the dredging activities, the extent to which there can be a beneficial used for the sediments dredged, the volumes to be disposed of at the offshore dredge disposal site and also the turbidity that will be generated at the dredging and dredge spoil disposal locations.

A review of the available geotechnical information (Aurecon 2012b, BKS, 2013) suggests that the sediments in the area of interest generally comprise sediments that are predominantly sandy in nature overlying Cretaceous bedrock. Silty clays and clayey silts are virtually absent from available geotechnical borehole data in the vicinity of the proposed new 600 series berths. It should however be noted that no borehole data exists for the area to be dredged for berths 604 and 605. The only borehole data are those (D30, D44 and D25) located in the proposed 500 series berth area to the southwest of the proposed 604 and 605 berths and inland to the northeast of the proposed new 600 berths (B606-P11 and B606-P040), implying that the nature of the sediments to be dredged remains relatively uncertain (Aurecon, 2012b).

An initial assessment of all of the material to be dredged as part of the overall Port Expansion Project that includes all possible development options (Options 1A, 1D and Option 3A) for the 500, 600 and 800 series of berths, suggested grain size distributions as described in Table 7-4 below (BKS, 2013). However subsequent communications with the engineering and environmental assessment practitioners and the final FEL-2 design report suggest a significantly different assumed distribution of grain sizes and sediment types (Table 7-5). These are the size distributions assumed for this study. Note that the volumes reported in Tables 7-4 and 7-5 are based on the original dredge volume estimate of ~ 9.7 million m3 not those used in this study, i.e. approximately 4.930 million m3.

Table 7-4: **Grain size distribution and sediment volumes for the material to be dredged during the Port Expansion project (BKS, 2013).**

	% Sediment type	Volume of sediment type
Gravel	22%	2,121,000
Sand	4%	394,000
Soft Clay	32%	3,093,000
Stiff Clay	14%	1,326,000
Rock	29%	2,784,000
Total	**100%**	**9,718,000**

Table 7-5: Grain size distribution and sediment volumes for the material to be dredged for the Option 3A port development component of the Port Expansion project (Aurecon, 2012a).

Sediment Type	% Sediment type	Volume of sediment type*	
		Narrow Basin	Wide Basin
Gravel	-	-	-
Sand	4%	206 400	388 000
Silt	0%	0	0
Soft Clay	34%	1 754 400	3 298 000
Stiff Clay	14%	722 400	1 358 000
Rock	48%	2 476 800	4 656 000
Total	**100%**	**5 160 000**	**9 700 000**

*Includes a 5% increase in the estimated volumes to be dredged to allow for potential over-dredging or inaccuracies in the estimates of material to be dredged. This is done to ensure a conservative assessment of potential dredging impacts.

7.12.2.3 Dredging Technology, Dredging Durations and Dredging Rates

The duration of the dredging operations is determined by the dredging technology used and the quantity of material to be dredged. The exact dredging technology to be used will determine not only the dredging duration but also sediment loading at the dredging location. Furthermore, the different dredge technologies proposed for the project (i.e. a cutter suction dredger (CSD) or the use of a combination of a trailing suction hopper dredger (TSHD) and backhoe dredger (BH)) are likely to have different outcomes in terms of mobility of the dredge spoil disposed at the offshore dredge spoil disposal site, particularly where there is a large quantity of fines in the dredge spoil. The material from a backhoe tends to remain more consolidated when disposed at an offshore disposal site and consequently is less likely to be re-suspended and become mobile (i.e. is likely to result in a lesser elevation in water column turbidity during storms, etc). Conversely, the material from a Cutter Suction Dredger (and to a lesser extent from a Trailing Suction Hopper Dredger) will not remain consolidated to the same extent as material from a backhoe operation and consequently is more likely to be re-suspended and display greater mobility at an offshore dredge spoil disposal site, with an associated greater elevation in water column turbidity. These differences in behaviour are expected to amplify with increasing fines content in the material to be dredged. For the above reasons it is important that there is a sufficient knowledge of the proposed dredge technology (or technologies) to allow a robust assessment of likely turbidity and sediment movement in the dredging and dredge spoil disposal modelling study.

It is stated in the FEL-2 study (Aurecon, 2012a) that the preferred dredge technology is one of two combinations of dredging technologies. The first of these comprises the use of one barge-loading CSD with five 3 700 m3 barges to transport the material to the offshore disposal site located approximately 10 km offshore. The second proposed dredge technology is the use of a combination of a TSHD to dredge sands, silts and soft clays and the use of a backhoe dredger to dredge the stiff clays and rock material.

Here it is assumed that four barges (size not specified) will be used to transport the material to the dredge spoil disposal site (located approximately 10 km offshore).

Using dredging production rates for CSD, TSHD and BH dredgers, reported in Pullar and Hughes (2009), indicative high and low "effective" dredge rates and dredge durations have been estimated for *in-situ* dredge quantities of 4.930 million m^3 (narrow layout) and 9.7 million m^3 (wide layout). This provides indicative dredging duration using various dredge technologies (see Table 7-6).

Table 7-6: Effective dredging rates and durations for various dredge technologies for proposed dredge volumes of 4.930 million m^3 (narrow layout) and 9.293 million m^3 (wide layout).

	Small Backhoe	Medium Backhoe	Large Backhoe	TSHD (low rate)	TSHD (high rate)	CSD (low rate)	CSD (medium rate)	CSD (high rate)
Rate of dredging (m^3/h)	200	400	800	1 000	12 500	500	1 500	3 000
Rate of dredging assuming 100 operational hours/week (m^3/week)	20 000	40 000	80 000	100 000	1 250 000	50 000	150 000	300 000

Rate of dredging assuming 140 operational hours/week (m^3/week)	28 000	56 000	112 000	140 000	1 750 000	70 000	210 000	420 000
Duration of dredging assuming **dredge volumes of 4.930 million m^3** and **100 operational hours/week** (weeks)	246.5	123.3	61.6	49.3	3.9	98.6	32.9	16.4
Duration of dredging assuming **dredge volumes of 4.930 million m^3** and **140 operational hours/week** (weeks)	176.1	88.0	44.0	35.2	2.8	70.4	23.5	11.7
Duration of dredging assuming **dredge volumes of 9.293 million m^3** and **100 operational hours/week** (weeks)	464.7	232.3	116.2	92.9	7.4	185.9	62.0	31.0
Duration of dredging assuming **dredge volumes of 9.293 million m^3** and **140 operational hours/week** (weeks)	331.9	165.9	83.0	66.4	5.3	132.8	44.3	22.1
Sediment Loading Rate (kg dry material/m^3 dredged)	25	17	12			3 to 6 (no LMOB*) 13 to 16 (with LMOB*)		

*LMOB refers to lean mixture overboard, which is a process where overflow is allowed from the hoppers, the purpose being to increase the sediment volume in each hopper load. This overflow water has a relatively high concentration of fine sediments and this significantly increases the sediment loading at the dredging location.

Additional information on possible dredging technologies, dredging scenarios and sediment loading of the water column due to dredging activities is provided in (Bray, 1997, van Ballegooyen *et al*., 2006 and Pullar and Hughes, 2009).

For the purposes of this study we have assumed that CSD dredging operation3 with a CSD capable of a just more than medium effective dredging rate (263 400 m3 per week). This results in an estimated dredging duration of 18.7 weeks or approximately 131 days of continuous dredging operations. In terms of dredge spoil disposal a barge size of 3 700 m3 has been assumed. For the above assumed effective dredge rates, this implies that 21 barge trips to the dredge spoil disposal site will be required for each day of dredging, *i.e*. a total of 2 880 trips. These dredging rates are similar to those that occurred for the Berth 306 development where a total of 3,840,361 m3 of material was dredged and disposed of at the offshore dredge spoil disposal site in 882 barge trips (average of 4,354 m3 of *in-situ* dredged sediment per 10 330 m3 hopper load) over a period of 22 weeks. This suggests that the hoppers contained 27% sediments by weight (dry weight) per hopper load. In this study it is assumed that the barges contain 30% sediments by weight, a slightly higher percentage of sediments than occurred during the Berth 306 dredging.

Dredging activities for the Berth 306 development commenced on the 6 August 2005 and ended in early January 2006, with the last spoils being disposed of early on the morning of 5th January 2006. This gave and effective dredge rate of approximately 175 000 m3 per week, *i.e.* a dredge rate approximately 78% of that assumed for this study. The dredging programme undertaken at that time therefore is similar to that assessed in this modelling study, the major differences being 28% increase in the volume of sediments being dredged and an approximate 50% increase in the assumed dredging rate (due to the assumption of a slightly shorter dredging duration for the increased volume of sediments assumed for this study).

This leads to a quite a conservative assessment in terms of the sediments being released into the marine environment due to dredging activities. Consequently the results of the modelling study may be considered indicative of potential impacts associated with the dredging and disposal of larger dredge volumes of sediments over a somewhat longer time period.

7.12.2.4 Dredge Spoil disposal

The possibilities for the disposal and/or beneficial use of the dredged material has been discussed in some detail in BKS (2013), based largely on a number of previous feasibility studies by the CSIR (e.g. CSIR, 1994, 2000, 2002, 2004a,b, 2005a).

The dredge spoil disposal and or beneficial use option considered were as follows:

- Land creation (sand, silt): No need was identified for land creation in Richards Bay (for plans up until the year 2060;
- Land improvement (sand, silt): This includes the improvement of the quality of soil and/or making the land functional by elevating it above flood levels. At that stage no need for land improvement was identified within this study in Richards Bay;
- Offshore berms (sand): This involves the construction of offshore sand berms for the protection/nourishment of adjacent beaches. These have been previously evaluated (e.g. CSIR, 1994a) as a nourishment method (i.e. as feeder berms) for the northern beaches in Richards Bay, however and environmental concern is the suspension of fine material in the water column during the placement of the sediments. It may be necessary to separate sand from clay to make this option viable.
- Beach nourishment (sand): There is a clear need for sand for beach nourishment on the northern beaches of Richards Bay, in addition to sand routinely supplied from maintenance dredging operations. However the efficacy of this would need to be carefully evaluated, particularly given that the dredge material constitutes mainly clays (48%) and rock (48%).
- Capping of waste sites (sand, clay): Sand material can be used for capping of contaminated material disposal sites on the seabed for which sand, clay or mixed

materials can be used. However there is at present no requirement for this in Richards Bay.

- Capping at landfill sites: This requires clay, and while a viable usage from the dredge material, it may require separation of clays from other size fractions. Furthermore, depending on the origin of the material and how it was excavated or dredged, the available material may not be suitable for this purpose.
- Replacement fill (sand): Fill is a beneficial use that can be considered when dredged material has superior physical qualities compared to soils near the dredging site. The material proposed to be dredged comprises mainly clays that are unsuitable for this purpose, however the large percentage of rock may be used for this purpose.
- Other on-land uses: Other on-land uses such as construction material (present dredged material mostly not suitable) and habitat generation (for which fines are quite suitable.

Based on the size distributions of the material to be dredged (mainly rock and clays), the chances are that most of the fines (clays and small percentage of sand) will be disposed of at the offshores dredge spoil disposal site. The rock in principle could be used for fill, however it is a relatively large quantity of rock and, furthermore, the rock may not be suitable for this purpose. The rock could also be disposed of at the offshore dredge spoil disposal site, however this may not be wise as it will remain on the dredge spoil disposal site and not be redistributed as would be the fine material. The sequence of dredging this material (clays first and then rock or rock and clay together) suggests that the disposal of the rock at the offshore site will severely hinder the movement of fines off the dredge spoil disposal site and therefore limit the future use of this site for the disposal of dredge spoil due to the resulting “semi-permanent” change in water depth that has the potential to have long-term affects adjacent shorelines or as a minimum change the longshore sediment transport dynamics of this section of the shoreline.

Nevertheless, for the purposes of this assessment we have assumed that all of the dredged material (including rock) will be disposed of at the offshore dredge spoil disposal site as this provides a worst case scenario in terms of changes on the seabed at, and in the vicinity of, the dredge spoil disposal site. The inclusion of rock in the model simulations does not change the sediment loading of the water column as it is almost exclusively the fines being dredged and dumped that result in elevated turbidity in the water column. While at the site of dredging, all material dredged is considered to contribute to the sediment loading of the water column, at the dredge spoil disposal site it is only the fine material that is considered to generate sediment loading in the water column. Thus the consequences in terms of elevated water column turbidity are limited should the rock material be included or excluded from the model simulations.

7.12.2.5 Potential Dredging Scenarios

In terms of potential environmental impacts, the sediment loading (**S_d**) at the dredging location ranges between 3 and 6 kg dry material per m^3 of in-situ material dredged while for Trailing Suction Hopper Dredgers (TSHD) the sediment loading (**S_d**) at the dredging location ranges between 1 and 7 kg dry material per m^3 of in-situ material dredged. Provided that the dredging rates of a TSHD dredging rates do not exceed those of the CSD, the assumption that the use of CSD dredging technology alone will provide conservative model results both in terms of the loading at the dredging location and at the dredge spoil disposal site offshore. Given that, if a TSHD is used, that a significant proportion of the material to be dredged (*i.e*. the rock) will have to be removed by backhoe that typically has a low dredging rate, the sediment loading rates associated with a TSHD/Backhoe combination is expected to be significantly lower than for the use of only a CSD for the dredging. The exception will be the initial 10 weeks or so of dredging when the when the dredging rates are likely to be comparable as will be the sediment loading rates. It should be noted that most of the overlying sediments will need to be removed by excavation or TSHD before the backhoe can access the deeper rock, therefore it is unlikely that both a TSHD and backhoe will be deployed simultaneous for significant periods.

The nature of the material from Cutter Suction Dredge dredging operations (largely a slurry with some clumps of clay) will, in all likelihood, result in a greater loss of fines into the water column during disposal. This material, in all likelihood, also will display a higher mobility once deposited on the seabed. Backhoe dredging operations are expected to result in a greater “clumping” of dredge material, which is likely to release less fines into the water column when disposed at the dredge spoil disposal site and will also in all likelihood display a lesser mobility than dredge spoil generated by a Cutter Suction Dredge. These differences in the two operations are likely to increase for increasing amounts of muds in the material to be dredged.

Table 7-7: Indicative sediment loading rates for the various dredging technologies proposed for the Richards Bay Port Expansion Option 3A development assuming an in-situ dredge volume of 4.930 million m^3

	Small Backhoe	Medium Backhoe	Large Backhoe	TSHD for soft material	CSD only
Volume of material to be dredged (m3 of in-situ material	2 366 400 (48% of the total)			2 563 600 (54% of the total)	4 930 000
Rate of dredging (m^3/h)	200	400	800	1 820	1880
Rate of dredging assuming 140 operational hours/week (m^3/week)	28 000	56 000	112 000	255 000	263 400
Duration of dredging assuming dredge volumes of 4.930 million m^3 and 140 operational hours/week (weeks)	84.5	42.3	21.1	10.1	18.7
Sediment Loading Rate (kg dry material/m^3 dredged)	25	17	12	1 to 7 (no LMOB) 11 to 17 (with LMOB)	3 to 6 (no LMOB) 13 to 16 (with LMOB)
Sediment loading rate ($\mathbf{S_d}$) for assumed rate of dredging (tonnes dry material/week)	700	952	1 344	255 to 1 785 (no LMOB) 2 805 to 4 335 (with LMOB)	790 to 1 580 (no LMOB) 3 425 to 4 215 (with LMOB)
Sediment loading rate ($\mathbf{S_d}$) for assumed rate of dredging (kg dry material/s)	1.16	1.57	2.22	0.42 to 2.95 (no LMOB) 4.648 to 7.17 (with LMOB)	1.31 to 2.61 (no LMOB) 5.66 to 6.97 (with LMOB)

* LMOB refers to lean mixture overboard, which is a process where overflow is allowed from the hoppers, the purpose being to increase the sediment volume in each hopper load.

The effective dredging rates assumed for the modelling study are summarised in Table 7-8 below. These have been translated into the sediment loading rates used in the modelling study reported in Table 7-9.

Table 7-8: The effective dredging rates and sediment loading rates at the dredge site that have been used in the modelling study assuming a dredge volume of 4.930 million m3.

	CSD
Volume to be dredged (m^3 *in-situ* material)	4 292 750
Assumed rate of dredging (m^3/of *in-situ* material/week)	263 400
Sediment Loading Rate ($\mathbf{S_d}$) (kg dry material/m^3 dredged)	3*[1] (13)*[2]
Sediment loading rate for assumed rate of dredging (tonnes dry material/week)	790 (3 424)*[2]
Sediment loading rate ($\mathbf{S_d}$) for assumed rate of dredging (kg dry material/s)	1..307 (5.662)*[2]

Table 7-9: The sediment loading rates at the dredge spoil disposal site that have been used for the modelling study assuming a dredge volume of 4.930 million m3.

Type of material	% of in-situ dredge material	Dry density of sediment fraction in hopper	Mass of sediment fraction per dump (kg)	Discharge flow rate per 6 min dump (m3/s)	Dry density of sediment fraction in hopper (kg/m3)	Sediment loading of fraction (kg/s)
Rock	48.0	382	1 411 920	10.278	381.60	3922
Gravel	0	0	0		0.00	0
Sand	4	32	117 660		31.80	327
Mud (10%)	4.8	38	141 192		38.16	392
Mud (90%)	43.2	343	1 270 728		343.44	3530
Total	**100**	**795**	**2 941 500**		**795.00**	**8171**

The estimated sediment loading in Table 7-9 above is based on the following assumptions:

- a barge volume of 3 700 m3 of which 30% comprises sediments when full and ready to sail to the dredge spoil disposal site;
- that it takes 6 minutes for the barge to empty once the barge doors have been opened;
- that all of the rock, gravel, sand and 90% of the muds are deposited at the seabed (*i.e.* are released into the bottom layer of the model), while the remaining 10% of the muds are assumed to be released into the water column (*i.e.* distributed evenly in all the vertical model layers).

In terms of the duration (rather than the intensity) of impacts, the assumption of any of the Backhoe dredging operations will constitute a worst case scenario in terms of impacts where duration is the major consideration. However, the persistence of the expected turbidity effects is likely to be somewhat mitigated by the fact that the release of sediments into the water column during dredge spoil disposal and subsequent re-suspension of this material is likely to be significantly less for dredging operations utilising a backhoe alone (or in combination with a TSHD being proposed as an alternative here) compared to Cutter Suction Dredge dredging operations.

The assumption of Cutter Suction Dredge dredging operations where lean mixture overboard is allowed constitutes a worst case scenario in terms of assessing potential environmental impacts. Should lean mixture overboard not be considered, the Cutter Suction Dredge dredging scenario would still constitute a worst case scenario under the assumption that the greatest concerns in terms of turbidity impacts are likely to be those in the marine environment external to the port and that the sediments re-suspended at the dredging site are largely retained within the port in close proximity to the dredging operations.

7.12.2.6 Findings

In summary, in terms of the following:

- the sediment loading rates at the dredging site;
- the rate of release of fines into the water column during dredge spoil disposal at the dredge spoil disposal site, and;
- the mobility and likely re-suspension of dredge spoil once on the seabed.

The assumption of a Cutter Suction Dredge dredging operation allowing lean mixture overboard comprises a conservative assumption in terms of assessing potential environmental impacts.

7.12.2.7 Environmental Conditions

The marine and coastal environment encompassing the Port of Richards Bay has been extensively, and repetitively, described in the various EIAs, SEAs and specialist studies conducted as part of the overall port development (*e.g.* CSIR, 1998, 2003, 2005b, 2009). The synopsis below is taken mainly from these reports. It focuses primarily on those coastal processes and areas where local marine ecosystems and activities may be directly or indirectly affected by the dredging activities.

7.12.2.7.1 Tides

Tides around South Africa are classified as semi-diurnal microtidal, with a dominant M2 tide (*i.e.* there are two high tides and two low tides per day), and tidal amplitudes generally below 2 m. A substantial spring-neap variation exists, with amplitudes as little as 0.5 m at neap tides and on occasion over 2 m at spring tides (South African Navy Tide Tables). The tides in Richards Bay thus are semi-diurnal and have a mean spring and neap tidal range of 1.86 m and 0.50 m, respectively (SAN Hydrographer, 2014).

The tidal period is 12 hours and 25 minutes, with a slight diurnal inequality. The tides propagate from west to east from an amphidromic point in the Southern Ocean. The tidal phase lag along the East Coast however is small and consequently irrelevant for the scale of modelling being undertaken here. The tidal characteristics for the Port of Richards Bay are listed in Table 7-10 below.

Longer-period water level variations also occur as a result of meteorological influences, particular wind. Coastal trapped waves along the south coast have sea level amplitudes that on occasion are in excess of 0.5 m (Schumann and Brink, 1990), however these changes in water level associated with meteorological conditions are less than for more southerly locations along the South African coastline (van Ballegooyen, 1996).. Net water level variations thus are a combination of longer period wind and wave set-up as well as shorter-period tidal variations. Offshore current variability associated with the Agulhas Current may result in additional low (periods of 20 days or more) and relatively small water level variations (van Ballegooyen, 1996).

Table 7-10: Tide Characteristics for the Port of Richards Bay.

Tide	Height (m) above Chart Datum
Highest Astronomical Tide	2.47
Mean High Water Spring	2.11
Mean High Water Neap	1.48
Mean Level	1.20
Mean Low Water Neap	0.97
Mean Low Water Spring	0.27
Lowest Astronomical Tide	0.00

Presently Chart Datum (CD) relative to Land Levelling Datum (LLD) is assumed to be -1.015 m and Mean Level (ML) is +1.2 m CD. Prior to 31 December 1997, CD relative to LLD was defined as -0.9 m and MLl was defined as +1.09 m CD.

Tidal currents are significant both within the Port of Richards Bay and the Mhlathuze Estuary, particularly in the vicinity of the harbour entrance, the mouth of the estuary and shallow regions both within the Estuary and the harbour.

7.12.2.7.2 **Waves**

Knowledge of the offshore wave conditions at Richards Bay is important in that waves exert significant event scale effects on nearshore currents and sediment distributions both nearshore and in deeper water (i.e. at the dredge disposal site).

The currents along the coastline and, to a much lesser extent; the currents across the harbour entrance are determined by prevailing wave conditions. The direction of the wave-driven currents along the shoreline depends on the angle of incidence of the waves at the coastline. The more oblique the arrival of the waves at the shoreline, generally the stronger the flows are. Furthermore, sediment transport at Richards Bay beaches (and at beaches inside the harbour mouth) is primarily driven by waves.

As noted above waves are not only important for their role in driving currents, but also in determining the sediment movement and distributions, particularly of fine sediments, on the seabed at locations exposed to wave action. The swell and wind-generated waves typically generate bed shear stress at the seabed that either maintain sediments in suspension or re-suspend sediments that have already been deposited on the seabed. The magnitude of the bed shear stress generated is a function of wave height and wave period, as well as current velocity where this is of sufficient magnitude.

In the harbour and adjacent estuary the wave turbulence keeping the fine sediments in suspension is a consequence of both swell and longer waves penetrating into the port as well as locally-generated wind-waves. Currents, particularly tidal currents, are also expected to play a role in limiting the deposition of sediments where these currents are of significant magnitude.

Further offshore, the wind-driven currents and those due to the influence of larger-scale flow associated with the close proximity of the Agulhas Current may constitute a significant contributory factor to the re-suspension and re-distribution of sediments. However, at the dredge spoil disposal site, the re-suspension in the sediments is expected to be largely due to wave turbulent stresses while the advection of the re-suspended sediments are determined largely by the wind-driven and larger scale flows.

The wave conditions in the entrance channel to the Port of Richards Bay also are important due to the limited under keel clearances of vessels utilising the port.

NCEP hind cast wave data (from the NOAA/NCEP WAVEWATCH III Global Model) at position (29.00°S; 32.5.°E), located beyond the continental shelf break, have been used to characterise the deep water wave climate (Figure 7-15). These data show a clear predominance of SSW swell with lesser occurrence on onshore wave conditions comprising predominantly easterly waves (Figure 7-16), especially in summer and autumn. A small NE wave component is observed during Spring. The highest wave conditions (SSW) occur during Winter and to a lesser extent Spring.

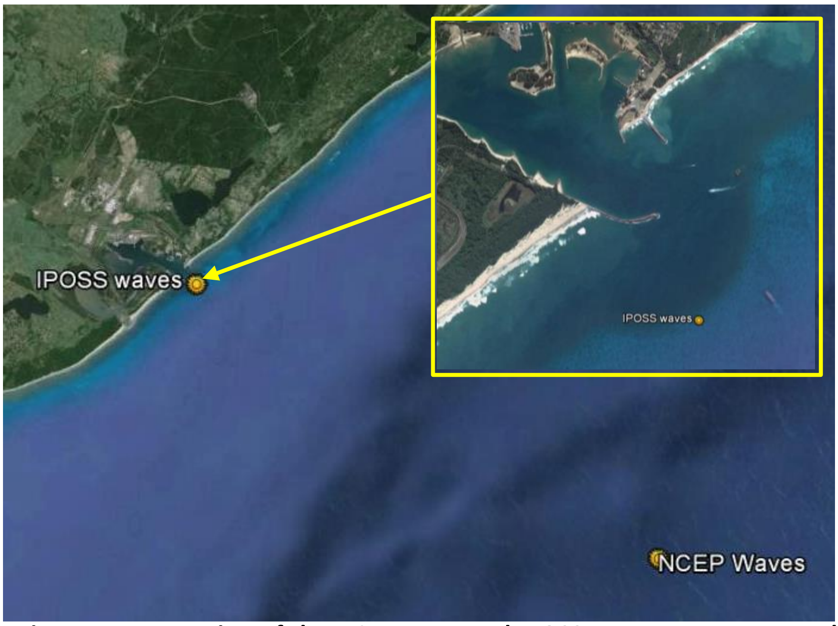
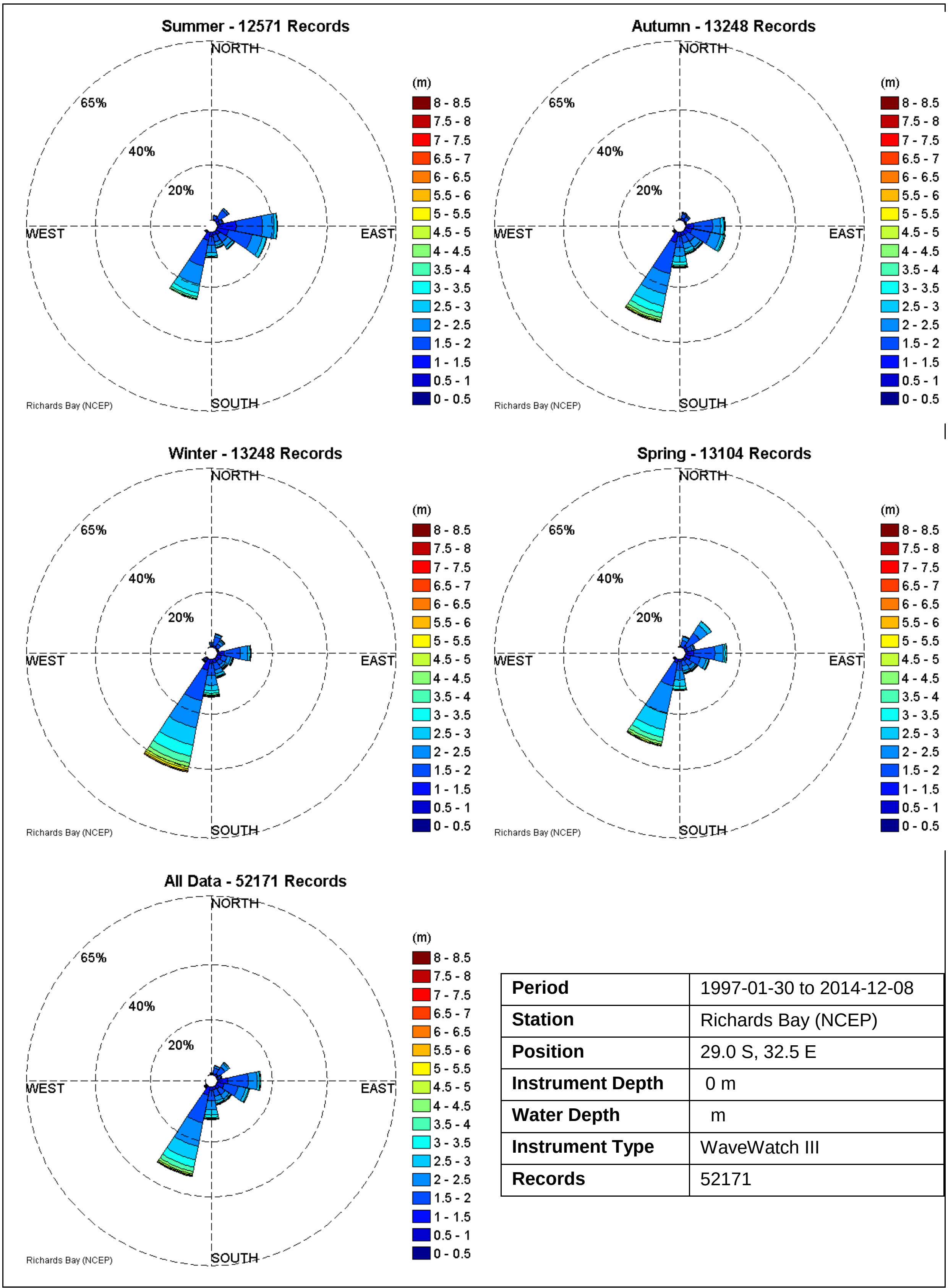


Figure 7-15: Location of the NCEP wave and IPOSS waves measurement locations offshore of the Port of Richards Bay

These deep sea waves are refracted as they move landwards into shallower waters with all but the shorter period waves (sea as opposed to swell) becoming more shore normal in direction. The resultant nearshore wave distribution has been measured at a site some 2 km south of the southern breakwater in an approximate water depth of-19 m CD (Figure 7-17). At this location, the wave are predominantly from SSE, however SE and SSE wave components are not uncommon, particularly during the summer months. As expected the highest waves are observed during the winter months and to a lesser extent in Spring.

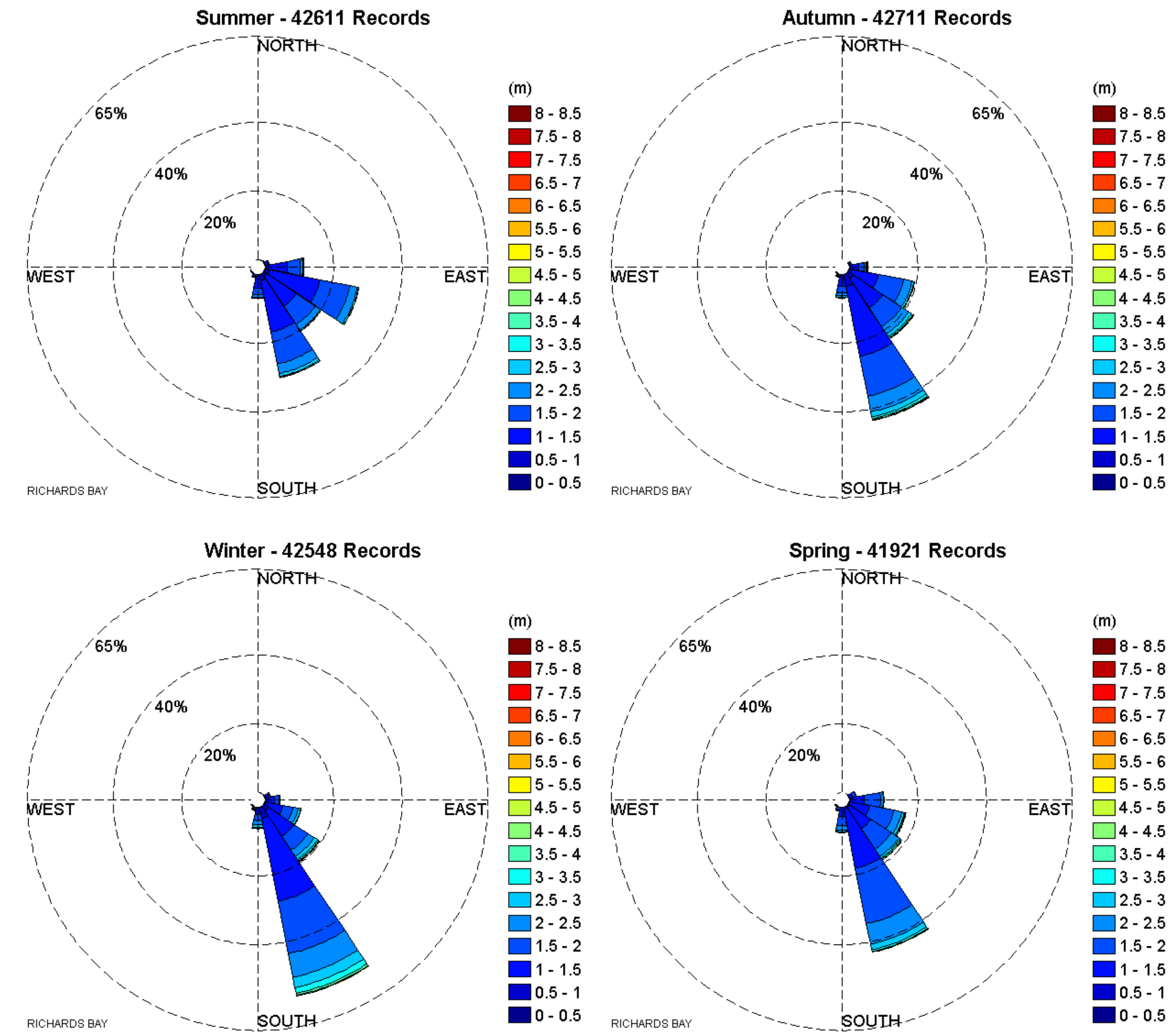
The wave conditions in the Port of Richards Bay and the Mhlathuze Estuary have been simulated for a range of offshore wave and local winds condition (CSIR, 2000, CSIR, 2001a). The results of these simulations (Figures 7-18 to 7-21) provide some important insights into the wave conditions prevailing within the port environs, within the adjacent estuary and in the marine environment offshore of the Port of Richards Bay.

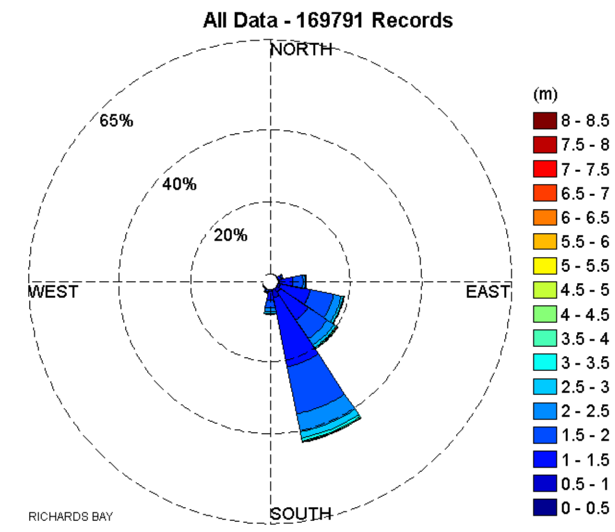
For these studies, the offshore wave conditions imposed at the offshore boundary of the wave model were such that the simulated inshore wave conditions recovered from the model results at the location of the IPOSS wave measurement locations are the same as those actually recorded. This is also the approach used in this modelling study due to deficiencies in the NCEP data recorded offshore of the Port of Richards Bay (see Section 5.3.3 of the Specialist report in Appendix 9 for the wave calibration).



Period	1997-01-30 to 2014-12-08
Station	Richards Bay (NCEP)
Position	29.0 S, 32.5 E
Instrument Depth	0 m
Water Depth	m
Instrument Type	WaveWatch III
Records	52171

Figure 7-16: Annual wave rose for the NCEP wave data measured at a deep water location offshore of the Port of Richards Bay (see Figure 7-15 for the NCEP wave data "measurement" location)





Period	2005-03-01 to 2015-01-31
Station	RICHARDS BAY
Position	-28.8265 S, 32.104 E
Instrument Depth	0 m
Water Depth	22 m
Instrument Type	Directional Waverider
Records	169791

Figure 7-17: Wave roses indicating wave height (Hmo) vs wave direction for wave data from the Richards Bay IPOSS measurement system

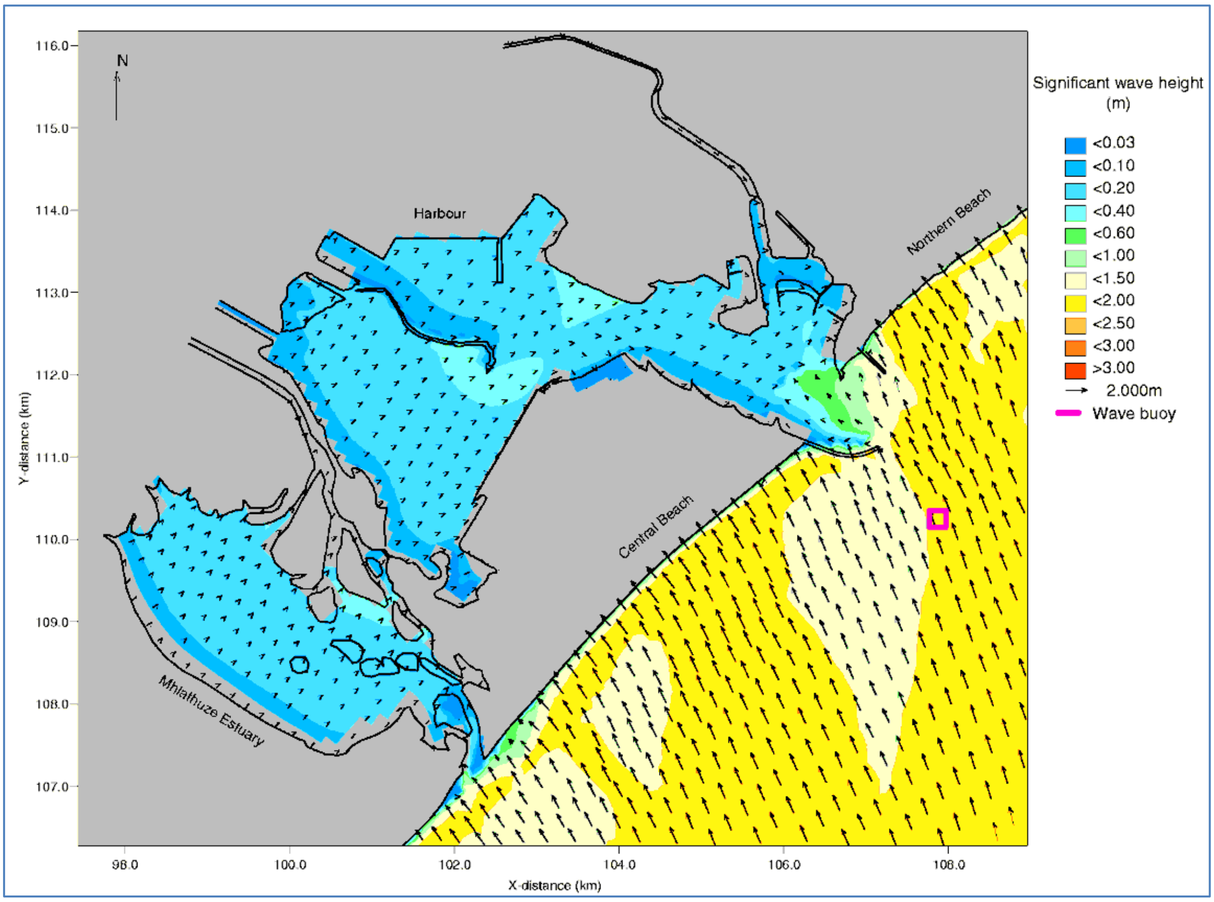


Figure 7-18: Significant wave height and direction for low to moderate wave conditions at wave buoy (H_{mo} = 1.5 m T_p = 10s, Direction SSE) and moderate SW winds (wind speed 7 m/s). (after CSIR, 2001a)

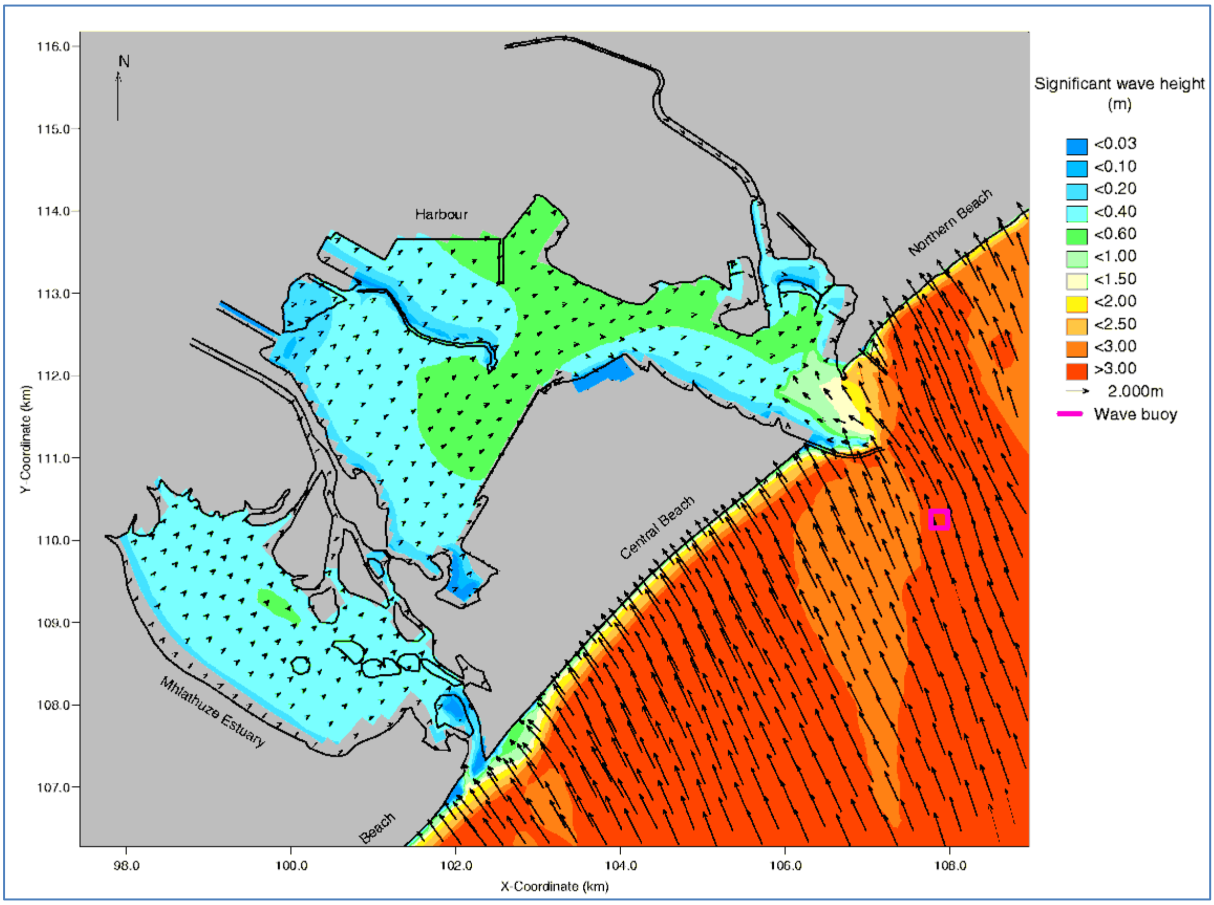


Figure 7-19: Significant wave height and direction for high wave conditions at wave buoy (Hmo = 3 m Tp = 14s, Direction SSE) and strong SW winds (wind speed 16 m/s). (after CSIR, 2001a).

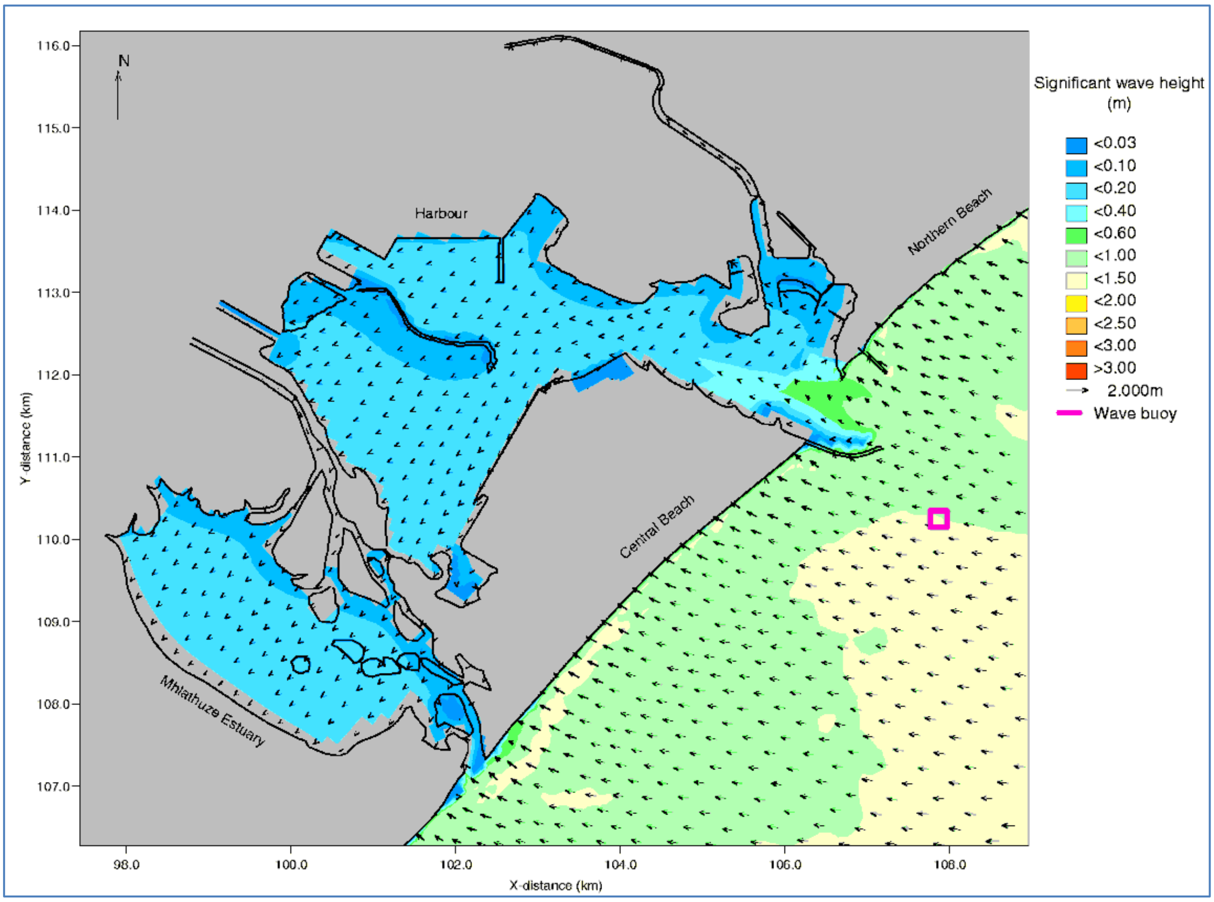


Figure 7-20: Significant wave height and direction for low to moderate wave conditions at wave buoy (H_{mo} = 1.5 m T_p = 10s, Direction ESE) and moderate NE winds (wind speed 6 m/s). (after CSIR, 2001a)

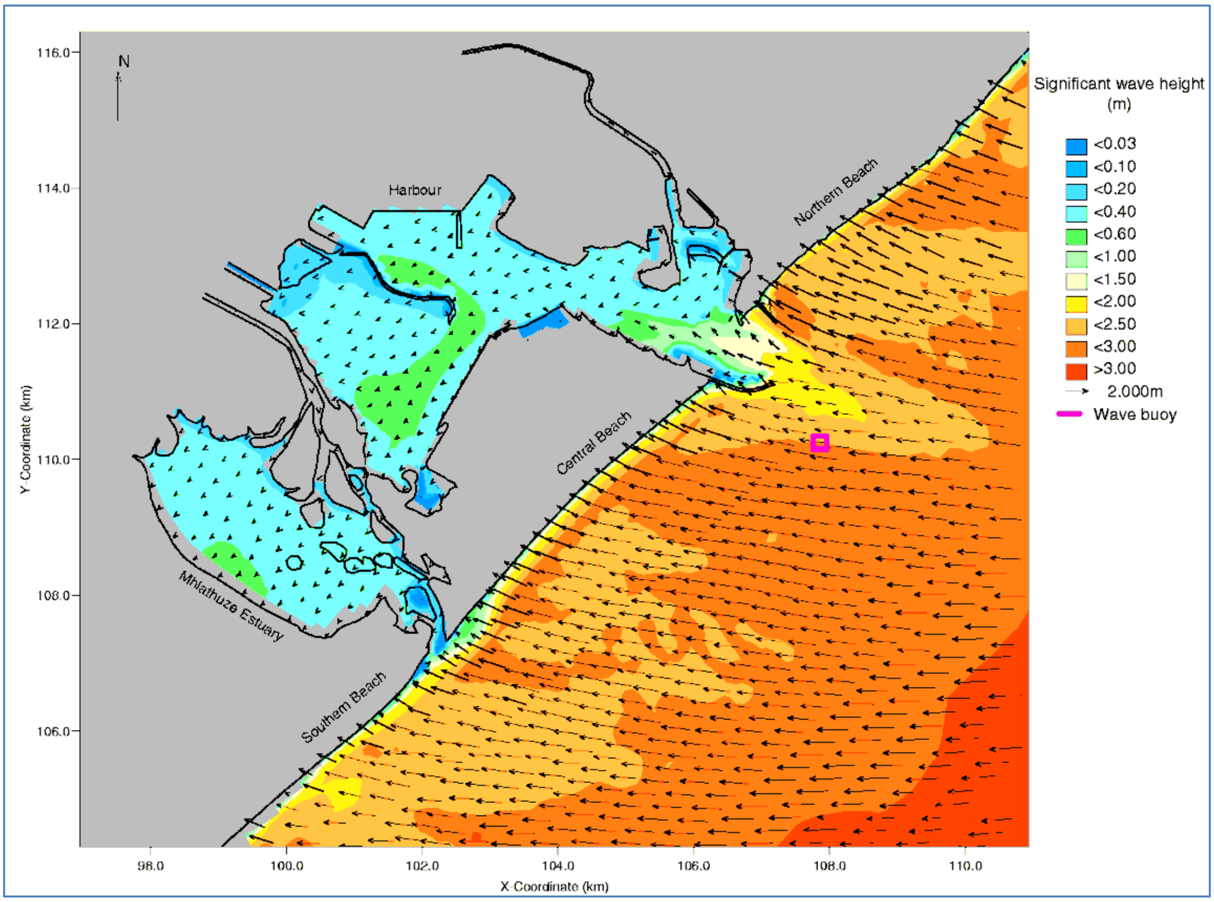


Figure 7-21: Significant wave height and direction for high wave conditions at wave buoy (H_mo = 3 m T_p = 14s, Direction ESE) and strong NE winds (wind speed 14 m/s). (after CSIR, 2001a)

Wave simulations for SSE wave conditions under low to moderate offshore wave conditions (Hmo=1.5 m and Tp=10s*1) and moderate SW winds (wind speed = 7 m/s) indicate a minimal penetration of wave energy into the harbour and a narrow surf zone along the coast. Waves from a SSE direction reach the shoreline at an oblique angle and will tend to drive a northward flowing surf zone current (Figure 7-18). The moderate SW wind generates wind waves that reach a height of approximately 0.20 m at the north-eastern side of the harbour (and the estuary). Simulations for high offshore wave conditions from the SSE (Hmo=3.0 m and Tp=14s) and strong SW winds (wind speed = 16 m/s) indicate a significantly increased surf zone width due to the increased incident wave height (Figure 7-19), while the strong SW wind generates wind waves that exceed 0.4 m at the north-eastern side of the harbour. Evident in both Figure 7-18 and 7-19 is the important role of that the sandspit has in providing protection to the 600 and 700 series of berths from such wind waves.

Wave simulations for ESE wave conditions under low to moderate offshore wave conditions (Hmo=1.0 m and Tp=8 s) and moderate NE winds (wind speed = 6 m/s) indicate a significant penetration of wave energy into the harbour (Figure 3.13). Waves from a ESE direction reach the shoreline at an oblique angle and that will tend to drive a southward flowing surf zone current. A moderate NE wind generates wind waves that reach a height of approximately 0.18 m at the south-western side of the harbour (and the estuary). Simulations for ESE wave conditions under high offshore wave conditions (Hmo=2.5 m and Tp=11s) and strong NE winds (wind speed = 14 m/s) indicate a significantly increased surf zone width due to the increased incident wave height (Figure 7-21), while the strong NE winds generates wind waves that exceed 0.4 m at the south-western side of both the harbour and Estuary. Evident in both Figures 7-20 and 7-21 is the role of the sand spit in providing protection to the mudflats from wind waves under NE wind conditions. Strong wind conditions result in the waters overlying the mudflats becoming quite turbid. The existence of the sandspit provides a degree of protection from the wind waves being generated that stir up the bottom sediments to create turbid conditions.

Long wave energy is known to exist off the coast of KZN. Long waves have been recorded within Richards Bay (berth 609 and 701), however the occurrence of conditions leading to these long wave motions in the port are seemingly rare and most of the long wave energy recorded lies at periods exceeding 200 s (CSIR, 2005b). The existing long wave energy therefore is not expected to result in mooring motions and cargo handling problems of sufficient magnitude and regularity to be of major concern (CSIR, 1994b; Rossouw *et al*., 2013). The sand banks, the sand spit and irregular shoreline of the existing port layout are considered to limit the long wave energy within the port.

7.12.2.8 Water Column Stratification

Water column stratification is important in that it affects the oceans response to wind and current forcing and therefore the vertical distribution of flow velocities. Generally the higher the water column stratification the greater the vertical shear in the horizontal flow velocities and vice versa.

Water temperature in the region offshore of the Port of Richards Bay is strong influence by large scale influences of the Agulhas Current. It is in this region where the Agulhas current brings cold waters closer to the seas surface in a process that has been termed topographic upwelling.

Depending on the local winds, these cold waters may be exposed at the sea surface or remain subsurface. When the Agulhas Current is far offshore the seawater temperatures are generally lower and water column stratification is generally weaker than when the Agulhas Current is located closer inshore. When closer inshore the warmer surface waters of the

Agulhas Current and the resultant upwelling that occurs on the inner edge of the Agulhas Current enhance the water column stratification. Similarly local winds may enhance or suppress the upwelling of colder deeper waters and depending on the circumstances may enhance or weaken the water column stratification.

While measurements further offshore (mid-self to shelf-break) indicate an often moderate to highly stratified water column, there are occasions during upwelling conditions when the water column is largely isothermal. Water column profiling measurements from the Berth 306 dredge monitoring programme (Pillay *et al.*, 2008a), while displaying the expected seasonal variation, suggest that the water column offshore of Richards Bay is surprisingly weakly stratified given the nature of the flows and physical processes prevailing in the region. There were however two or three occasions in early to late summer) when the water column stratification seemed to be significant, less so for the sites in the immediate vicinity of the dredge spoil disposal site and more so for sites extending northwards from the dredge spoil disposal site (Figures 7-22, 7-23 and 7-24).

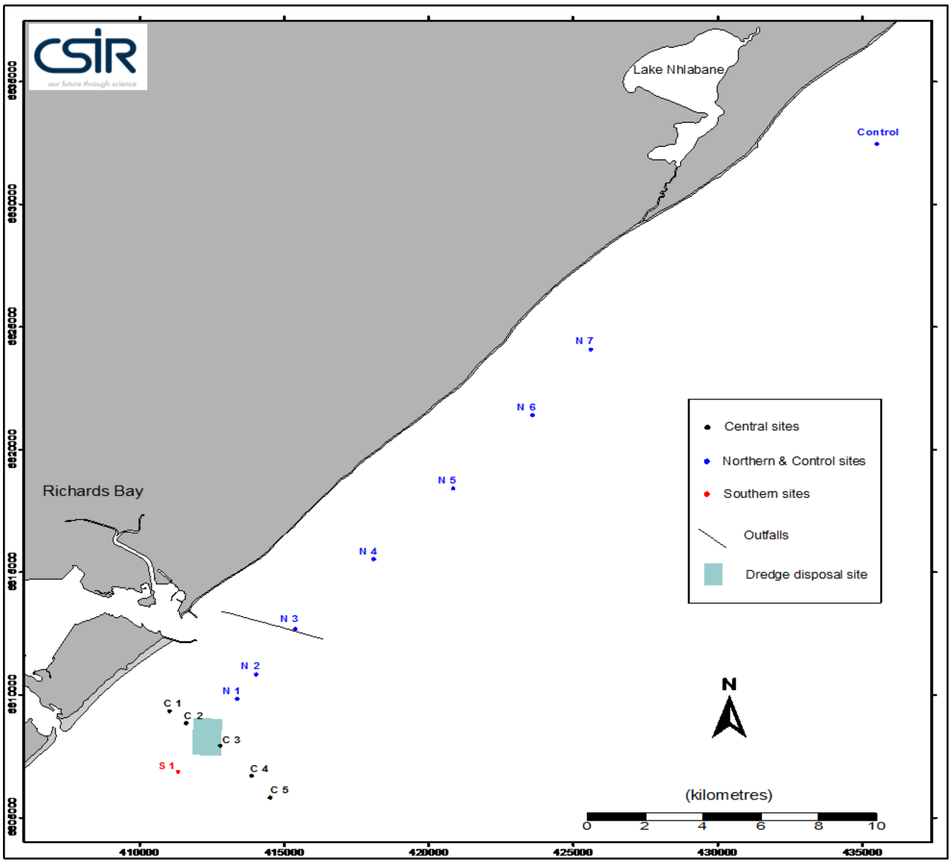


Figure 7-22: Location of the offshore water quality measurement sites at which temperature profiles shown in Figures 7-23 and 7-24 were measured

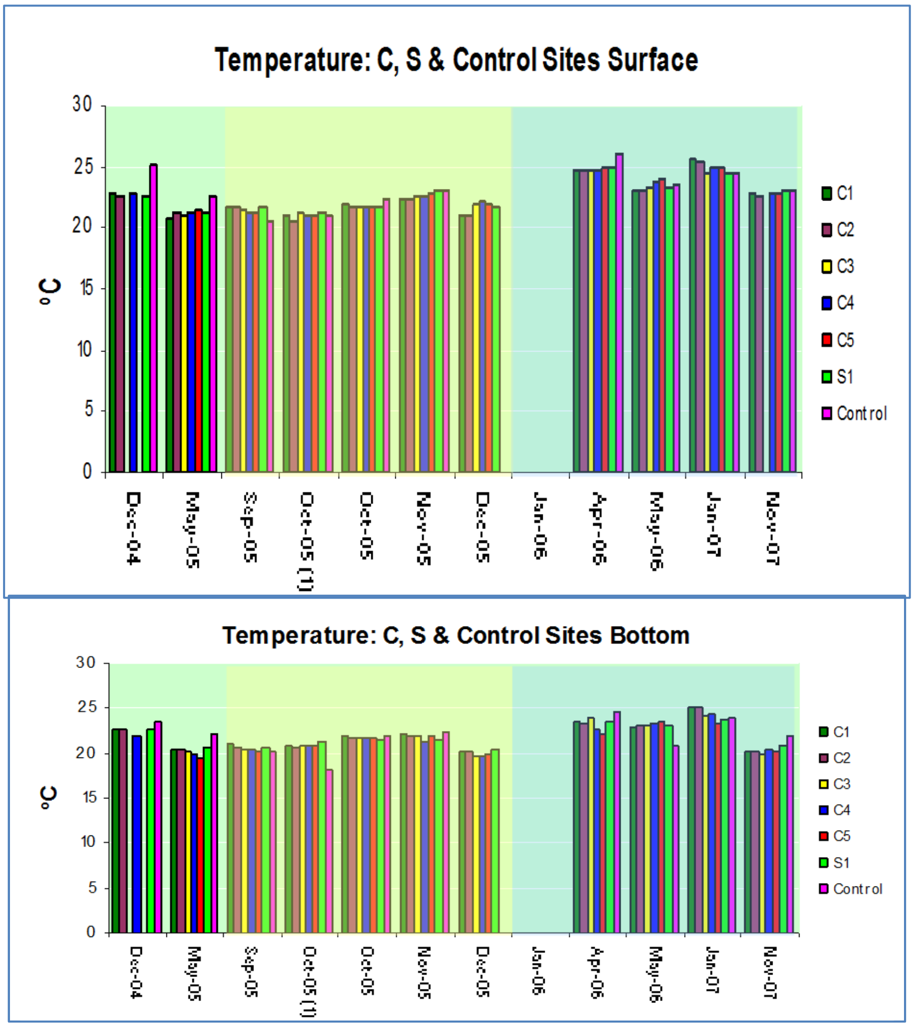


Figure 7-23: Surface and bottom water temperatures in the vicinity of the dredge spoil disposal site

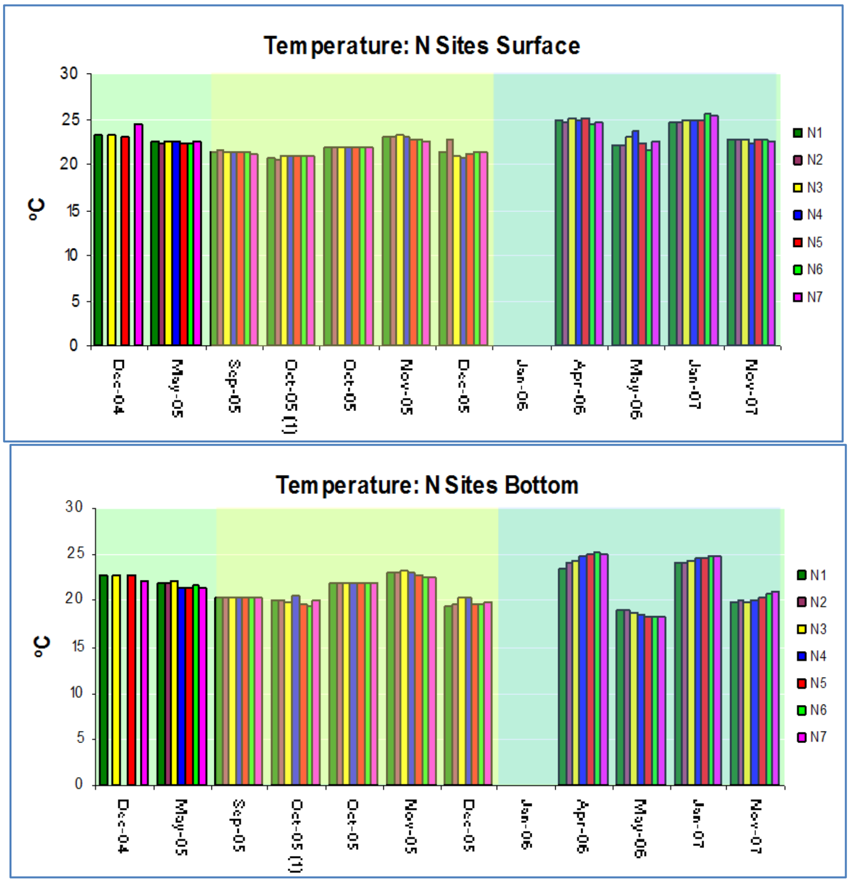
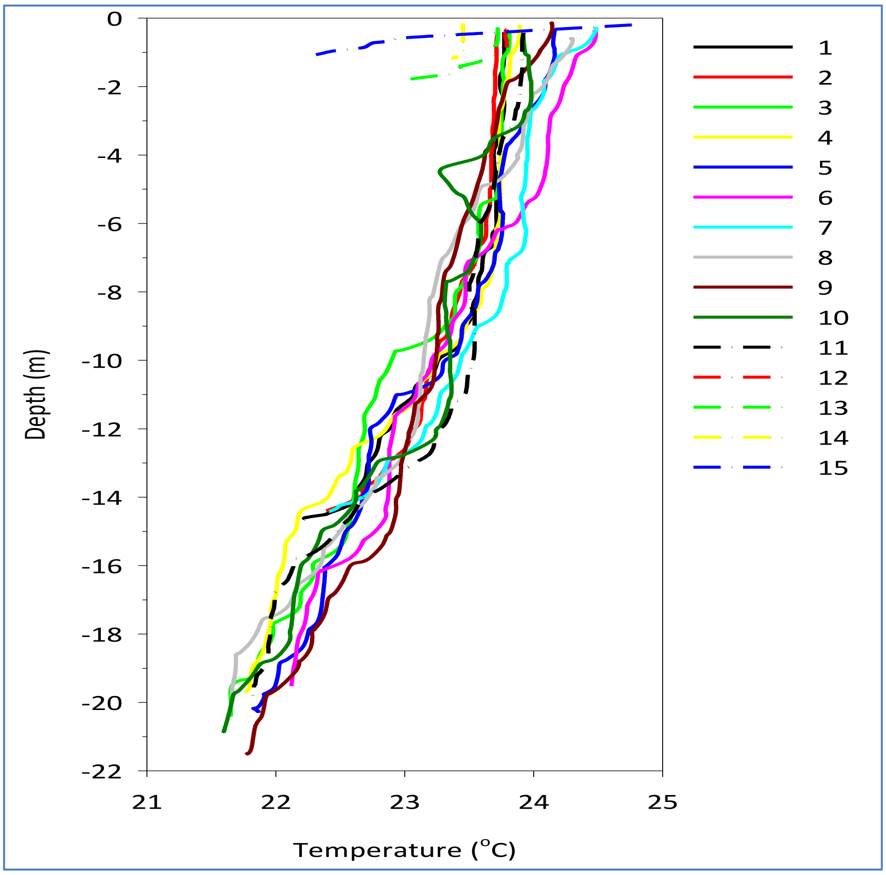


Figure 7-24: Surface and bottom water temperatures for sites extending northwards from the dredge spoil disposal site

Historical measurements of surface and bottom salinity and temperature within the Port of Richards Bay (reported in CSIR, 2005b) indicate that significant vertical stratification of the water column occurred on a couple of occasions during the summer period. Given that the bottom temperatures observed on these occasions seemingly are similar to those measured at other times of the year and that the surface temperatures observed on these occasions are elevated compared to other times of the year, the observed stratification may simply be a consequence of local heating of the surface waters under relatively calm conditions and not necessarily indicative of cold bottom water intrusions into the harbour. (A cursory examination of wind conditions during these stratification episodes indicated that on one occasion the observations of stratification were made just prior to weak NE winds changing to strong SW winds. On the other occasion no such clear relationship with winds existed.)

Measurements undertaken in the Port of Richards Bay during monitoring programme for the Berth 306 capital dredging were mostly in shallow water and therefore not suitable for assessing the degree of temperature stratification within the Port of Richards Bay. More recent measurement at a number of sites around the port that included the deeper shipping channels undertaken for the Richards Bay Capacity Expansion project (CSIR, 2013b) indicated an approximate change of 2 °C temperature difference between the surface and bottom waters over an approximate 19 to 20 m water depth. This is seemingly consistent with other data measured within the port during summer months. In winter it is expected that the water column will be largely isothermal.

Figure 7-25: Map of Richards Bay showing the positions were in situ water quality measurements (*i.e.* temperature profiles) was made.



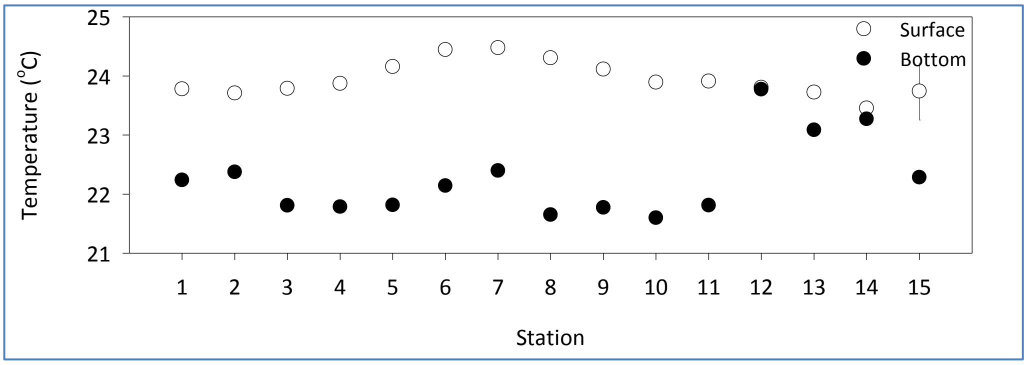


Figure 7-26: Temperature profiles (upper panel) and temperature differences between the surface and bottom waters as measured on 13 February 2013 (CSIR, 2013b).

Based on the above observations, together with limitations in available data to inform the modelling study, it was decided not to include stratification effects in the modelling study. Given the manner in which the modelling was approached, if anything, this will result in a more conservative assessment in terms of turbidity impacts in the water column.

7.12.2.9 Currents

For the Port of Richards Bay and its surrounds, three zones of current forcing may be identified upon moving offshore. In the inshore region, the currents are predominantly wave-driven except in the vicinity of the mouth of the harbour and the Mhlathuze Estuary where tidally driven flows predominate. In the zone between the surf zone and the inshore edge of the Agulhas Current (located approximately 10 to 30 km offshore), the currents are predominantly wind-driven (CSIR, 1981; Schumann, 1981) with an increasing influence of the Agulhas Current upon moving offshore. The Agulhas Current dominates at the shelf break and beyond.

The wind-driven currents have a periodicity of 4 to 6 days (Bang & Pearce, 1978) and lag the local winds by approximately 18 hours (Schumann, 1981). There is evidence in this region of the surface waters having a more offshore tendency with the deeper waters having an onshore tendency. This is consistent with dynamic upwelling that occurs at the inshore edge of the Agulhas Current (Lutjeharms et al., 1989). The presence of cold upwelled water offshore of the mouth of Richards Bay has significance in that cold water on occasion may enter the deeper regions of the bay. The resultant water column stratification and associated potential for increased vertical shear in currents in the bay is expected to provide conditions for a more rapid flushing of the waters of Richards Bay than would normally be expected. This effect however is expected to be quite limited.

A number of model simulations of the currents in Richards Bay have been undertaken (e.g. CSIR, 1998a, 2000, 2004a,b,c,; CSIR, 2001a). Only one of these studies considered the effects of water column stratification (CSIR, 1998a), however these model simulations were focussed on storm water discharges into the mouth of the Port of Richards Bay and did not report extensively on three dimensional flows within the port. Given the high resolution modelling required (particularly in the surf-zone) and the fact that the focus was strongly on surf-zone processes, the modelling undertaken comprised two-dimensional (2D) hydrodynamic simulations (CSIR, 2000, 2004a,b,c; CSIR, 2001a). While such 2D modelling adequately simulates wave-driven currents (and to a large extent tidal currents), three dimensional (3D) processes such as vertical shear in currents (due to wind forcing and stratification effects) and local wind-driven re-circulation are excluded. Given the lack of measured data in the Port of Richards Bay, the importance of these 3D processes in determining the water quality within the bay is uncertain, however it is deemed prudent to include these processes modelling studies focussed on water quality processes with the harbour. In the present modelling study three-dimensional flows are modelled however stratification effects and any influence that these may have in changing the vertical shear in horizontal flows are not included in the model.

The main circulation features within the Port of Richards Bay as indicated by these modelling studies (CSIR, 2000, 2001a, 2004a,b,c;) and summarised in CSIR (2005b) are as follows:

- Strong tidal currents occur in the mouth of the Mhlathuze Estuary where predicted current speeds exceed 1.4 m/s at spring ebb and flood (*e.g*. Figure 3.19 and 3.20). Tidal currents in entrance of the harbour are predicted to rarely exceed 0.2 m/s at spring ebb and flood, however for high wind conditions the spring flood and ebb flows in the mouth may significantly exceed 0.2 m/s. Tidal currents are also significant in shallow regions such as the mudflats on the south-west side of the bay and the mangrove regions, particularly the mangroves south of RBCT;
- Under high SW winds and spring ebb flow conditions, current of up to 0.5 m/s may be generated on the northern side of the mudflats while under strong NE winds the flows are somewhat reduced and concentrated on the southern side of the mudflats;
- Under SW winds clockwise flows are generated on the mudflats both during spring flood and ebb conditions. Conversely, under NE winds conditions an anti-clockwise residual circulation develops over the mudflats during both spring flood and ebb conditions. The magnitude of these residual circulations increase with increasing wind speeds.
- In general, the surf zone current follows the wave direction in all conditions modelled (i.e. SSE waves drive the surf zone current northward and the ESE waves drive the surf zone current southward), except when winds are strong enough to reverse weaker inshore wave-driven currents associated with low wave conditions (e.g. a northward inshore current due to the low to moderate SSE wave is reversed

by strong NE winds). Consequently, surf-zone currents may flow in an opposite direction to the wind-driven currents prevailing further offshore (e.g. a combination of ESE waves and strong SW winds will result in southward flowing surf zone currents and northward flowing wind-driven currents further offshore).

Significant freshwater inflows into the Port of Richards Bay through the Bhizolo, Manzamnyama and Mzingazi Canals occur on occasion. These inflows have the potential to set up locally significant flows within the harbour and also locally affect water column stratification. Walmsley et al., (1999) report that there is no monitoring of the fresh water flowing into the Port of Richards Bay, however limited data on these inflows is believed to exist (Archibald, Schoonees, pers. Comm.).

The key wind, wave, current and sediment transport processes within the Port of Richards Bay and its immediate surrounds have been schematised in (CSIR, 2005b). The major hydrodynamic features may be summarised as follows:

- Strong tidal currents occur in the narrow mouth of the Mhlathuze Estuary. The tidal currents in the mouth of the harbour are much smaller in magnitude and are considered to range from approximately 0.03 m/s during neap tides to approximately 0.17 m/s during spring tides (CSIR, 1998b). Under certain wind conditions the wind-driven component of the flow in the harbour mouth is expected to reinforce these tidal flows. The tidal flows diminish towards the inner recesses of the harbour;
- Strong wind-driven flows occur within the port under higher wind conditions, particularly in the shallow regions. Strong SW winds set-up a residual clockwise circulation on the mudflats on the south-west side of the harbour. Conversely, strong NE winds set up an anticlockwise residual circulation;
- Freshwater inflows via the Bhizolo Canal, the Manzamnyama Canal and particularly the Mzingazi Canal are expected to set-up locally significant flows in the harbour;
- Accretion and erosion problems occur within the harbour due to wave action. Regions of shoreline erosion and accretion within the Port of Richards Bay ;
- Wave action and wave-driven surf-zone currents result in significant sediment transport along the beaches. The magnitude and direction of these near shore current are variable and are determined by the prevailing near shore wave direction; however there is a string net transport to the north.

7.12.2.10 Water Quality

The water quality within the Port of Richards Bay has been described in CSIR (2013b) where potential threats to water quality within the Port of Richards Bay have been identified. Previous water quality sampling to characterise dredging impacts were not suitable for developing an appropriate water quality baseline due to their sparse coverage and limited sampling of the port in areas potentially impacted by the proposed Richards Bay Capacity Expansion capital dredging activities. The key variables of concern when assessing dredging activities namely dissolved oxygen, turbidity and suspended sediment concentrations are summarised below.

7.12.2.11 Dissolved Oxygen

The dissolve oxygen values measured as part of the baseline surveys (CSIR, 2013b) range between just below 6 mg/ℓ to more than 8 mg/ℓ while the percentage saturation of dissolved oxygen concentrations range between approximately 80% to more than 120%. In general the dissolved oxygen concentrations decrease with depth. Bottom water dissolved oxygen concentrations at numerous of the deeper water stations fell marginally below the South African Water Quality Guidelines for Coastal Marine Waters target of 6 mg/ ℓ l that must be met 95% of the time, but exceeded the target of 5 mg/ℓ l that must be met 99% of the time. These observations were for a summer period when stratification effects are the greatest. It is therefore expected that the dissolved oxygen concentrations in the water column, particularly in the deeper waters, generally would exceed those measured in this study, especially in the winter months when the water column is much less stratified or well-mixed. It is only in the late summer months, when stratification could more significant, that one would expect the dissolved oxygen concentrations to be lower in the near bottom waters than those observed during the February 2013 survey.

7.12.2.12 Turbidity and Total Suspended Solids Concentration

The most critical measurements when assessing potential dredging impacts are turbidity and total suspended sediment concentrations in the water column. Although turbidity and total suspended solids concentrations in the water column, in principle, should display a strong relationship to one another this is not always the case (CSIR, 2013c). Poor relationships may come about because the total weight of particles in suspension is a direct function of their number, size and specific gravity, but turbidity is a direct function of the number, surface area and refractive index of the particles but an inverse function of their size. Dissolved substances, which are not part of the suspended solids load, affect turbidity but not the suspended solids concentration as they pass through a 45 µm pore size filter (*i.e.* the filter generally used when determining total suspended solids concentrations). This also may contribute to a poor relationship between turbidity and total suspended solids concentrations. It is for this reason that both turbidity and suspended sediment concentrations are reported here.

The turbidity and suspended sediment concentrations observed in the Mhlatuze Estuary, the Port of Richards Bay (and its immediate environs) and offshore in the vicinity of the dredge spoil site and beyond, have been summarised by Weerts (2008). In the Mhlatuze estuary turbidity typically ranges from 10 NTU to more than 60 NTU on occasion, however typical values are in the 15 to 30 NTU range. Using the relationships developed in CSIR (2013c), this translates into typical suspended sediment concentrations of between approximately 25 and 50 mg/ℓ. In the Port of Richards Bay there is a strong spatial variation in the turbidity observed with the highest turbidity being observed on the mudflats, increasing towards the Bhizolo Canal (Weerts, 2008). The observed turbidity is much lower through most of the water column in the deeper waters of the shipping canals and berths. Turbidity measured near the seabed may be high due to the increased fines content of the sediments in these deeper waters. The measured distribution of the observed *in-situ* turbidity (measured in the field using a profiler) and turbidity and suspended solid concentrations obtained in the laboratory from field samples that were taken (CSIR, 2013c). The location of the profiling and the sampling are indicated in Figure 7-27 below.

Figure 7-27: Locations in the Port of Richards Bay were turbidity profiling and water sampling for the laboratory measurement of turbidity and analysis of suspended sediment concentrations

Turbidity measurements undertaken during the Berth 306 capital dredging monitoring programme, suggest that water column turbidity in the vicinity of the proposed dredge spoil disposal site typically ranges between 2 and 10 NTU (Weerts, 2008). Using the relationships between NTU and suspended sediment concentrations in mg/ℓ reported in CSIR (2013c), this translates into a range of suspended sediment concentrations of between 3 and 17 mg/ℓ.

The depth averaged turbidities measured in the vicinity of the dredge spoil disposal site are presented in Figure 7-28 below.

If these measurements are to be interpreted as suspended solid concentrations, the NTU value need to be multiplied by approximately a factor of 1.65 (CSIR, 2013c).

It is interesting that these turbidity values did not display clear and unequivocal evidence of the expected elevation in turbidity associated with dredge spoil disposal, possibly due to the confounding effects of seasonality in the sediment-laden inflows into the marine environment that occur in this region. However there exists periods during the dredging when there seemingly were elevated turbidity in the vicinity of the dredge spoil disposal site, including one occasion (27/11/2005) where elevated turbidity (~ + 5 NTU compared to pre-dredging values) was observed stretching some 12 km north of the dredge spoil disposal site (Weerts, 2009).

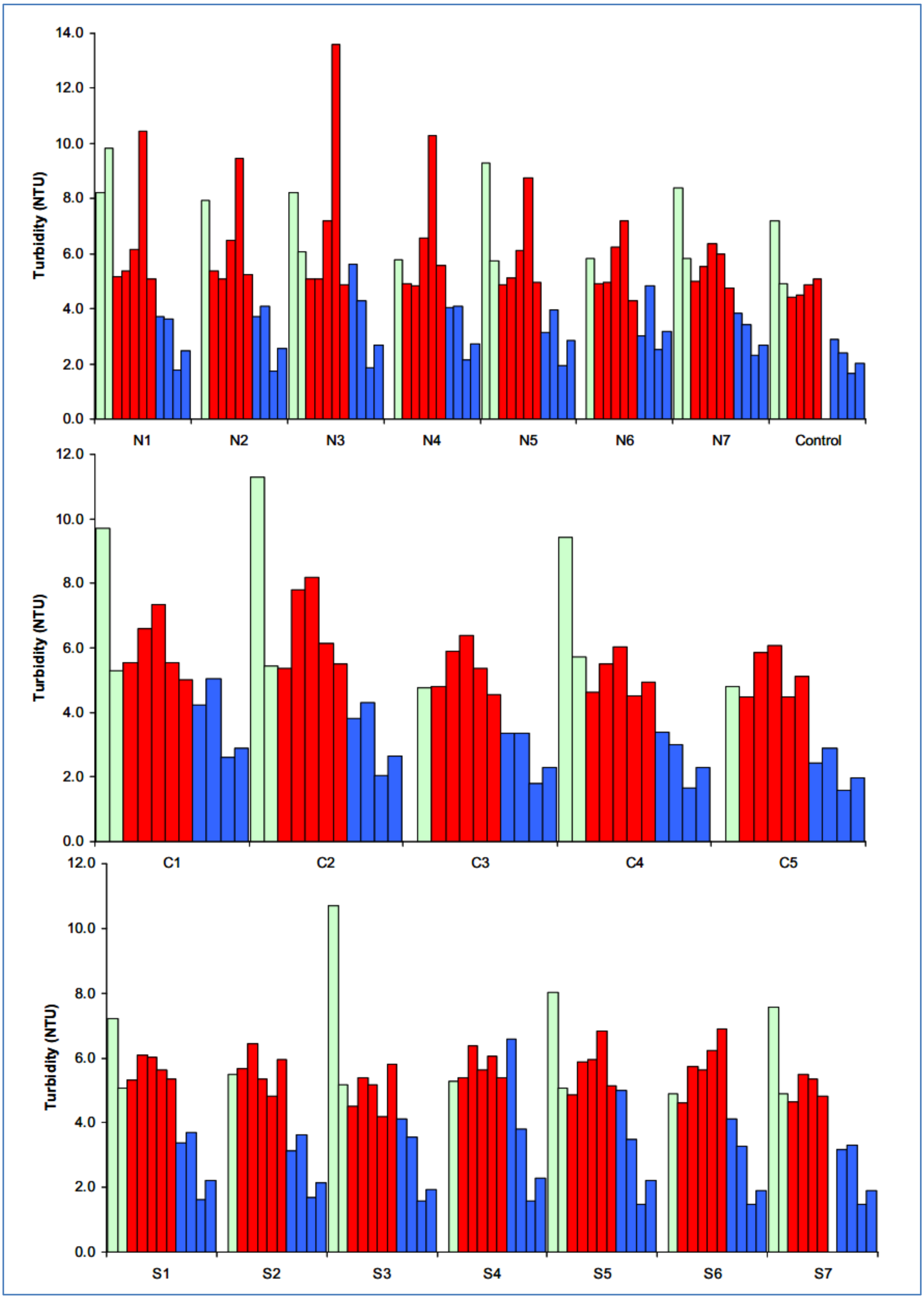


Figure 7-28: Water column averaged turbidity measured at the offshore locations (Source: Weerts, 2008).

Continuous measurements of turbidity using optical backscatter (OBS) instrumentation on moorings located both to the north (location K) and the south (location L) of the dredge spoil disposal site (Figure 7-29) indicate a number of occasions where there is significant elevation of water column turbidity. While there were issues with the bio-fouling and subsequent calibration of these instruments, there is reasonable confidence in the limited periods of data. These observations indicate the expected temporal variability in turbidity associated with wind, wave and current events. Significant is that the profiling from the field exercises reported in Weerts (2009) only co-incided with the period of valid OBS data on two occasions. Furthermore, on only one of these occasions did the turbidity profiling from the field surveys co-incide with a period of elevated turbidity identified in the OBS mooring data (26-27/11/2005). This is the occasion identified in Weerts (2009) when the most extreme elevations in turbidity were observed stretching northwards of the dredge spoil disposal site. This suggests that if the monitoring of the offshore region were to have been more regular, the chances are that more such events would have been observed in the data from the offshore profiling surveys.

The implication of these observations is that care should be taken in using the profiling data alone to develop an environmental baseline for turbidity in the offshore region. Furthermore, even greater care should be taken in using only the profiling data (that has limited temporal resolution) to set thresholds for compliance monitoring and management of dredging activities as has been done in CSIR (2013c).

Figure 7-29: Locations of the OBS moorings K and L during the Berth 306 Dredge monitoring programme

7.13 TURBIDITY MODELLING STUDY

The modelling of dredging and dredge spoil disposal impacts has been undertaken using the Deltares DELFT3D-WAVE and DELFT3D-FLOW (including the sediment capability) software (Booij *et al.*, 1999; Lesser *et al.*, 2004; Deltares, 2011a,b). This requires the set-up of a DELFT3D-WAVE to provide time series of wave conditions to the DELFT3D-FLOW three-dimensional wave model that in turn is used to determine sediment transport of the material being dredged and disposed of at the offshore dredge spoil disposal site. These models have been set-up for a one year duration, namely from 1 February 2001 to 1 March 2002.

7.13.1 Methods

The objective of the modelling is to simulate the transport and fate of the predominantly the fine component of the dredged material, both at the site of dredging inside the port and at the dredge spoil disposal site. Accordingly the model needs to account for the following dominant physical processes:

- Refraction of deepwater waves to determine the wave conditions throughout the model domain, particularly at the dredge spoil disposal site and in the surf zone;

- Generation of wind-waves inside the port and the estuary;
- The effect of waves on currents via forcing, enhanced turbulence and enhanced bed shear stress;
- Generation of tidal currents in the port and in the estuary;
- Generation of wind-driven currents in the port, estuary and offshore;
- Vertical mixing processes and possibly water column stratification;
- The introduction of a source of suspended sediment and the advection-dispersion of the resulting turbid plume;
- The settling-deposition-resuspension of the sediment particles and the evolution of the dredge spoil mound over time.

All these processes are accounted for by the relevant models forming part of the DELFT3D modelling system, developed by WL|Delft Hydraulics in the Netherlands. These comprise the wave model (DELFT3D-WAVE), the hydrodynamic model (DELFTD-FLOW) and the suspended sediment model (DELFT3D-SED), as described below.

The core of the modelling has been undertaken using the DELFT3D-SED model that comprises an extended capability of the DELFT3D-FLOW model. The DELFT3D-SED model can be run in two modes. The first mode is one where there is no feedback between the hydrodynamics and the evolving seabed. The second mode is one where there is feedback between the changes in the seabed and the hydrodynamics. In the present study that is focussed on the transport and fate of the fine dredge spoil only, DELFT3D-SED is used without feedback from the changes in the seabed.

7.13.2 Model Results

The model results have been analysed and presented in a manner suitable to inform the impact assessment undertaken in the Marine Ecology specialist studies (MER, 2013, Cyrus 2014a,b), as well as additional impacts considered in this report.

7.13.3 Visual Results

In terms of visual impacts it is the visibility of sediment plumes that are of concern. The plumes may be visible at the dredge spoil disposal site and will be visible around the dredger in the port.

In a conservative guideline of 10 mg/ℓ elevation in suspended sediments in the upper water column has been assumed for a threshold above which plumes are likely to be visible in the marine environment. Extending the conservative approach we have assessed the number of days that the suspended solid concentration in the surface waters exceeds 10 mg/ℓ. As the model results do not include background turbidity, in reality it is assumed that plumes become visible when the suspended sediment concentrations are increased by 10 mg/ℓ or more above background levels. The same threshold is assumed for both offshore waters and the Port of Richards Bay and surrounds. The model results are presented as contours of the number of days per season that the suspended sediment concentrations in the surface waters are increased by 10 mg/ℓ or more above background. A season is considered to have a duration of approximately 3 months (or 90 days). Given that the model simulations for Cutter Suction Dredger dredging operations have a duration of approximately 5 months, the total number of days of exceedance of the thresholds indicated will therefore be approximately twice that reported in the figures contained in this report when the full 6 month period is considered. One of the reasons for reporting the results as days of exceedance of a threshold is that this enables impacts to be assessed should the dredging durations be different to those simulated in this modelling study.

The days of exceedance of a 10 mg/ℓ threshold at the sea surface in the Port of Richards Bay, reported in Figures 7-30, indicate that visual impacts from the dredging activities will be limited to the confines of the port, and then mostly to the area being dredged. This is somewhat of an unexpected result. However, the dredging activities are confined to the inner recesses of the port, where tidal and other wind-driven flows are minimal providing limited opportunity for the spread of turbid waters. The visual impacts in the port, although not continuous, will persist on and off for at least the duration of dredging activities

It is likely that it will be difficult to discern the visual plumes due to the dredging from other high turbidity in the port due to activities such as berthing activities. What may however occur is that the accumulation of fines at the seabed may provide reservoir of fine material that would be easily re-suspended by shipping activities. Thus the normal elevations in turbidity due to shipping and berthing activities may be exacerbated by the dredging activities. Weerts (2008) provides evidences of such elevated water column turbidity due to shipping activities at the Richards Bay Coal terminal (Figure 7-31). These observations were made approximately two years after the capital dredging that was undertaken for the Berth 306 development. While it is tempting to attribute the severity of these elevated turbidity events to a legacy of the fines accumulated in the Richards Bay Coal Terminal basin during the capital dredging activities for the Berth 306 development, it should be noted that similar visual observations of elevated turbidity have been noted more recently (2014 and 2015) which are more difficult to attribute to previous capital dredging activities (Figure 7-32). Observations in other South African ports environments (Saldanha Bay), have suggested that the benthic sediments “recover“ from the elevated fines observed in the benthic sediments after capital dredging events typically over a period of approximately 5 years. This may not be the case in a more sheltered environment such as Richards Bay.

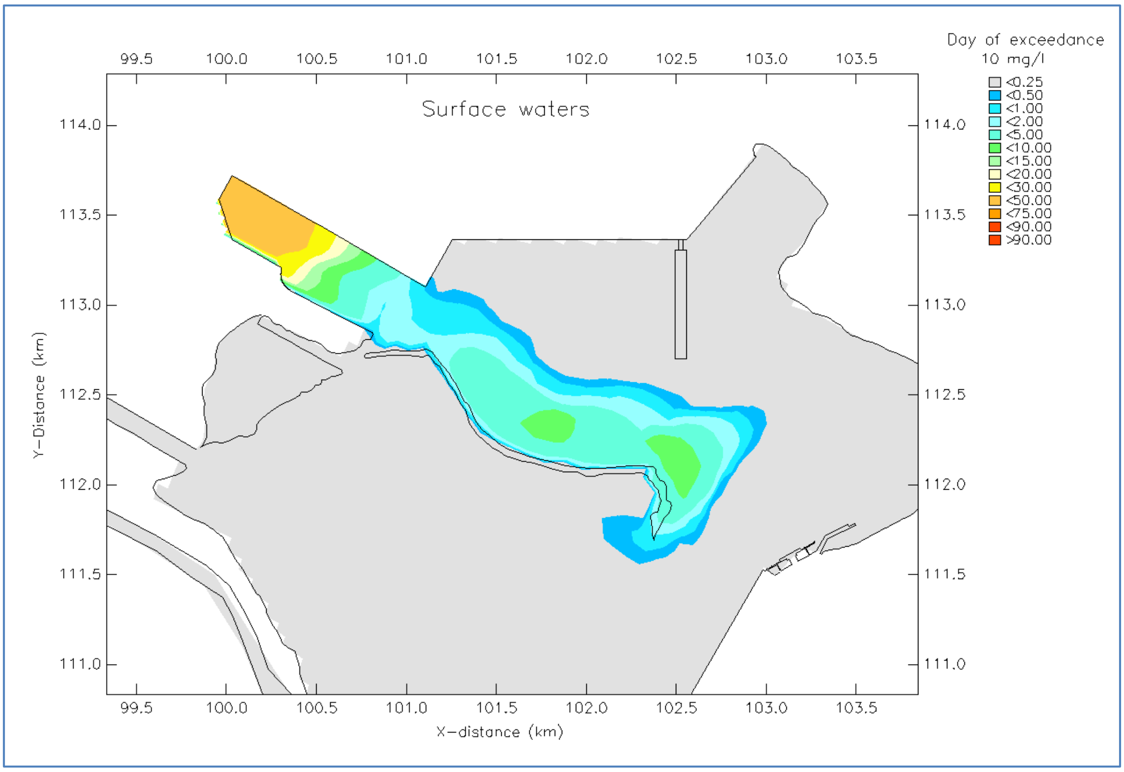


Figure 7-30: Day of exceedance of a suspended sediment concentration of 10 mg/ℓ in the surface waters of the port

Figure 7-31: Sediment driven into suspension by ship berthing activities in the coal basin in the Port of Richards Bay (photo taken 24th April 2008) (Source: Weerts (2008))

Figure 7-32: Sediment driven into suspension by ship berthing activities in the coal basin (upper panel) in the Port of Richards Bay (GoogleEarth image: 3 May 2014) and in the entrance channel (lower panel) of the Port of Richards Bay (GoogleEarth image: 5 May 2015)

Further offshore there is predicted to be discoloration of the surface waters over a fairly extensive region the duration being up to approximately 50% of the time in the immediate vicinity of the dredge spoil disposal site. It is however expected that the discoloration of the surface waters will decrease significantly when dredge spoil disposal operations cease. Elevated turbidity in the surface layers would only be expected during storm conditions. The discoloration of nearshore waters due to the dredging operations is predicted not too exceed 10 days in a season. The discoloration (> 10 mg/l) of the surface waters at the entrance to the Mhlatuze estuary and the port entrance is predicted to be minimal and not exceed 5 days per season.

In terms of visual impacts, most of the time it will not be able to easily discern these predicted impacts from the already high turbidity events occurring in the region, the nearshore turbidity from shoreline erosion to the north of the port, as well as the turbidity associated with ongoing maintenance dredging.

8 DESCRIPTION & COMPARATIVE ASSESSMENT OF ALTERNATIVES

8.1 OVERVIEW

"*Alternatives are different means of meeting the general purpose and need of a proposed activity. The identification, description, evaluation and comparison of alternatives are important for ensuring the objectivity of the assessment process. In cases where there is no objective and thorough assessment of alternatives, the EIA process usually only confirms a chosen activity and the value of the assessment as an input to a decision-making may be compromised*" (DEAT Guideline 4, 2006).

Various alternatives have been determined, considered and screened based on specialist planning, environmental, social, engineering and economical inputs during the Scoping Phase.

8.2 THE "DO NOTHING" / "NO GO" ALTERNATIVE

The DEA stresses that the "Do-Nothing" "No Go" approach should be considered in cases where the proposed activity will have a significant negative impact that cannot be effectively or satisfactorily mitigated.

The "Do-Nothing" approach entails that the proposed Richards Bay Port Expansion is not developed in the area, i.e. that no development as per the proposal is undertaken. The prevention of the proposed project will provide a setback as the current terminal facilities and machinery are near their operational capacity and many of the assets are at or near the end of their useful life, requiring major refurbishment and/or replacement. On the other hand no development means that the biodiversity connectivity for plants and animals continue to exist.

The advantages for the proposed Richards Bay Port Expansion include the following:

- New coal berths are constructed in deep water, by extending the Dry Bulk Terminal (DBT) jetty, and no dredging is needed for these berths;
- Four New Products (NP) berths at 600 series constructed alongside a large NP stockpile. So all NP can be consolidated on the western side of the port;
- The new NP berths could be converted to container berths in future;
- Three new tipplers provide additional throughput capacity and reduce train turnaround times;
- A fourth twin cell tippler will be dedicated to discard coal and this will open up capacity on the other tipplers;

- Consolidating the non-priority break bulk to the west of the port, next to 600 series berths;
- Short travel distances to the berths reduce traffic inside the port;
- Flexibility to export non-priority break bulk through berths 706-708, although not preferred;
- All the discard coal is consolidated in the east of the port;
- All commodities are exported through berths as close as possible to the storing areas;
- Current storing areas for chrome, magnetite, ferrochrome, BHP aluminium and non-priority bulk are not moved to new positions;
- Development of non-priority break bulk infrastructure to the east of the port allows for easy expansion and is in agreement with the port's future development plan;
- Utilization of the 600 series berths in Option 3 is better when compared to Option 1;
- Constructing berths in the dry such as at the 600 series is considered simpler than in the wet.

8.3 Multi-Criteria Analysis During FEL1 And FEL2

Through a combination of the various bulk materials handling and marine options a total of fifteen possible options were identified during the FEL-1 phase. The possible environmental impact of the fifteen development options were evaluated and described. The fifteen possible options developed as a result of the combination of the various development options were subjected to a multi-criteria analysis process to determine the preferred options for development. Through this process the number of options was reduced to ten during FEL1.

The ten identified development options were subjected to a second multi-criteria analysis in the Prioritisation Phase of FEL-2.

When considering how "good" any solution design option is, many factors or criteria need to be considered. A Multi Criteria Analysis aims to rate each design option against weighted criteria in order to determine the most favourable option(s) across the entire spread of criteria. A Multi Criteria Analysis is a logical process to determine a "most favourable" option across multiple criteria. The sections that follow detail all the steps taken by the project team to identify criteria, weight the identified criteria, rate the various options, and interpret the results obtained. The process is detailed in Figure 8-1.

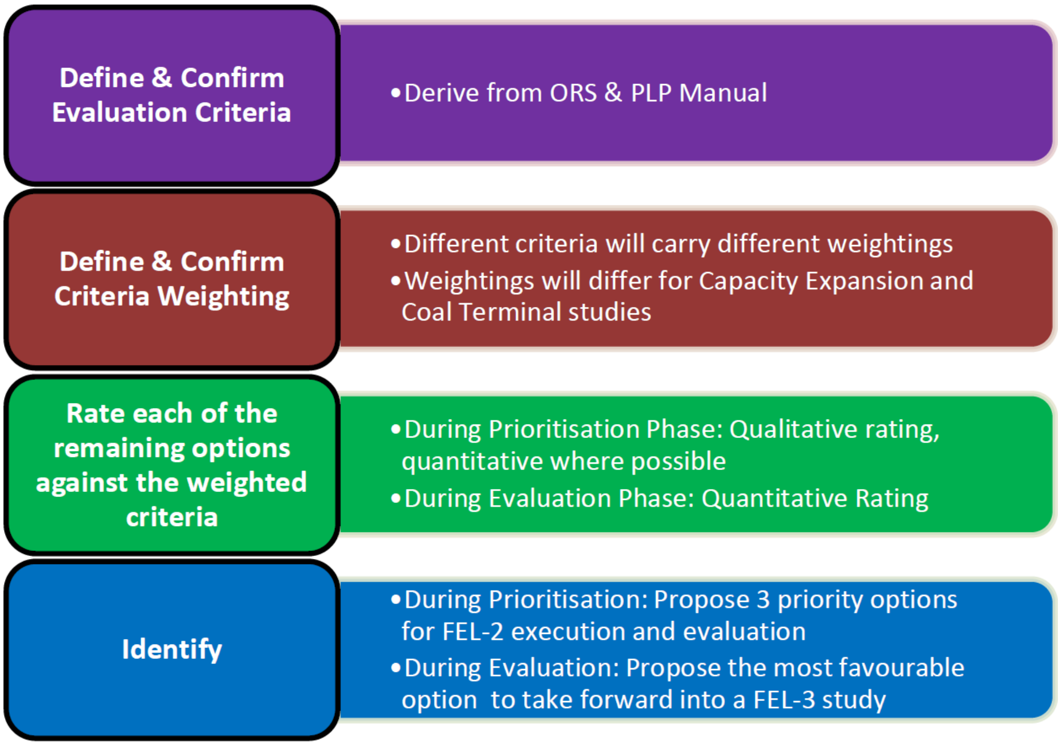


Figure 8-1: Multi-Criteria Analysis

During the FEL-1 study, the FEL-1 Owners Requirements Specification (ORS) Evaluation Criteria (i.e. safety, health, environment, community and society, sustainability, finance, operational performance, and direct and indirect job creation) were interpreted and expanded to suit the needs of the Richards Bay Port Expansion Capacity Programme's FEL-1 evaluation. The FEL-2 study required a greater level of analysis and details to ensure that Aurecon applied its mind to all relevant aspects regarding the remaining design options. Aurecon identified 6 main FEL2 criteria, which were further divided into sub-criteria (which are described behind each main criteria). When evaluating any solution over many criteria it is important to weight the criteria in a way that suits the objectives of the project. A new development might be weighted more in favour of economic sustainability while an upgrade might focus on operational performance.

The 6 main criteria used were as follows (with the weighting indicated in brackets):

- **Health and Safety** (10%) are a critically important design criterion. It is important to identify which design concept is safe in terms of construction and new operations, even during FEL 1. Any design with critical safety fatal flaw must be excluded.
- **Environmental and Social Sustainability** (20%): when dealing with any development/construction, one of the most important aspects to consider is the effect on the environment as well as the community. It is critical to identify and quantify (to an extent), the environmental impact of the Richards Bay Port Expansion Project with regards to fauna, flora, social aspects, waste, water, energy efficiency, and the cost/effort of mitigating these impacts.

- **Finance** (25%): From Transnet's side there is no doubt that Capital Expenditure (Capex) will be a major driver. Operational Expenditure (Opex) is just as important as Capex when considering any new development. There is often a trade-off between the initial expenditure and the cost of running/maintaining a solution.
- **Operational Performance** (20%) of a port terminal: the main operational elements that were considered include Rail Yard Operations, Offloading & Stacking Operation, Stockpile Position & Cross Hauling Operations, Reclaiming & Shiploading Operations, Marine Operations, and Scalability / Flexibility of the proposed solution.
- **Economic Impact** (10%): A successful strategic transport solution is one that will have a positive impact on the economy of Richards Bay and South Africa. Aspects considered are job creation (during construction and due to expansion), the GDP impact, compliance to long-term planning, and compliance to SIP1.
- **Constructability** (15%): In a port terminal as complex as the Port of Richards Bay, the constructability of any solution could be a defining factor. Aspects considered include ease of construction, construction impact on current operations, and time to readiness.

Scoring was conducted by a broad technical team which included expertise in various relevant technical and non-technical disciplines. When scoring the options, the goal was to rate each option against each criterion, and award a score out of ten based on the option’s performance in that criteria. Each set of criteria has a unique approach to scoring the respective options although the rating scale remains consistent.

The chosen scoring methodology was as follows:

- Each criterion has a different approach to scoring an option as some can be quantitatively measured while other criteria will have largely qualitative ratings.
- Each option is given a score between 0 and 10 where a 0 is a fatal flaw, and a 10 is ideal. These scores are based on the scoring approach for that particular criterion.
- These weighted scores are then tallied to a percentage score for the entire option, which is then compared to the other options.
- The goal is to select a well-balanced solution(s) that consistently scores well across many criteria.

All scores from the various criteria have been tallied and weightings have been applied. Table 8-1 lists the results obtained. The results show that options 1A, 1D and 3A are the most favourable and should be prioritised for FEL-2 Execution and Evaluation.

Table 8-1: Summary Scoring Sheet and Results

	Option	1A	1D	3A	1B	1C	3E	3C	2C	2A	2E
	Total % Score	65.4%	63.9%	63.8%	62.0%	60.4%	59.0%	57.3%	53.2%	53.0%	50.5%
Main Criteria	Sub-criteria										
Health & Safety	H&S During Construction	6	6	6	10	10	6	10	6	10	6
Health & Safety	H&S New Operations	7	7	8	7	8	8	8	4	7	4
Environmental & Social Sustainability	Environmental Red flags (Fauna & Flora)	6	4	6	3	5	5	5	6	5	5
Environmental & Social Sustainability	Social Red Flags (Community interface)	7	7	5	7	7	5	5	3	3	3
Environmental & Social Sustainability	Waste Management	3	3	4	3	3	4	4	5	5	5
Environmental & Social Sustainability	Water and Energy Usage	7	7	6	7	7	6	6	5	5	5
Finance	Capex	9	10	8	9	7	7	6	7	5	7
Finance	Opex	7	7	6	7	7	6	6	5	5	5
Operational performance	Rail yard & Operations	8	8	6	8	8	6	6	4	4	4
Operational performance	Offloading & Stacking	8	8	8	8	8	8	8	8	8	8
Operational performance	Stockpile Position & Cross Hauling	4	5	9	2	1	5	2	6	4	3
Operational performance	Reclaiming & Shiploading	7	7	7	7	4	7	4	5	5	5
Operational performance	Marine Operations	6	4	6	4	3	4	5	6	4	4
Operational performance	Scalability / Flexibility	5	4	7	4	4	6	5	5	5	5
Economic Impact	Job Creation (Construction)	6	5	7	6	7	7	8	7	9	7
Economic Impact	Job Creation (Due to expansion)	6	6	6	6	6	6	6	6	6	6
Economic Impact	GDP Impact	6	5	7	6	7	7	8	7	9	7
Economic Impact	Compliance to Long term planning	9	7	8	5	8	8	8	7	7	7
Economic Impact	Compliance to SIPS	8	8	8	8	8	8	8	8	8	8
Constructability	Ease of construction	6	6	6	6	6	6	6	6	6	6
Constructability	Construction Impact on current operations	6	6	6	6	7	6	7	6	7	6
Constructability	Time to readiness	7	7	7	7	7	7	7	7	7	7

The preferred options were subjected to an Evaluation Phase of FEL-2 to identify the go-forward option for FEL-3. The three priority issues were engineered and evaluated to a FEL 2 design accuracy level and are described in Table 8-2 below.

Table 8-2: Brief Description of Priority Issues

ORS main Element	Rail	Marine Works	Bulk Material Handling				
			Other Break-Bulk	Discard Coal	Chrome	Magnetite	Ferrochrome & Ferro-manganese
Option 1A	Rail Balloon with split off for Ferros, short train arrival yard & long train arrival yard	2 new berths at the 600 series. Finger Jetty extension (2 berths)	Break-bulk consolidated on Eastern end of port, next to the high-700 series berths	On the western end of the port behind the 600 series berths	As per Current Location with new storage method	As per Current Location with expansion south and new Bulk Material Handling equipment	Use existing system and extended Ferro slab.
Option 1D	Rail Balloon with split off for Ferros, short train arrival yard & long train arrival yard	2 new berths on the new 500 series, extend Finger jetty (2 berths)	Break-bulk consolidated on Eastern end of port, next to the high-700 series berths	On the western end of the port behind the 600 series berths	As per Current Location with new storage method	As per Current Location with expansion south and new Bulk Material Handling equipment	Use existing system and extended Ferro slab.
Option 3A	Rail Balloon with split off for Ferros, short train arrival yard & long train arrival yard	2 new berths at the 600 series. Finger Jetty extension (2 berths)	Break-bulk consolidated on western side of port next to the 600 series berths	Stockpile on eastern side of port behind the high 700 series berths	As per Current Location with new storage method	As per Current Location with expansion south and new Bulk Material Handling equipment	Use existing system and extended Ferro slab.

This evaluation is based on the evaluation criteria as defined during the Prioritisation phase (FEL1), and the technical findings of the Execution phase (FEL2). During the Options Selection workshop, held in conjunction with Transnet in February 2013, the following process was followed:

- The Aurecon Project Team presented the FEL-2 technical findings and then proposed scoring per criterion.
- Transnet was then given the opportunity to vote on the score by giving their own score of between 1 and 10 via an electronic keypad. The goal of the voting system was not to obtain a democratic answer, but rather to drive consensus between Transnet's Operating Divisions.
- The 1-10 scale is described as follows:
  - 9-10 – Ideal
  - 6-8 – Acceptable
  - 4-5 – Can be Improved
  - 1-3 – Possible but has many challenges
- Whenever a vote was cast, a histogram of the distribution of votes for that criterion was shown on the presentation. From these histograms it was a simple task to determine whether there was consensus in the room. When there was no consensus, a discussion was initiated, and the vote was retaken.

Table 8-3 below shows the summary of the scoring and final result of the workshop.

Table 8-3: Option Selection Workshop Results

		Option		1A	1D	3A
		% Score		56.9%	60.0%	62.4%
Main Criteria	Weight	Sub-criteria	Weight			
Health & Safety	10%	H&S During Construction	40%	6.1	5.7	5.3
		H&S New Operations	60%	6	5.8	7.6
Environmental & Social Sustainability	20%	Environmental Red flags (Fauna & Flora)	35%	5.1	3.6	5.7
		Social Red Flags (Community interface)	35%	6.5	6.7	4.7
		Waste Management	10%	3.7	3.2	4.2
		Water and Energy Usage	20%	6.6	6.7	6.8
Finance	25%	Capex	50%	0.6	3.4	2.4
		Opex	50%	6.6	7.3	6.9
Operational performance	20%	Rail yard & Operations	15%	7.7	7.4	6.4
		Offloading & Stacking	5%	8.2	8.2	8.1
		Stockpile Position & Cross Hauling	20%	7.6	7.6	9.2
		Reclaiming & Shiploading	25%	7.3	5.7	9.1
		Marine Operations	20%	4.7	6.2	5.7
		Scalability / Flexibility	15%	7.0	5.7	7.4
Economic Impact	10%	Job Creation (Construction)	20%	10.0	9.2	9.7
		Job Creation (Due to expansion)	28%	7.0	7.0	7.0
		GDP Impact	22%	10.0	9.5	10.0
		Compliance to Long term planning	20%	6.7	5.9	7.3
		Compliance to SIPS	10%	7.0	7.0	7.0
Constructability	15%	Ease of construction	20%	5.8	6.2	6.5
		Construction Impact on current operations	60%	5.9	6.6	6.6
		Time to readiness	20%	4.4	5.4	5.5

Option 3A was thus chosen to be the most favourable option.

8.4 SUSTAINABILITY ALTERNATIVES

The following criteria should be considered in the design of buildings and structures (where applicable) to support the efforts of Transnet towards a sustainable port:

Good construction management including:

- Environmental management and auditing;
- Waste management (recycling construction waste: rubble, steel, timber);
- Constructing of airtightness; and
- Protection of topsoil on site.

8.4.1 Buildings

Ensuring the indoor environmental quality is of a high quality, energy and water consumption remains efficient and thus building occupants remain healthy. This includes:

- Mechanical systems are designed to ensure that there is increased fresh air into the building:
    - Air movement i.e. no stagnant air;
    - Measures to control carbon dioxide build up i.e. carbon dioxide monitoring and measure to increase fresh air when required;
    - Less energy usage through efficient HVAC systems;
    - Less water usage through air cooled systems or water reuse systems;
    - Less harmful emissions into the atmosphere by specifying refrigerants with an Ozone Depleting Potential of zero.
    - Allow occupants to control their own temperature zones by providing manual controls, or controllable air vents etc.
- Electrical/ lighting systems that are specified to reduce uncomfortable headaches from low frequency flicker (high frequency ballasts to be used in all fluorescent lighting):
    - Ensuring that lighting is sufficient, but not overdesigned. Keep maintained luminance levels lower than 400 lux;
    - Sub-meter all energy uses, in order for building managers to monitor energy consumption so that the causes of high consumption can be resolved;
    - Zone lighting layouts for switching, reducing unnecessary energy consumption when occupants are not in certain areas of the building;
    - Reduce the consumption of energy in peak periods, through the use of ice tanks or photovoltaic panels; and
    - Generators that minimise harmful emissions should be specified.
- Building envelope and materials:
    - High performance glazing, wall and roof insulation to reduce energy loads and keep the building cool in the summer and warm in the winter;
    - Provide windows to allows a lot of natural daylight into the building, but include external shading to eliminate discomfort and glare from direct sun rays;
    - Avoidance of very deep internal spaces within the building, unless well-lit atria are included in design. Allow for external views of all occupants by locating usable area within 8m of a window;

   - Thorough hazardous material surveys must be conducted if buildings are being refurbished or extended;
   - Materials with good acoustic properties to ensure low noise levels should be specified;
   - Building materials with a recycled content (steel, wood etc.) should be chosen;
   - Timber from certified sustainable forests is preferred;
   - Substitute cement in concrete with flyash/ aggregate;
   - Specify paints, adhesives and carpets with low VOC contents;
   - Avoidance of products with formaldehyde content, for example: composite woods;
   - Contractor to source all building materials locally to reduce emissions of transportation and support the local economy;
   - All thermal insulation to be manufactured with no ozone depleting substances.
- Wet service design to include rainwater harvesting, grey water recycling, reduction of landscape irrigation;
   - Use waterless urinals, water efficient taps, shower heads and toilets; and
   - Sub-meter all major water uses, in order for building managers to monitor water consumption so that the causes of high consumption can be resolved;
- Provision of facilities to encourage alternative transport to work. Cyclist facilities that include bicycle racks, lockers and showers; preferential parking for car pool vehicles, alternative fuel transport and scooters.
- Include a recycling storage area for office waste.

8.4.2 Storm Water Management

The methodology during the FEL-2 study is based on collecting the dirty runoff volumes for at least a 10 mm first flush of the site into a collection sump and containing a maximum of 10 mm first flush events in a surge and dirty water containment facility. The dirty runoff will be pumped from collection sumps into the surge dam from which the water will be treated and reused.

In the occurrence of a single rainfall event of more than 10 mm precipitation, the dirty water will first be contained and pumped to the surge dam, while any excess runoff thereafter is assumed to be clean which can overflow into a 1:2 year storm water system that discharges into the sea.

8.4.3 Waste Minimisation

The implementation of waste minimisation methods in existing and proposed operations will reduce the environmental impacts. Waste taken to the landfill site can be significantly reduced by employing the following solutions within the port:

- ***Beneficiation***: Is a process were commodity waste streams can be recovered from being treated to improve the physical or chemical properties. This enables the port to reduce the waste volume disposed to landfill.
- ***Eco-efficient and economic handling equipment***: Eco-efficiency generates more value through technology and process changes whilst reducing resources use and environmental impact throughout the product or service's life.

8.4.4 CO_2 Footprint

The reduction of CO2 footprint in ports and terminals is possible through a cleaner energy mix and through reduced energy consumption using some of the following technology indicated below:

- Electric AC Drive Technology;
- VSG (Variable Speed Generator) Technology;
- Hybrid Technology with energy storage and recirculation.

Efficiency and operability of equipment have direct impact on the environment. By employing eco efficient technology they will serve as solutions in the reduction of handling operations, improvement of operation efficiency, reduction of emissions and energy savings.

8.4.5 Recycling

When reuse can no longer be carried out, the materials should preferably be recycled back into similar products or become secondary raw materials for the production of new products.

Generally producing new products from recycled materials consumes less energy and minimises the impact on the environment. In addition to conserving resources and reducing the environmental impacts, recycling also minimizes the use of landfill space, an important waste management objective.

8.4.6 Recovery

Recovery can be a viable option after reduction, reuse, and recycling have been fully explored. It can involve for example, incineration of waste and heat generation. The heat generation can be converted into power to be used commercially or domestically.

8.4.7 Energy efficiency

- Passive design methods towards energy conservation and consumption.
- Energy efficient solutions and installations for lighting, ventilation, cooling, heating, etc. (e.g. energy efficient light fittings).
- Alternative or renewable energy sources where practical, feasible or economical.

8.4.8 Water Conservation

- The saving or re-use methods (e.g. the stormwater collection system and disposal into the storage dam proposed by Aurecon).

9 IMPACT ASSESSMENT METHODOLOGY

9.1 Overview

In order to determine the significance of an impact, the following criteria would be used: extent, duration, intensity and probability. The extent and probability criteria have five parameters, with a scaling of 1 to 5. Intensity also has five parameters, but with a weighted scaling.

The assessment of the intensity of the impact is a relative evaluation within the context of all the activities and other impacts within the framework of the project. The intensity rating is weighted as 2 since this is the critical issue in terms of the overall risk and impact assessment (thus the scaling of 2 to 10, with intervals of 2). The intensity is thus measured as the degree to which the project affects or changes the environment.

9.2 Impact Assessment Criteria

The criteria used for the assessment of the potential impacts of the proposed Richards Bay Port Expansion Programme are described in **Table 9-1**. Cumulative impacts will be included as part of the impact assessment process.

Table 9-1: Impact Assessment Criteria

Criteria	Description
Nature	Includes a description of what causes the effect, what will be affected and how it will be affected.
Extent	The physical and spatial scale of the impact.
Duration	The lifetime of the impact is measured in relation to the lifetime of the proposed development.
Intensity	Examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself.
Probability	This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time.
Status	Description of the impact as positive, negative or neutral.
Significance	A synthesis of the characteristics described above and assessed as low, medium or high. A distinction will be made for the significance rating without the implementation of mitigation measures and with the implementation of mitigation measures.
Confidence	This is the level of knowledge/information that the environmental impact practitioner or a specialist had in his/her judgement.
Reversibility	Examining whether the impacted environment can be returned to its pre-impacted state once the cause of the impact has been removed.
Replaceability	Examining if an irreplaceable resource is impacted upon
Cumulative	Synthesis of different impacts in concert, considering the knock-on impacts thereof.

9.2.1 Nature and Status

The nature of the impact is the consideration of what the impact will be and how it will be affected. This description is qualitative and gives an overview of what is specifically being considered. That is, the nature considers 'what is the cause, what is affected, and how is it affected?'.

The status is thus given as being positive, negative or neutral, and is deemed to be either direct or indirect in impact.

9.2.2 Extent

The physical and spatial scale of the impact is classified in **Table 9-2**.

Table 9-2: Extent

Description	Explanation	Scoring
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	**1**
Site	The impact could affect the whole, or a significant portion of the site.	**2**
Local	Impact could affect the adjacent landowners.	**3**
Regional	Impact could affect the wider area around the site, that is, from a few kilometres, up to the wider Council region	**4**
National	Impact could have an effect that expands throughout a significant portion of South Africa – that is, as a minimum has an impact across provincial borders.	**5**

9.2.3 Duration

The lifetime of the impact is measured in relation to the lifetime of the proposed project, as per **Table 9-3**.

Table 9-3: Duration

Description	Explanation	Scoring
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than any of the development phases (i.e. less than 2 years).	**1**
Short to Medium term	The impact will be relevant through to the end of the construction phase (i.e. less than 5 years).	**2**
Medium term	Impact will last up to the end of the development phases, where after it will be entirely negated (i.e. related to each phase development thus less than 10 years).	**3**
Long term	The impact will continue or last for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter (i.e. during decommissioning) (i.e. more than 10 years, or a maximum of 60 years).	**4**
Permanent	This is the only class of impact that will be non-transitory. 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 (i.e. will remain once the site is closed).	**5**

9.2.4 Intensity

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project, as per **Table 9-4**.

Table 9-4: Intensity

Description	Explanation	Scoring
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	**2**
Low-Medium	The impact alters the affected environment in such a way that the natural processes or functions are slightly affected.	**4**
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.	**6**
Medium-High	The affected environment is altered, and the functions and processes are modified immensely.	**8**
High	Function or process of the affected environment is disturbed to the extent where the function or process temporarily or permanently ceases.	**10**

9.2.5 Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the lifecycle of the activity, and not at any given time. The probability classes are rated in **Table 9-5**.

Table 9-5: Probability

Description	Explanation	Scoring
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience (less than 24% chance of occurring).	**1**
Possible	The possibility of the impact occurring is very low, either due to the circumstances, design or experience (25 – 49%).	**2**
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made (50 – 69%).	**3**
Highly likely	It is most likely that the impacts will occur at some stage of the Development. Plans must be drawn up before carrying out the activity (70 – 89%).	**4**
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied upon (90 – 100%).	**5**

9.2.6 Confidence

The level of knowledge the EAP or a specialist had in their judgement and is rated in **Table 9-6**.

Table 9-6: Confidence

Description	Explanation
Low	The judgement is based on intuition and not on knowledge or information.
Medium	The judgement is based on common sense and general knowledge.
High	The judgement is based on scientific and/or proven information.

9.2.7 Level of Significance

The level of significance is expressed as the sum of the area exposed to the risk (extent), the length of time that exposure may occur over in total (duration), the severity of the exposure (intensity) and the likelihood of the event occurring (probability). This leads to a range of significance values running from '*no impact*' to '*extreme*'.

The significance of the impacts have been determined as the consequence of the impact occurring (reflection of chance of occurring, what will be affected (extent), how long will it be affected, and how intense is the impact) as affected by the probability of it occurring, this translates to the following formula: **Significance value = (Extent + Duration + Intensity) x Probability**.

Each impact is considered in turn and assigned a rating calculated using the results of this formula, and presented as a final rating classification according to **Table 9-7**. A distinction will be made for the significance rating of (a) without the implementation of mitigation measures, and, (b) with the implementation of mitigation measures.

Table 9-7: Level of Significance

Description	Explanation	Scoring
No Impact	There is no impact.	**0-9**
Low	The impacts are less important, but some mitigation is required to reduce the negative impacts.	**10-24**
Medium	The impacts are important and require attention; mitigation is required to reduce the negative impacts.	**25-49**
Medium to High	The impacts are of medium to high importance; mitigation is necessary to reduce negative impacts.	**50-74**
High	The impacts are of high importance and mitigation is essential to reduce the negative impacts	**75 - 89**
Extreme	The impacts present a fatal flaw, and alternatives must be considered.	**90-100**

9.3 IDENTIFICATION OF MITIGATION MEASURES

The purpose of mitigation measures is to reduce the significance level of the anticipated impact. Therefore, the reduction in the significance level after mitigation is directly related to the scores used in the impact assessment criteria. The effect of potential mitigation measures to reduce the overall significance level is also to be considered in each issues table (i.e. values with or without mitigation are presented).

9.4 CUMULATIVE IMPACTS

A cumulative impact, in relation to an activity, is the impact of an activity that may not be significant but may become significant when added to the existing and potential impacts arising from similar or other activities in the area. The possible cumulative impacts of this project were considered.

Cumulative impacts are those which have incremental impacts of the activity as a whole, and, others that past, present and future activities will have an impact on a common resource.

10 ASSESSMENT OF IMPACTS

10.1 OVERVIEW

The aim of the Scoping Phase was to identify, record and describe the issues that have been identified and/or raised by stakeholders, I&APs and specialists with regard to the proposed Richards Bay Port Expansion Programme. This enabled the specialist studies to be clearly focused on aspects of significant concern. It also provided a framework for the assessment of the impacts that the proposed Richards Bay Port Expansion will have on the environment, and of the impacts the environment will have on the proposed Richards Bay Port Expansion Programme.

The description of all environmental issues that were identified during the Scoping Phase of the EIA process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures have been considered in this section of the document and the associated draft Site-Specific EMPr. The cumulative impacts anticipated for the proposed development are considered at the end of this section.

The following environmental impacts were identified. Mitigation measures proposed have been included in the assessment and draft EMPr.

Table 10-1: Potential Identified Impacts

Potential Identified Impacts	
Socio-Economic Impacts	Noise Impact
	Impact on Air Quality
	Impact on Heritage Resources
Bio-Physical Impacts	Increased Turbidity and Suspended Solids Concentration
	Biodiversity Impact on Development
	Impact on Water Quality
	Dredge Disposal Site Assessment
	Climatological Impacts
Engineering Impacts	Waste Impacts
	Infrastructure Impacts

The specialist information was considered in terms of a formal quantification of the impact as per facets of the specific field highlighted by the specialist, as presented in **Section 7** of the EIA Report. In each case the specialist's recommendations were converted into potential mitigation measures and linked in the EMPr (Appendix **3**). The mitigation measures are summarised in the impact tables.

Note that the consideration of the health impacts have been considered in terms of the media through which the health impact could be delivered, that is, air quality and groundwater contamination impacts.

10.2 SOCIO-ECONOMIC IMPACTS

The purpose of this section is to identify anticipated social impacts which may occur as a result of the social change processes. Social impacts can be positive or negative, and occur within the context of human behaviour, which is often unpredictable, which varies according to cultures, traditions, political and religious beliefs, and which are influenced by perceptions. It should be noted that all of the social impacts identified and discussed in this section apply to the project in its entirety.

10.2.1 Increased spread of disease

Any development which causes the migration of people has the potential to lead to the spread of disease (HIV and AIDS are of particular concern in the case of Southern Africa). Research suggests that the presence of migrant construction workers leads to socially deviant behaviour such as an increase in activities like prostitution, alcohol abuse and promiscuous behaviour. This could lead to a scenario where infected construction workers migrating into the project area spread various sexually transmitted infections through unprotected intercourse with sex trade workers or local individuals, who, in turn, spread infections locally. Alternatively, an uninfected construction worker could become infected through unprotected intercourse and, on return to his/her place of origin spread the disease there.

An increase in disease has significant indirect social impacts including reduced productivity, increased dependency, an increase in child headed households, reduced school attendance, etc. All off these impacts ultimately result in an increased burden on the state. This is magnified because during construction it is assumed that a large amount of the required materials and construction equipment will be transported via road, rail and sea, all of which will result in a large number of people, traditionally associated with deviant social behaviour, moving temporarily through the project area and surrounds.

Considering the size of the project, the anticipated influx of workers and job seekers and the extended period over which construction will take place, it is anticipated that there will be a relatively significant increase in the spread of disease. However, it also needs to be considered that the receiving environment is not isolated in nature but is already characterised by the movement of people into and through it on a relatively consistent basis; thus, the incidence of disease and in particular HIV and AIDS is already considered significant.

<table>
<tr><th colspan="3">THEME - SOCIAL</th></tr>
<tr><th>Phase</th><th>Construction Phase</th><th>Operational Phase</th></tr>
<tr><td>Nature of impact</td><td colspan="2">Increased spread of disease</td></tr>
<tr><td>Status of impact</td><td>Negative</td><td rowspan="11">N/A</td></tr>
<tr><td>Extent of impact</td><td>4 - Regional</td></tr>
<tr><td>Duration of impact</td><td>3 – Medium term</td></tr>
<tr><td>Intensity of impact</td><td>6 - Medium</td></tr>
<tr><td>Probability</td><td>5 – Definite</td></tr>
<tr><td>Calculation</td><td>(4+3+6) x 5 = 65</td></tr>
<tr><td>Level of significance before mitigation</td><td>High</td></tr>
<tr><td>Confidence</td><td>High</td></tr>
<tr><td>Reversibility</td><td>Yes</td></tr>
<tr><td>Replaceability</td><td>Yes</td></tr>
<tr><td>Mitigation measures</td><td colspan="2">An HIV and AIDS awareness/education component should be included in the induction programme for all personnel working on the proposed project.
Ensure there is easy access to HIV and AIDS related information and condoms for all workers involved with the proposed project.
Encourage voluntary HIV and AIDS counselling and testing.</td></tr>
<tr><td>Level of significance after mitigation</td><td>Medium</td><td>N/A</td></tr>
</table>

10.2.2 Reduced road safety

Construction

During construction, there will be a significant increase in the volume of traffic making use of public roads, in particular, heavy duty vehicles. The increase in the presence of heavy duty vehicles on the roads is likely to lead to an increased possibility of road traffic accidents and, thus, reduced road safety for all road users. While an increase in vehicle traffic is likely to be noticeable within the primary and secondary study areas (the study site itself as well as Richards Bay) the likelihood of reduced road safety is not thought to be of major significance due to the recently completed upgrades of the John Ross Highway. Of concern, however, is reduced road safety as a result of the increase in the number of heavy duty vehicles on the already congested N2 (particularly to the north of Richards Bay) and other major roads connecting the hinterland and the Richards Bay Port.

It is understood that a traffic specialist study has been conducted as part of the suite of specialist studies. Greater detail regarding road safety is provided in this report.

Operation

As a result of the expansion, the port will be able to handle a higher volume of cargo. The increase in the handling capacity of the port is likely to increase the number of heavy duty vehicles on roads thereby potentially reducing road safety. The increase in vehicle traffic will not only occur in and around Richards Bay but will extend on major road networks inland i.e. an impact felt within the primary, secondary and tertiary study areas.

An increase in the number of vehicles will bring with it various issues including increased pressure on the existing road infrastructure as well as reduced road safety for all users. It should be added that concerns regarding an increase in traffic were raised during the public participation process and that it was requested that a Specialist Traffic Study be undertaken to determine what the implications are for traffic outside of the port area.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Reduced road safety**	
Status of impact	Negative	Negative
Extent of impact	5 - National	5 - National
Duration of impact	3 – Medium term	3 – Medium term
Intensity of impact	6 - Medium	6 - Medium
Probability	4 – Highly likely	4 – Highly likely
Calculation	(5+3+6) x 4 = 56	(5+3+6) x 4 = 56
Level of significance before mitigation	**Medium**	**Medium**
Confidence	Medium	Medium
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• The Traffic Specialist should develop a traffic management plan (for construction and operations) during project planning, which should be implemented throughout all stages of construction. • Implement the traffic management plan.	
Level of significance after mitigation	**Medium**	**Medium**

10.2.3 Increase in informal dwellers and/or destitute people

It is anticipated that there will be a significant influx of job seekers into the area during the construction phase of the project. Considering the size of the proposed project and the long period of time over which the proposed expansion will take place, it is likely that a large percentage of job seekers will migrate not only from the secondary study area (surrounding rural areas which are characterised by high levels of poverty) but from throughout KwaZulu-Natal, other provinces in South Africa and potentially other countries, in particular Swaziland and Mozambique. For some of the job seekers moving into the area it is likely that they will not have the financial capability to return to their place of residence if they do not find work. It should be noted that this is a point raised by a representative of Zululand Business Against Crime, stating that, at present, there are an undisclosed number of people living in the bush on the periphery of Richards Bay who arrived from the outlying rural areas in search of work but have not found any and do not have sufficient funds to return to their original homes (Whittaker. D., pers. comm., 2014). These people are likely to set up informal settlements in and around the city which may lead to further social problems such as increased petty crime, reduced property value, health concerns due to a lack of sanitation and drinking water, and ultimately an increased financial burden for local government.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increase in informal dwellers**	
Status of impact	Negative	N/A
Extent of impact	3 - Regional	
Duration of impact	3 – Medium term	
Intensity of impact	6 - Medium	
Probability	4 – Highly likely	
Calculation	(3+3+6) x 4 = 48	
Level of significance before mitigation	**Medium**	
Confidence	Medium	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• Prior to construction, the City of uMhlathuze LM should be informed of the possibility of an increase in informal dwellers and/or destitute people so that the necessary planning can be undertaken. • During project planning, provide clarity in the media regarding the available number of jobs so that there are not raised expectations, which hopefully will reduce population in-migration.	
Level of significance after mitigation	**Low**	**N/A**

10.2.4 Increased noise

Construction

Construction activities, especially the construction of the railway and 'rail balloon' due to its close proximity to residential areas and the Tuzi Gazi Water Front, are likely to increase the amount of noise experienced by people in the area. Likely sources of noise include construction machinery, such as jack hammers, earth moving equipment, etc. The increase in noise can be considered a nuisance factor specifically for businesses working from Tuzi Gazi as well as for residents in the upmarket residential complexes adjacent to the small craft harbour. It should be noted that while the area is currently characterised by noise, it is of a very different nature to noise associated with construction activities. It is, however, understood that a noise impact assessment has been conducted which provides greater detail into the impact of noise on sensitive receptors.

Operation

As a result of the port expansion there will be an increase in the number of vessels within the port, an increase in the number of vessels being loaded and unloaded and an increase in road traffic within the port. All of these factors are likely to increase the amount of noise being generated by the port. The most likely parties to be affected are within the primary and secondary study areas and particularly those residing in the residential areas close to the small craft harbour as well as businesses based at the Tuzi Gazi Water Front. However, it should be added that during discussions with the owner of the Tuzi Gazi Water Front it was noted that there was little concern over noise created by the port citing water front development of such a nature as being characterised by a certain level of noise (Hughes. R., pers. comm., 2015). In addition, a specialist noise impact assessment has also been conducted for the proposed project which notes that there is a low significance of noise impact during the operational phase of the project (De Jager, 2014).

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased noise**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	2 – Short-medium term	3 – Medium term
Intensity of impact	4 – Low-medium	4 – Low-medium
Probability	5 – Definite	5 – Definite
Calculation	(3+2+4) x 5 = 45	(3+3+4) x 5 = 50
Level of significance before mitigation	**Medium**	**Medium**
Confidence	Medium	Medium
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Noise suppression techniques should be used as far as possible. • Avoid construction before sunrise and after sunset. • Inform neighbouring residential areas and businesses beforehand if excessively high noise generating activities are going to be taking place. • Comply with recommendations provided in the noise impact assessment.	
Level of significance after mitigation	**Medium**	**Medium**

10.2.5 Increased pressure on road and services infrastructure

Construction

During construction, it is likely that there will be an increase in the number of vehicles making use of public roads, in particular heavy duty vehicles. The increase in heavy duty vehicles will place increased pressure on the existing road infrastructure. If not suitably dealt with damage to the road infrastructure may reduce overall road safety for all road users in the area. This impact is likely to occur within the primary study area (port), the secondary study area (Richards Bay and the surrounding DM) and potentially on a national level (tertiary study area) where an increase in heavy duty trucks may damage existing road infrastructure, particularly on small roads.

Within the secondary study area (Richards Bay and the surrounding LM and DM), services such as water, sanitation and electricity, the influx of people into the area (both workers and job seekers) will place increased pressure on an already stretched water and sanitation system. In addition, it is anticipated that during the construction period, the demand for electricity will increase. Considering the current power supply crisis in South Africa, any additional strain on the existing system could cause system failure and increased load shedding events.

Operation

During the operational phase of the proposed project the increase in road vehicle traffic will lead to increased pressure on road infrastructure. The increase in pressure on road infrastructure, if not planned for, will have secondary impacts including reduced road safety.

The proposed project is also likely to bring with it increased investment in the primary and secondary study areas. This increase in industry, if not planned for, is likely to place increased pressure on existing services such as water and electricity.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased pressure on road and services infrastructure**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	4 – Long term	3 – Medium term
Intensity of impact	4 – Low medium	4 – Low medium
Probability	3 – Likely	3 – Likely
Calculation	(3+4+4) x 3 = 33	(3+3+4) x 3 = 30
Level of significance before mitigation	**Medium**	**Low**
Confidence	Medium	Medium
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Communicate with the relevant authorities regarding water and electrical requirements. • Follow recommendations provided in the traffic management plan. • Communicate with the relevant authorities regarding future water and electrical requirements. • Follow recommendations provided in the traffic management plan.	
Level of significance after mitigation	**Low**	**Low**

10.2.6 Increased air emissions dust

Construction

Due to the amount of industry in Richards Bay, air emissions are an issue which is of particular concern to local residents. During the construction process, it is not anticipated that there will be a significant increase in emissions of SO2 and HF which are understood to be the most problematic emissions in the Richards Bay area. While there may be an increase in CO2 as a result of increased ship, train and vehicle traffic concentrated around the port, an Air Quality Impact Assessment was conducted which concluded that increases are not believed to be of significance. There is, however, the possibility that during construction there will be an increase in dust, in particular, PM10.The areas of greatest concern are those close to the port, in particular, the Tuzi Gazi Water Front as well as the upmarket residential areas adjacent to the small craft harbour. During times of strong winds from the south-east and south-west, other areas of Richards Bay may also be affected. It should be noted that the perceived increase in dust was identified by local government representatives (S. Govender. S., and Strachan. B., pers. comm., 2015) as well as the Tuzi Gazi Water Front representative as being of concern (Hughes. R., pers. comm., 2015).

Operation

During the operational phase, it is likely that there will be an increase in the amount of air emissions. Of particular concern, and raised by the Environmental Planning Department from the City of uMhlatuze, is the potential increase in PM10 as a result of an increase in the loading and offloading of vessels within the port (Govender, S., and Strachan, B., pers. comm., 2015). This is of particular concern during times of southerly winds as the particulate matter and dust will be blown towards residential areas of Richards Bay. The port expansion is also expected to lead to an increase in the number of vessels utilising the port, which, in turn, is likely to lead to an increase in CO2 emissions.

It should, however, be noted that the emissions of greatest concern in the Richards Bay area are SO2 and HF, both of which are not expected to increase as a direct result of the port expansion. However, possible indirect impacts should be noted, such as the possibility of the port expansion leading to further industrial development within Richards Bay which may contribute to an increase in air emissions. It is likely that increased air emissions will only affect the primary and secondary study areas (the port, Richards Bay and the surrounding LM an DM), however it is understood that an Air Quality Specialist Study has been undertaken which provides greater insight into potential changes to current ambient levels of different emissions and where the most sensitive receptors are located.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased air emissions and dust**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	2 – Short-medium term	3 – Medium term
Intensity of impact	4 – Low-medium	4 – Low-medium
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+2+4) x 4 = 36	(3+3+4) x 4 = 40
Level of significance before mitigation	**Medium**	**Medium**
Confidence	Medium	Medium
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Ensure that dust suppression techniques are practiced, such as spraying of exposed areas with water to suppress dust. • Keep exposed surfaces to a minimum and for the shortest possible time. • Ensure that air emissions are within the required legal limits. • Ensure that air emissions comply with legal requirements. • Practice dust suppression techniques at all exposed stock piles.	
Level of significance after mitigation	**Low**	**Low**

10.2.7 Increased criminal activity

An increase in criminal activity is often associated with large developments and/or projects where there is likely to be an in-migration of construction workers, job seekers and criminal opportunists.

In the case of the proposed project, the possibility of an increase in crime should not be under-estimated. It is anticipated that there will be a significant movement of people into the area some of whom are likely to be criminal opportunists. While the area immediately adjacent to the port, such as the Tuzi Gazi Water Front and the upmarket residential developments adjacent to the small craft harbour, may be affected by crime it is believed that existing security measures and the police presence in this area should keep possible criminal activity down. As such, it is more likely that the most significantly affected areas will be the secondary study area (Richards Bay and the surrounding LM and DM) in particular the settlements of Esikhalini and Nseleni. It is likely that job seekers and criminal opportunists moving into the area will settle in these less formal areas, with criminal opportunists taking advantage of potential ‘soft’ targets. While the possibility of increased criminal activity should not be ignored, it should be noted that during discussions with the Zululand Business Against Crime representative it was stated that the potential increase in employment that the proposed project may bring could lead to an overall reduction in petty crime as employed people will have a consistent income (Whittaker. D, pers. comm., 2014).

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased criminal activity**	
Status of impact	Negative	N/A
Extent of impact	3 - Regional	
Duration of impact	3 – Medium term	
Intensity of impact	6 - Medium	
Probability	3 - Likely	
Calculation	(3+3+6) x 3 = 36	
Level of significance before mitigation	**Medium**	
Confidence	Medium	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• Construction staff should be clearly identified by wearing uniforms and/or wearing identification cards that should be exhibited in a visible place on their body. • Instant dismissal and prosecution of any staff caught in criminal activities of any kind. • Inform local law enforcement agencies of the possibilities of increased criminal activity in the area.	
Level of significance after mitigation	**Low**	**N/A**

10.2.8 Loss of recreational areas

In the event of the proposed expansion taking place, the area referred to as the 'Casuarinas', which is currently open to and used by the public for recreational purposes, will no longer be available for recreational activities. Presently, the area is utilised by families and individuals from in and around the Richards Bay for fishing, walking, picnicking, etc. The loss of the area could potentially lead to opposition from the public who have used the area for an extended period of time. However, it should be noted that no concerns were raised during the public participation process regarding the loss of access to this area, albeit that it seems that greater public consultation is required. Also, the public will still have access to other areas around the port, such as Pelican Island and Naval Island.

However, concern was raised by representatives from the City of uMhlathuze LM who noted that the 'Casuarinas' area provides a buffer between the port and the Tuzi Gazi Water Front and upmarket residential developments. It was suggested that if this buffer is lost, these areas would be more exposed to negative impacts from the port, such as noise (S. Govender. S., and Strachan. B., pers. comm., 2015). It should however be noted that in terms of the planned expansion programme being assessed in this study, the 'buffer' will not be lost.

In this regard, it should be noted that the 'Casuarinas' area is located on Transnet land and it is understood that the use by the public has been at the consent of Transnet with no commitment of any type to keep the area for recreational purposes in perpetuity.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Loss of recreational areas**	
Status of impact	Negative	N/A
Extent of impact	2 - Site	
Duration of impact	4 – Long term	
Intensity of impact	6 - Medium	
Probability	5 – Definite	
Calculation	(2+4+6) x 5 = 60	
Level of significance before mitigation	**High**	
Confidence	High	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• During project planning, engage with affected parties to assess their concerns and establish how other recreational areas may be improved. • Endeavour to improve the facilities (toilets, picnic areas, etc.) at other recreational areas, in particular, Pelican Island and Naval Island. • Put in place maintenance programmes to keep these recreational areas clean and safe.	
Level of significance after mitigation	**Medium**	**N/A**

10.2.9 Increased employment opportunities

Construction

It has been projected that within the South African economy 9,151 jobs (skilled and unskilled) will be created directly, 3,810 jobs indirectly and 8,198 jobs induced as a result of the proposed port expansion. However, data on how many jobs will be required locally during construction is not available. It is however anticipated that there will be significant direct and indirect employment opportunities created. Considering the high levels of unemployment experienced within the greater study area and region an increase in employment opportunities of this nature are likely to have significant social impacts. As a direct impact of employment, the level of household income in communities will increase as will the amount of disposable income. Indirectly, local businesses will benefit through the increase in household income while the general standard of living of communities should also see an improvement. While it is unclear at this stage how many of the jobs will be required for the entire construction period of eight years, it is likely that some of the jobs will be relatively long-term, thereby prolonging this positive impact. In addition to the financial benefits of employment creation, an increase in employment opportunities will also enable skills development and re-skilling, both of which have the potential to have long-term social benefits.

Operation

Data on the number of jobs that will be created locally during the operational phase is not available. However, it is anticipated that new jobs will be required as a direct result of the port expansion. Considering the high levels of unemployment displayed by the population in the greater Richards Bay area, the potential for the creation of additional permanent jobs could be significant. However without data detailing the number of jobs likely to be created it is not possible to place the employment opportunities in context.

Due to the demand for various services as a result of the port expansion, indirect employment opportunities will also be created. Opportunities are likely to be created for various service providers while the potential for increased investment as a result of the port expansions will result in further employment opportunities.

The increase in employment within the area brings with it various indirect social benefits such as an increase in the general standard of living, increase in expendable income which benefits local business and an increase in tax revenue. The importance of the port in contributing to employment and, in turn, economic development in the region was noted by representatives of the Zululand Chamber of Commerce and Industry.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased employment opportunities**	
Status of impact	Positive	Positive
Extent of impact	3 - Regional	3 - Regional
Duration of impact	2 – Short-medium term	3 – Medium term
Intensity of impact	4 – Low-medium	4 – Low-medium
Probability	3 - Likely	3 - Likely
Calculation	(3+2+4) x 3 = 27	(3+3+4) x 3 = 30
Level of significance before mitigation	**Low**	**Low**
Confidence	Low	Low
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Endeavour to employ locally based labour as far as possible. • Ensure that contractors are required, as far as is feasibly possible, to employ local labour. • Conduct training and upskilling of employees so as to help them find employment after the construction phase of the project.	
Level of significance after mitigation	**Medium**	**Medium**

10.2.10 Increased opportunities for local service providers

During construction, various services will be required which can be fulfilled by local service providers. Examples of such services include security, fencing, accommodation, earth moving, refuse removal, transport, etc. The appointment of local service providers will lead to further employment for the local population and, thus, put a greater amount of money into the local economy.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased opportunities for local service providers**	
Status of impact	Positive	N/A
Extent of impact	3 - Regional	
Duration of impact	2 – Short-medium term	
Intensity of impact	4 – Low-medium	
Probability	3 – Likely	
Calculation	(3+2+4) x 3 = 27	
Level of significance before mitigation	**Low**	
Confidence	Low	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• During project planning, in conjunction with local government, develop a database of locally based vendors with the necessary expertise to provide the required services. • As far as possible employ local service providers.	
Level of significance after mitigation	**Medium**	**N/A**

10.2.11 Increased investment

Construction

During communication with representatives from the Zululand Chamber of Commerce and Industry it was reported that the presence of the port is a significant 'pull factor' for industry into the area (Patterson. M, pers. comm., 2015).

The importance of the port for investment in Richards Bay was also confirmed during discussions with the Richards Bay Industrial Development Zone. It was noted that the construction of the container terminal will assist the IDZ in attracting investors. This is particularly important for industries involved with mineral beneficiation as they require containers to transport processed goods (Ngcamu. S, pers. comm., 2015). Thus, in the event of the port expansion being confirmed and construction commencing, there is an increased likelihood that investors will consider Richards Bay as an area with a competitive advantage. This in turn has numerous secondary impacts such as employment creation.

It needs to be noted that the increase in investment may spread further afield than the primary and secondary study areas. It is possible that the proposed expansion to the port and the existing rail and road networks to the port may make investment in large industry and mining activities inland more viable. Thus, the importance of the port expansion in terms of attracting investment also needs to be considered on a tertiary (provincial and national) scale.

Operation

The expansion of the Richards Bay Port is likely to increase the attractiveness of Richards Bay to potential investors, in particular, large industry. The possibility of the port expansion is thought to be of specific significance to the Richards Bay Industrial Development Zone as it will serve as a further 'pull factor' for industry. This was noted by a representative of the Richards Bay Industrial Development Zone, who added that the construction of a functional container terminal is of particular significance (Ngcamu. S, pers. comm., 2015). An increase in investment will also assist in the creation of jobs.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Increased investment**	
Status of impact	Positive	Positive
Extent of impact	2 - Site	2 - Site
Duration of impact	3 – Medium term	3 – Medium term
Intensity of impact	4 – Low-medium	4 – Low-medium
Probability	3 – Likely	3 – Likely
Calculation	(2+3+4) x 3 = 27	(2+3+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	Low	Low
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Communicate with the RBIDZ regarding planned projects and potential investors. • Through the media and other public platforms, conduct marketing campaigns regarding the benefits of the proposed port expansions as well as the benefits of investing in the IDZ. It should be noted that this is a programme that can be run in conjunction with the IDZ. • Conduct public awareness and marketing campaigns through the media and other social platforms informing industry and business of the benefits of the expanded port and the IDZ. • Ensure that all infrastructure (roads, railways, etc.) are maintained and remain competitive with other ports.	
Level of significance after mitigation	**Medium**	**Medium**

10.2.12 Disruption to port activities

It has been confirmed by Transnet Capital Projects that during the expansion programme there is potential for disruption to current port activities. During construction, the utilisation of berths 606, 801 and 804 will be disrupted and it is believed by Transnet that there may be potential navigation difficulties as a result of the extension of the 800 series finger jetty. In addition, the woodchip conveyor will need to be relocated. Such disruptions could have economic impacts for the port itself as the number of vessels it is able to receive may decrease or alternatively the vessel 'turnaround' time may increase which could lead to shipping companies looking at alternative ports. This, in turn, may have implications for local businesses.

It does, however, need to be appreciated that without the expansion occurring, these issues, viz. increased 'turnaround' time, limits to the number of vessels, impacts on local businesses, etc are likely to occur in any event. Considering this, it appears that while disruptions are inevitable, the expansion activities need to take place.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Disruption of port activities**	
Status of impact	Negative	N/A
Extent of impact	2 - Site	
Duration of impact	2 – Short-medium term	
Intensity of impact	8 – Medium-high	
Probability	5 – Definite	
Calculation	(2+2+8) x 5 = 60	
Level of significance before mitigation	**High**	
Confidence	Medium	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• Phase project stages so as to limit disruptions. • Inform port users of potential disruptions prior to any disruptions taking place.	
Level of significance after mitigation	**Medium - High**	**N/A**

10.2.13 Opposition to the public participation process

During consultation with stakeholders, it emerged that a number of them reported that they felt there had been poor communication during the EIA phase of the project with a lack of feedback on project plans and project progress. Other stakeholders, such as the owner of the Tuzi Gazi Water Front, reported not having been informed of the project at all. While it is understood that significant public consultation was undertaken during the FEL 1 and FEL 2 phases of the project and that the legal requirements of the public participation process have been met, considering the size and the potential strategic importance of the project, possibly greater and wider consultation should be considered. This is a concern raised by the Richards Bay Port Users Committee who note that:

"If the legislated PPP (Public Participation Process) requirement is deemed to have been 'met' by the mere posting of an advert in the press, the placing of laminated notices in some random positions around the City of Umhlathuze to solicit I&AP's registration, followed by a mere 40 day review period of a veritable 473 page DSR, we declare this to fall far short of the spirit of collective engagement".

Considering the consistent response from key stakeholders regarding the lack of transparent communication and information dissemination, it is believed that in the event of no further consultation taking place, it is likely that the project proponent will be faced with significant opposition and appeals to any authorisation which is likely to prove costly and will slow down the authorisation process. It needs to be considered that delays in the authorisation of the port expansion will not only have implications for the primary and secondary study area but, due to the potential strategic significance of the port, impacts may be felt on a tertiary (provincial and national) level.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Opposition to the public participation process**	
Status of impact	Negative	N/A
Extent of impact	3 - Regional	
Duration of impact	2 – Short-medium term	
Intensity of impact	4 – Low-medium	
Probability	5 – Definite	
Calculation	(3+2+4) x 5 = 45	
Level of significance before mitigation	**Medium**	
Confidence	Medium	
Reversibility	Yes	
Replaceability	Yes	
Mitigation measures	• Review the existing public participation process. • Contact existing I&APs as well as additional stakeholders and determine if there is a demand for additional consultation. • If deemed necessary, undertake additional consultation.	
Level of significance after mitigation	**Medium**	**N/A**

10.2.14 Social impacts during decommissioning

Considering the nature of the project, it is unlikely that the complete decommissioning of the port will take place in the foreseeable future but rather that specific sections may be decommissioned or upgraded overtime. In this regard, it is likely that the social impacts that may occur will be similar in nature to those that occur during construction. However, it is anticipated that the socio-economic conditions prevailing in the project area would have changed significantly by the time decommissioning of port components occurs and, therefore, it is not possible to accurately quantify the significance of identified social impacts.

10.3 Noise Impacts

Increased sound levels are directly linked with the various activities associated with the construction, as well as the operational phase of the activity.

The construction of the project was not investigated as the implementation or construction of equipment is relatively quick in relation to operations of the facility, and equipment is less likely to be established during the more critical investigational night-time hours. Potential maximum noise levels generated by construction equipment as well as the potential extent are presented in the noise specialist report. The potential extent depends on a number of factors, including the prevailing ambient sound levels during the instance the maximum noise event occurred, as well as the spectral character of the noise and the ambient surroundings.

Rail traffic is considered as a line source of noise with a continuous area of impact both sides of and parallel to the railway line. Railway related noise is general acoustically characterised by high noise levels of relatively short duration. The wayside noise radiated into a community is the function of a number of different factors, namely:

- Interaction of wheels and rails. This includes the type of railway and wheel design, wheel diameter and "roughness".
- Amount of axels per carriage.
- The vehicle or locomotive propulsion system.
- Type of locomotive and wagons.
- Amount of trains per day/night.
- Braking technology employed on the wagons and locomotives.
- Railway alignment, in particular the design radius of curves and turns.
- Auxiliary equipment.
- Noise radiated from vibrating structures.
- Train speed.
- The length/amount of carriages.
- Aerodynamics.
- Locomotive warning devices or horn noise.

Although not significantly and generally far less than sources of noise mentioned above, other sources noises include:

- Ancillary equipment at rail passing loops (substations, compressors, refuelling, etc.).
- Railway maintenance operations.

- Workshops and other equipment maintenance.

Closure activities will not be considered in this report. In general, closure activities have a significant lower noise impact than both the operational and closure phases. The closure phase will therefore not be considered during this document for the following reasons:

- Closure activities are generally less intense than construction and operational activities. Noise levels are lower and frequently limited to daylight hours. This reduces the significance of the noise impact.
- Most rehabilitation takes place con-currently with mining. It is therefore just another activity generating noise that could be considered as part of the operational phase.
- A closure EMP must be developed by the mining operation at the end of the mining operation, which is more specific and accurate. If required, noise could be addressed in this document.

Based on the data the risk of a noise impact developing during the daytime operational hours is of a low significance.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Noise impact from construction and operation of railway balloon on receptors during daytime**	
Status of impact	Negative	Negative
Extent of impact	2 – Local	2 – Local
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	6 – Medium	6 – Medium
Probability	1 – Improbable	1 – Improbable
Calculation	(2+4+6) x 1 = 12	(2+4+6) x 1 = 12
Level of significance before mitigation	**Low**	**Low**
Confidence	Medium	High
Reversibility	No	No
Replaceability	No	No
Mitigation measures	• Ensure equivalent A-weighted noise levels below 55 dBA at potentially noise-sensitive receptors (daytime). • Ensure equivalent A-weighted noise levels below 45 dBA at potentially noise-sensitive receptors (night-time). • Define industrial boundaries as set out by municipality industrial zoning. Ensuring that equivalent A-weighted noise levels at this boundary does not exceed 61 dBA (over a 24 hour period); • Ensure that maximum noise events at potentially noise-sensitive receptors are less than 55 dBA eight times per night (RMS value); • Ensure that the change in Rating Level as experienced by Potentially Sensitive Receptors is less than 7 dBA; • Ensuring compliance with the National Noise Control Regulations and SANS10103:2008 guidelines. The referencing of the International Finance Corporation (World Bank) guidelines for an acceptable sound level in a residential area was also considered.	
Level of significance after mitigation	**Low**	**Low**

Based on the preceding data the risk of a noise impact developing during the night-time operational hours is of a low significance.

THEME - SOCIAL		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Noise impact from construction and operation of railway balloon on receptors during night-time**	
Status of impact	Negative	Negative
Extent of impact	2 – Local	2 – Local
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	6 – Medium	6 – Medium
Probability	2 – Improbable	1 – Improbable
Calculation	(2+4+6) x 1 = 12	(2+4+6) x 1 = 12
Level of significance before mitigation	**Low**	**Low**
Confidence	Medium	High
Reversibility	No	No
Replaceability	No	No
Mitigation measures	• Ensure equivalent A-weighted noise levels below 55 dBA at potentially noise-sensitive receptors (daytime). • Ensure equivalent A-weighted noise levels below 45 dBA at potentially noise-sensitive receptors (night-time). • Define industrial boundaries as set out by municipality industrial zoning. Ensuring that equivalent A-weighted noise levels at this boundary does not exceed 61 dBA (over a 24 hour period); • Ensure that maximum noise events at potentially noise-sensitive receptors are less than 55 dBA eight times per night (RMS value); • Ensure that the change in Rating Level as experienced by Potentially Sensitive Receptors is less than 7 dBA; • Ensuring compliance with the National Noise Control Regulations and SANS10103:2008 guidelines. The referencing of the International Finance Corporation (World Bank) guidelines for an acceptable sound level in a residential area was also considered.	
Level of significance after mitigation	**Low**	**Low**

10.4 Biodiversity Impacts

10.4.1 Avi - fauna

In terms of the bird fauna present in the three broad based habitats identified in the Rail Balloon Area it is concluded as follows:

- Despite the Secondary Woodland habitat having a well-established bird fauna the loss of this area to development would have no major effects on the fauna of the greater uMhlathuze area.
- Due to the current low water levels in the area no data of any substance was obtained from the Freshwater Wetland habitat. However this type of habitat is ecologically important and declining across KwaZulu-Natal. It is considered that the implementation of some form of Offset related to the nearby Thulazihleka Pan might be an option for the loss of this area to development.

- The Intertidal Mangrove and Sandflats was the only area where Red Data were present or considered to potentially occur. The intertidal areas are of importance to waders, terns and gulls and the loss of this habitat could be of some significance from a bird perspective.

THEME - AVIFAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Avi-fauna at Site A – Rail Balloon Area, Secondary Woodland**	
Status of impact	Negative	Negative
Extent of impact	1 – Footprint	Negative
Duration of impact	4 – Long term	1 – Footprint
Intensity of impact	4 – Low medium	4 – Long term
Probability	3 - Likely	4 – Low medium
Calculation	(1+4+4) x 3 = 27	(1+4+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	High	High
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• Suitable alternative habitat areas are available in sufficient supply in the surrounding area where avifauna are said to be able to vacate to	
Level of significance after mitigation	**Medium**	**Medium**

THEME - AVIFAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Avi-fauna at Site A – Rail Balloon Area, Freshwater Wetland**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	8 – Medium-high	8 – Medium-high
Probability	3 – Likely	3 – Likely
Calculation	(3+4+8) x 3 = 45	(3+4+8) x 3 = 45
Level of significance before mitigation	**Medium**	**Medium**
Confidence	High	High
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• A wetland rehabilitation plan is recommended to ensure that wetland habitat destruction is minimal and restored after construction • Suitable offsets should be sort for wetland area to be compromised by the development	
Level of significance after mitigation	**Medium**	**Medium**

THEME - AVIFAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Avi-fauna at Site A – Rail Balloon Area, Mangrove and Sandflats**	
Status of impact	Negative	Negative
Extent of impact	3 – Regional	3 – Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	10 – High	10 – High
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+10) x 4 = 68	(3+4+10) x 4 = 68
Level of significance before mitigation	**High**	**High**
Confidence	Medium	Medium
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • A detailed mangrove and sandflats conservation strategy is required to ensure that minimal impact is had on the mangroves and sandflat habitat • Suitable offsets should be investigated to determine if there are any suitable alternatives.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

THEME - AVIFAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Avi-fauna at Site C – Berth 600 Series Extension**	
Status of impact	Negative	Negative
Extent of impact	1 – Footprint	Negative
Duration of impact	4 – Long term	1 – Footprint
Intensity of impact	4 – Low medium	4 – Long term
Probability	3 - Likely	4 – Low medium
Calculation	(1+4+4) x 3 = 27	(1+4+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	Low	Low
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• Suitable alternative habitat areas are available in sufficient supply in the surrounding area where avifauna are said to be able to vacate to	
Level of significance after mitigation	**Low**	**Low**

10.4.2 Flora and Wetlands

From a plant community and wetland ecosystem perspective, the proposed development will include the following predicted impacts within Site A (Rail Balloon) and Site B (600 Series) of the study area:

Construction phase

- Removal of vegetation within construction footprint areas;
- Reshaping of the landscape to accommodate infrastructure
- Compaction of subsoils and construction of foundations within construction footprint areas
- Diverting and controlling water away from infrastructure
- Changing tidal movement of water
- Changing salinity of local and surrounding water bodies
- Changing the catchment areas of wetlands and mangroves
- Changing recharge regimes of wetlands, aquifers and mangroves

Operational phase

- Long term changes in hydrology of the study area will reduce habitat suitability for species and ecosystems of high conservation value
- Increased turbidity of water with negative implications
- Increased fragmentation due to linear infrastructure
- Reduced hydrological connectivity
- Restricts movement of plant propagules across barriers may influence population recruitment
- Altered nutrient levels and dynamics of affected wetland and estuarine ecosystems
- Eutrophication of wetland and estuarine ecosystems
- Lowered ecosystem resistance and resilience against natural storms

The proposed developments within Site A (Rail Balloon) and Site B (600 Series) of the study area will have far reaching effects on its vegetation and wetland ecosystems. The flat landscape, extremely shallow water table, large bodies of surface water and porous substrates result in very high levels of hydrological interconnectedness between ecosystems. Interference with water drainage, including tidal interchange, will have adverse effects on established and maintenance of mangroves and other wetland ecosystems. Compaction of the porous substrate under the proposed infrastructure will further restrict the movement of subsurface water, altering the dynamic hydrological patterns within the study area. Likewise, the use of filling material to stabilise soft soils will impede water movement through these interconnected wetland landscapes.

Construction within mangroves and wetlands will result in the direct loss of nationally protected mangrove and wetland habitat within the foot-print area of the proposed development. Direct loss of plant communities will occur within the footprint of the proposed development. Construction within terrestrial non-wetland plant communities may further have major impacts on the hydrology of nearby wetlands, such as can currently be seen from numerous artificial structures within the study area.

In order to mitigate the potential impact of the proposed development on the vegetation and wetland ecosystems of the study area, construction should be such that no prolonged interference with present hydrological patterns and processes. Historical drainage patterns should be reinstated where possible. Soil erosion along flowing water and siltation of open water systems should be prevented.

THEME - FLORA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on vegetation and wetland systems**	
Status of impact	Negative	Negative
Extent of impact	3 – Regional	3 – Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	10 – High	10 – High
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+10) x 4 = 68	(3+4+10) x 4 = 68
Level of significance before mitigation	**Medium -High**	**Medium - High**
Confidence	**High**	**High**
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• Construction should be such that no prolonged interference with present hydrological patterns and processes. • Historical drainage patterns should be reinstated where possible. • Soil erosion along flowing water and siltation of open water systems should be prevented.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

10.4.3 Frogs

Based on sophisticated recording equipment and scientific experience with the group of organisms the study concluded that:

- The study area is not a particularly good site for frogs.
- After prolonged rains the wetland will most likely gather water and will provide suitable breeding habitat for several species including Painted Reed Frogs (H. marmoratus), Tinker Reed Frogs (H. tuberilinguis) and Water Lily Frogs (H. pusillus).
- None of the threatened frog species known to occur in the Richards Bay area would be expected to occur in the area studied.
- Loosing this site will not affect the population of frogs in the greater Richards Bay area.

THEME - AMPHIBIANS		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on amphibians within the study area**	
Status of impact	Negative	Negative
Extent of impact	1 - Footprint	1 - Footprint
Duration of impact	3 – Medium term	3 – Medium term
Intensity of impact	2 – Low	2 – Low
Probability	3 – Likely	3 – Likely
Calculation	(1+3+2) x 3 = 18	(1+3+2) x 3 = 18
Level of significance before mitigation	**Low**	**Low**
Confidence	High	High
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• None required	
Level of significance after mitigation	**Low**	**Low**

10.4.4 Fish

In terms of the fish fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area it is concluded as follows:

- The loss of these Intertidal Mangrove and Sand Bank habitats could potentially have a significant effect on the fish fauna as intertidal sand banks are limited in their occurrence in Richards Bay Harbour.
- The loss of the Intertidal Mangroves will also have an impact on the fish fauna, however this habitat is of far greater significance in the broader sense of ecosystem functioning than just to the fish fauna.

In terms of the macrobenthic fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area it is concluded as follows:

- The area is characterised by relatively low macrobenthic diversity which is related to the sandy substrate and low organic content in both areas.
- The low macrobenthic diversity in the intertidal mangroves area was related to the unusually sandy, low organic content substrate in the area, which support primary suspension feeding macrobenthic organisms.
- Despite the relatively low benthic diversity and other issues mentioned in 1 and 2 above, this habitat is ecologically important in an estuarine intertidal context and the loss of which will affect the functioning of intertidal habitat in Richards Bay Harbour.

The importance of Richards Bay Harbour as a functioning ecosystem has been highlighted on several occasions in the past (Cyrus & Forbes 1994 & 1996; Forbes et al. 1997) and more recently by CSIR (2005), Cyrus & Vivier (2009), Vivier & Cyrus (2009) and MER (2013). As a result all the issues raised are discussed in more detail and assessed, in conjunction with results from the other components investigated.

THEME - FAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on fish fauna**	
Status of impact	Negative	Negative
Extent of impact	3 – Regional	3 – Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	10 – High	10 – High
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+10) x 4 = 68	(3+4+10) x 4 = 68
Level of significance before mitigation	**Medium - High**	**Medium - High**
Confidence	**High**	**High**
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • A detailed mangrove and sandflats conservation strategy is required to ensure that minimal impact is had on the mangroves and sandflat habitat • Suitable offsets should be investigated to determine if there are any suitable alternatives.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

THEME - FAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on macrobenthic fauna**	
Status of impact	Negative	Negative
Extent of impact	1 – Footprint	1 – Footprint
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	4 – Low medium	4 – Low medium
Probability	3 - Likely	3 - Likely
Calculation	(1+4+4) x 3 = 27	(1+4+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	**High**	**High**
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • A detailed mangrove and sandflats conservation strategy is required to ensure that minimal impact is had on the mangroves and sandflat habitat • Suitable offsets should be investigated to determine if there are any suitable alternatives.	

THEME - FAUNA		
Phase	**Construction Phase**	**Operational Phase**
Level of significance after mitigation	**Medium**	**Medium**

THEME - ECOLOGY		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on macrobenthic habitat**	
Status of impact	Negative	Negative
Extent of impact	3 – Regional	3 – Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	10 – High	10 – High
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+10) x 4 = 68	(3+4+10) x 4 = 68
Level of significance before mitigation	**Medium - High**	**Medium - High**
Confidence	**High**	**High**
Reversibility	Yes	Yes
Replaceability	No	No
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • A detailed mangrove and sandflats conservation strategy is required to ensure that minimal impact is had on the mangroves and sandflat habitat • Suitable offsets should be investigated to determine if there are any suitable alternatives.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

10.4.5 Aquatic Vegetation

The discovery of well-established stands of Zostera capensis in the Intertidal Shallows area, which is being extensively utilized by the fauna, is of great significance due to the contribution it is making in terms estuarine ecosystem functioning within Richards Bay Harbour. It is also significant due to this species having been absent from the harbour for more than 30 years and the fact that it is now on the IUCN Red List of Threatened Species and designated as Vulnerable.

In terms of the fauna and flora present in the Shallow Intertidal area of the Berth 600 Series Extension area it is concluded as follows:

- There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem.
- There is a need to establish if there are any other stands of *Z.capensis* that may have developed within Richards Bay Harbour and which remain as yet undiscovered.

- There is a need to establish if there are any other comparable areas of this nature in the port which could be used for offset purposes.
- There is a need to establish if *Z.capensis* has indeed made a recovery in the Mhlathuze Estuary and to what extent this has taken place.

The importance of Richards Bay Harbour as a functioning ecosystem has been highlighted on several occasions in the past (Cyrus & Forbes 1994 & 1996; Forbes et al. 1997) and more recently by Cyrus & Vivier (2009), Vivier & Cyrus (2009) and MER (2013). As a result all the issues raised are discussed in more detail and assessed, in conjunction with results from the other components investigated.

THEME – FLORA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Aquatic Vegetation**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	8 – Medium high	8 – Medium high
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+8) x 4 = 60	(3+4+8) x 4 = 60
Level of significance before mitigation	**Medium - High**	**Medium - High**
Confidence	Low	Low
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • There is a need to establish if there are any other stands of *Z.capensis* that may have developed within Richards Bay Harbour and which remain as yet undiscovered. • There is a need to establish if there are any other comparable areas of this nature in the port which could be used for offset purposes. • There is a need to establish if *Z.capensis* has indeed made a recovery in the Mhlathuze Estuary and to what extent this has taken place.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

THEME - FLORA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on habitat for aquatic vegetation**	
Status of impact	Negative	Negative
Extent of impact	3 - Regional	3 - Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	8 – Medium high	8 – Medium high
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+8) x 4 = 60	(3+4+8) x 4 = 60
Level of significance before mitigation	**Medium - High**	**Medium - High**
Confidence	Low	Low
Reversibility	Yes	Yes
Replaceability	No	No
Mitigation measures	• There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem. • There is a need to establish if there are any other stands of *Z.capensis* that may have developed within Richards Bay Harbour and which remain as yet undiscovered. • There is a need to establish if there are any other comparable areas of this nature in the port which could be used for offset purposes. • There is a need to establish if *Z.capensis* has indeed made a recovery in the Mhlathuze Estuary and to what extent this has taken place.	
Level of significance after mitigation	**Medium - High**	**Medium - High**

10.4.6 Benthic Invertebrates

In terms of the macrobenthic faunal composition, it can be concluded that:

- Extension of the Finger Jetty will have limited direct risk associated with the macroinvertebrate fauna in the deep-water environment other than the direct loss of the habitat under the footprint of the extended quay. The deepwater habitat was found to typically host a low diversity of macrobenthic fauna.
- The off-channel muddy sand habitat to the south of the shipping channel revealed higher benthic densities and a higher number of taxa. Although not directly impacted on by construction of the Finger Jetty extension, the benthic fauna in these areas could be subjected to indirect toxicological impacts related to re-suspension of contaminated fine sediments during dredging.
- Highest macrobenthic diversity was observed in the subtidal Kabeljous mudflats. Intertidal mudflats are regarded as of high conservation importance and should be the focus of concerted efforts to avoid any impacts during the development.

THEME - FAUNA		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on Benthic Invertebrates**	
Status of impact	Negative	Negative
Extent of impact	3 – Regional	3 – Regional
Duration of impact	4 – Long term	4 – Long term
Intensity of impact	10 – High	10 – High
Probability	4 – Highly likely	4 – Highly likely
Calculation	(3+4+10) x 4 = 68	(3+4+10) x 4 = 68
Level of significance before mitigation	**Medium - High**	**Medium - High**
Confidence	**High**	**High**
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Monitoring of the macrobenthic fauna at the sampling sites be continued before, during and after construction of the Finger Jetty.	
Level of significance	**Medium - High**	**Medium - High**

10.5 Heritage Resources Impacts

The heritage survey of the proposed Richards Bay Port expansion project was undertaken in May 2009. Mr Gavin Anderson consulted with known archaeological databases to obtain an understanding of previously recorded sites in the area. This database noted ~40 previously recorded sites within a 10km radius of the study area. We also consulted with historical photographs to obtain a better understanding of the impact of the harbour on the environment and thus archaeological sites.

The survey recorded nine archaeological sites of varying significance, and the potential for palaeontological remains that are of high significance. Out of these nine sites, three areas will need to be monitored, sampled and/or excavated if they are effected in any manner. We suggested a detailed monitoring and sampling program for the palaeontological remains. This management program has the potential for “advertising” the project in terms of heritage management and thus public relations for Richards Bay. The excavations at Berth 306 received negative publicity due to a foreign (alleged) palaeontologist who brought in newspapers claiming that the HIA was not undertaken. If Richards Bay ever builds a museum, then some of these remains can be used for display purposes. The port expansion project will need to obtain a permit from Amafa KZN for the destruction of archaeological sites. All sites within the admiralty reserve fall under the South African Heritage Resources Agency, and they will need to issue a permit for the destruction of these sites

THEME - HERITAGE		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on heritage resources:** **1) RBP01 - Ephemeral scatter of LIA pottery** **2) RBP 03 - MSA and LSA stone tools** **3) RBP04 - Ephemeral scatter of ESA and MSA stone tools** **4) RBP06 - ephemeral scatter of MSA tools**	
Status of impact	Negative	N/A
Extent of impact	1 - Footprint	
Duration of impact	5 - Permanent	
Intensity of impact	4 – Low-medium	
Probability	3 - Likely	
Calculation	(1+5+4) x 3 = 30	
Level of significance before mitigation	**Medium**	
Confidence	High	
Reversibility	No	
Replaceability	No	
Mitigation measures	• None required	
Level of significance after mitigation	**Medium**	**N/A**

THEME - HERITAGE		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on heritage resources:** **1) RBP09 - several shell species of which some have been burnt, as well as a three weathered stone tools.**	
Status of impact	Negative	N/A
Extent of impact	2 - Site	
Duration of impact	5 - Permanent	
Intensity of impact	4 – Low-medium	
Probability	3 - Likely	
Calculation	(2+5+4) x 3 = 33	
Level of significance before mitigation	**Medium**	
Confidence	High	
Reversibility	No	
Replaceability	No	
Mitigation measures	• The area should be monitored if effected, with the possibility of excavations.	
Level of significance after mitigation	**Low**	**N/A**

THEME - HERITAGE		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Impact on heritage resources:** **1) RBP08 – geological formation that has formed a shelf protruding from the sand dunes, as the dunes are eroded**	
Status of impact	Negative	N/A
Extent of impact	2 - Site	
Duration of impact	5 - Permanent	
Intensity of impact	10 - High	
Probability	4 – Highly likely	
Calculation	(2+5+10) x 10 = 68	
Level of significance before mitigation	**Medium - High**	
Confidence	High	
Reversibility	No	
Replaceability	No	
Mitigation measures	• The area will need to be monitored and sampled.	
Level of significance after mitigation	**Medium - High**	**N/A**

10.6 Air Quality Impacts

The air quality impacts considered in this section of the report are based on the findings of the Air Quality Assessment. As indicated in this section's overview, the specialist's recommendations were converted into mitigation measures, as proposed, and linked in the EMPr.

The dispersion models indicate that slightly higher increases are expected in SO2 and NOx levels. Without a comprehensive understanding of all emissions sources in the area, it is difficult to accurately predict the expected impact that the additional ship traffic will have but it does appear that, although some impact will be felt, that impact is unlikely to be significant in the context of the general pollution profile of an industrial area like Richards Bay.

Areas that are likely to experience increases and occasional spikes in pollution are the area immediately to the west of the harbour (fortuitously, where the Bayside SO2 monitoring station is already situated) and along the northern edge of the harbour mouth. These spikes may be exacerbated by the periodic nature of real ship emissions rather than the long term steady emissions that can be modelled here.

THEME – AIR QUALITY		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Effect of increased SO_2 due to shipping**	
Status of impact	N/A	Negative
Extent of impact		3 – Regional
Duration of impact		4 – Long term
Intensity of impact		6 – Medium
Probability		3 – Likely
Calculation		(3+4+6) x 3 = 39
Level of significance before mitigation		**Medium**
Confidence		Low
Reversibility		Yes
Replaceability		Yes
Mitigation measures	• The Air Emission License should be amended	
Level of significance after mitigation	**N/A**	**Medium**

THEME – AIR QUALITY		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Effect of increased NOx due to shipping**	
Status of impact	N/A	Negative
Extent of impact		3 – Regional
Duration of impact		4 – Long term
Intensity of impact		6 – Medium
Probability		3 – Likely
Calculation		(3+4+6) x 3 = 39
Level of significance before mitigation		**Medium**
Confidence		Low
Reversibility		Yes
Replaceability		Yes
Mitigation measures	• The Air Emission License should be amended	
Level of significance after mitigation	**N/A**	**Medium**

The dispersion model indicates that the expected increase in shipping should have a marginal impact on the particulate load of the area.

THEME – AIR QUALITY		
Phase	**Construction Phase**	**Operational Phase**
Nature of impact	**Effect of increased PM**	
Status of impact	N/A	Negative
Extent of impact		3 – Regional
Duration of impact		4 – Long term
Intensity of impact		2 – Low
Probability		3 - Likely
Calculation		(3+4+2) x 2 = 27
Level of significance before mitigation		**Medium**
Confidence		Low
Reversibility		
Replaceability		
Mitigation measures	• The Air Emission License should be amended	
Level of significance after mitigation	**N/A**	**Medium**

10.7 Turbidity Modelling Impacts

The turbidity modelling impacts considered in this section of the report are based on the findings of the Turbidity Modelling Report. As indicated in this section's overview, the specialist's recommendations were converted into mitigation measures, as proposed, and linked in the EMPr.

THEME - BIOPHYSICAL		
PHASE	**CONSTRUCTION PHASE**	**OPERATIONAL PHASE**
Nature of impact	**Visual Impacts of visibility of Sediment Plumes**	
Status of impact	Negative	Negative
Extent of impact	1 - Footprint	1 - Footprint
Duration of impact	3 – Medium term	3 – Medium term
Intensity of impact	4 – Low - Medium	4 – Low - Medium
Probability	3 – Likely	3 – Likely
Calculation	(1+3+4) x 3 = 24	(1+3+4) x 3 = 24
Level of significance before mitigation	**Low**	**Low**
Confidence	High	High
Reversibility	Yes	Yes
Replaceability	Yes	Yes
Mitigation measures	• Are to follow compliance monitoring procedures and management options diligently and to follow the normal due diligence measures associated with dredging (e.g. minimisation of lean mixture overboard etc.). • There are no obvious mitigation measures for the offshore environment, since elevated turbidity and so on is largely determined by previous disposal of dredge material and prevailing environmental conditions, neither of which can be managed/controlled	
Level of significance after mitigation	Low	Low

THEME - BIOPHYSICAL		
PHASE	**CONSTRUCTION PHASE**	**OPERATIONAL PHASE**
Nature of impact	**Ecological impacts associated with elevated turbidity**	
Status of impact	Negative	Negative
Extent of impact	1 – Footprint	Negative
Duration of impact	4 – Long term	1 – Footprint
Intensity of impact	4 – Low medium	4 – Long term
Probability	3 - Likely	4 – Low medium
Calculation	(1+4+4) x 3 = 27	(1+4+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	Medium	Medium
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• monitoring of water quality (primarily turbidity and total suspended solids) in the environment(s) likely to be affected by dredging and dredge spoil disposal activities; • pre- and post-dredging bathymetric surveys of the dredge site(s) and dredge spoil disposal site; • sediment quality (biogeochemical) characterisation of the dredge site(s) and dredged spoil disposal site prior to dredging; and • measurements to support modelling studies undertaken as part of the assessment of environmental impacts	
Level of significance after mitigation	**Medium**	**Medium**

THEME - BIOPHYSICAL		
PHASE	**CONSTRUCTION PHASE**	**OPERATIONAL PHASE**
Nature of impact	**Ecological impacts associated with distribution of contaminated sediments and smothering effects**	
Status of impact	Negative	Negative
Extent of impact	1 – Footprint	Negative
Duration of impact	4 – Long term	1 – Footprint
Intensity of impact	4 – Low medium	4 – Long term
Probability	3 - Likely	4 – Low medium
Calculation	(1+4+4) x 3 = 27	(1+4+4) x 3 = 27
Level of significance before mitigation	**Low**	**Low**
Confidence	Medium	Medium
Reversibility	No	No
Replaceability	Yes	Yes
Mitigation measures	• monitoring of water quality (primarily turbidity and total suspended solids) in the environment(s) likely to be affected by dredging and dredge spoil disposal activities; • pre- and post-dredging bathymetric surveys of the dredge site(s) and dredge spoil disposal site; • sediment quality (biogeochemical) characterisation of the dredge site(s) and dredged spoil disposal site prior to dredging; and • measurements to support modelling studies undertaken as part of the assessment of environmental impacts	
Level of significance after mitigation	**Medium**	**Medium**

10.7.1 Water Quality, Turbidity & Sediment Metal

The CSIR Metal contamination of sediment and implications for dredging (technical) report provided a high resolution spatial understanding of metal contamination of sediment, not only in the expansion footprint, but across the port. It has provided much needed insight into the potential ecological implications of dredging of potentially contaminated sediments required for the port expansion. Recommendations were made with regard to mitigation of the current contamination levels and also how to approach the environmental and legal issues related to the dredging of the sediment. The primary issues raised in the report included that the Inner Basin complex contained metal contaminated sediment of anthropogenic origin, more specifically related to port associated activities. The major implications for the proposed Richards Bay Port Expansion programme was the possibility that the DEA may prohibit unconfined openwater disposal of sediment dredged from certain contaminated areas of Inner Basins 2 and 3, where concentrations of some metals exceeded the Level II of the South African sediment quality guidelines.

The CSIR Turbidity and total suspended solids report provided comprehensive overview of TSS and water turbidity, the availability of relevant data on these parameters in the port, the need for continued focused monitoring and the potential effects associated with elevated levels of these parameters. Turbidity and total suspended solids concentrations at all stations in the port, were relatively low, with the implication that the water in the port (at least at the 15 sites sampled) was relatively clear and there was no cause for concern related to elevated TSS concentrations. It was however, acknowledged that there is too little data to define turbidity and total suspended solids baselines for all areas of Richards Bay, not ably for the Inner Basin complex, where the majority of construction activities for proposed expansion footprint will be. As a result, further monitoring/research prior to and during construction will be required for the definition of baselines and to estimate the potential ecological risks associated with dredging.

The CSIR basic water quality survey provided a detailed overview of the water quality of the port and the potential implications for the port expansion programme. The implications of elevated nutrient concentrations from surface runoff and anthropogenic activities raises concerns related to the potential eutrophication of the dead-end Inner Basins 1, 2 and 3 in the proposed Richards Bay Port Expansion programme. The implication for the proposed expansion programme is that if port development further restricts the exchange of water between ‘dead-end’ basins and the greater Richards Bay and anthropogenic nutrient inputs continue then there is strong possibility that eutrophic conditions may manifest. This will ultimately lead to the development of hypoxia and possibly even anoxia in bottom water and sediment, with a host of associated adverse ecological impacts. Careful consideration must, therefore, be given during the infrastructure design phase for achieving the maximum possible water exchange between ‘dead-end’ basins and the greater Richards Bay.

The CSIR report on Turbidity and Suspended Solids Concentration thresholds for Dredging Compliance Monitoring provides a detailed and comprehensive overview of the importance of turbidity and suspended solids concentrations during compliance monitoring for dredging during the upcoming Richards Bay Port Expansion project. Relevant turbidity and suspended solids threshold concentrations were derived based on field and laboratory data and using appropriate regression methods. Importantly, guidelines are provided for compliance monitoring in terms of the frequency and duration of monitoring and the methodology to be used. Guidelines are also provided for open water spoil disposal compliance monitoring, based on the outcome and lessons learnt during previous monitoring programmes.

10.8 DREDGE SPOIL DISPOSAL

While the review of options for dredge spoil disposal are treated comprehensively, the BKS (2013) report falls well short on matters associated with land based disposal. This particularly as an old 'Full Development Plan of the Port' assessed by CSIR (2004) was used as the basis of the assessment. In addition CRUZ-E believe that the assessment of environmental impacts related to spoil disposal may not be as comprehensive as they should be in line with the significance of the ecosystems in the Port of Richards Bay and the adjacent Mhlathuze Estuary that may be impacted by these activities. Furthermore land based dispersal of spoil containing a high salt content would have substantial impacts on the fauna and flora. Based on the selected sites in BKS (2013) study and results of previous investigations into dredge spoil disposal, it is concluded that offshore disposal would ecologically be the best option. The dredging report concurs that there is sufficient capacity for this at the existing offshore disposal sites although the rocks should be alternatively dispose of or this will drastically shorten the life of these disposal areas.

11 ENVIRONMENTAL MANAGEMENT PROGRAMME

A draft site-specific Environmental Management Programme (EMPr) has been included as part of the EIA Report (Appendix 3).

The EMPr outlines the impacts and mitigation measures for the planning and design, construction, operational phases and rehabilitation of the Richards Bay Port Expansion. The EMPr comprises of the following:

a) Summary of Impacts: The identified negative environmental impacts for which mitigation is required are summarised. Positive impacts requiring enhancement have been listed.

b) Description of mitigation measures: The EMPr identifies feasible and cost effective mitigation measures to reduce significant negative environmental impacts to acceptable and legal levels. Mitigation measures are described in detail and accompanied by designs, equipment descriptions, and operating procedures, where appropriate. The technical aspects of implementing the mitigation measures are also described.

c) Description of a monitoring programme: Environmental performance monitoring is designed to ensure that mitigation measures are implemented. The monitoring programme clearly indicates the linkages between impacts, indicators to be measured, measurement methods and definition of thresholds that will signal the need for corrective actions.

d) The institutional arrangements depict and define the responsibilities for mitigation and monitoring actions.

e) Legal enforceability: The key legal considerations with respect to the EMPr are:

   i. Legal framework for environmental protection.

   ii. Legal basis for mitigation.

f) The implementation schedule and reporting procedures that specify the timing, frequency, and duration of the mitigation measures.

g) A description of requirements for record keeping, reporting, review, auditing and updating of the EMPr have been provided.

12 ENVIRONMENTAL IMPACT STATEMENT

The Transnet Port Terminals in Richards Bay are a target for major demand growth in bulk products up to 2014. The demand forecast for rail, road and harbour bound conveyor linked industry, is expected to grow from 23 million tonnes per annum in 2012 to over 59 million tonnes by the year 2040; with the bulk of demand expected to be realized in the next 10 years. It is therefore evident that Transnet needs to expand the Port and recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand.

During the FEL2 Phase of the Port Expansion study, a Prioritisation FEL2 Multi-Criteria Evaluation (or alternatives analysis) was conducted where Option 3A was identified as the preferred option for the Expansion of the Port of Richards Bay for continuation into the Front-End Loading Phase 3 (FEL3) study (or Feasibility Phase), i.e. this application for an environmental authorisation and the detailed engineering design phase.

The proposed Option 3A for the Richards Bay Port Expansion was selected due to Geotechnical founding conditions at 600 series berths seem reasonably good for the area, the 600 series coal berths can be constructed in the dry in a coffer dam which is in many instances simpler than marine based construction. The new Break Bulk berths could be converted to container berths in future.

The prevention of the proposed project will result in the Port of Richards Bay not being able to cater for the increase in the general freight demand that is predicted by the year 2040.

12.1 THE ADVANTAGES OF THE PROPOSED RICHARDS BAY PORT EXPANSION DEVELOPMENT INCLUDE THE FOLLOWING:

12.1.1 Increase in employment opportunities

It has been projected that within the South African economy 9,151 jobs (skilled and unskilled) will be created directly, 3,810 jobs indirectly and 8,198 jobs induced as a result of the proposed port expansion.

As a result of the expansion, the port will be able to handle a higher volume of cargo.

12.1.2 Increased opportunities for local service providers

During construction, various services will be required which can be fulfilled by local service providers. Examples of such services include security, fencing, accommodation, earth moving; refuse removal, transport, etc. The appointment of local service providers will lead to further employment for the local population and, thus, put a greater amount of money into the local economy.

12.1.3 Increased investment

During communication with representatives from the Zululand Chamber of Commerce and Industry it was reported that the presence of the port is a significant ‘pull factor’ for industry into the area (Patterson. M, pers. comm., 2015).

The importance of the port for investment in Richards Bay was also confirmed during discussions with the Richards Bay Industrial Development Zone. It was noted that the construction of the container terminal will assist the IDZ in attracting investors. This is particularly important for industries involved with mineral beneficiation as they require containers to transport processed goods (Ngcamu. S, pers. comm., 2015). Thus, in the event of the port expansion being confirmed and construction commencing, there is an increased likelihood that investors will consider Richards Bay as an area with a competitive advantage. This in turn has numerous secondary impacts such as employment creation.

It needs to be noted that the increase in investment may spread further afield than the primary and secondary study areas. It is possible that the proposed expansion to the port and the existing rail and road networks to the port may make investment in large industry and mining activities inland more viable. Thus, the importance of the port expansion in terms of attracting investment also needs to be considered on a tertiary (provincial and national) scale.

12.2 DISADVANTAGES OF THE PROPOSED RICHARDS BAY PORT EXPANSION DEVELOPMENT INCLUDE THE FOLLOWING:

12.2.1 Increased spread of disease –

Any development which causes the migration of people has the potential to lead to the spread of disease (HIV and AIDS are of particular concern in the case of Southern Africa). Considering the size of the project, the anticipated influx of workers and job seekers and the extended period over which construction will take place, it is anticipated that there will be a relatively significant increase in the spread of disease. However, it also needs to be considered that the receiving environment is not isolated in nature but is already characterised by the movement of people into and through it on a relatively consistent basis; thus, the incidence of disease and in particular HIV and AIDS is already considered significant.

12.2.2 Reduced road safety –

During construction, there will be a significant increase in the volume of traffic making use of public roads, in particular, heavy duty vehicles. The increase in the presence of heavy duty vehicles on the roads is likely to lead to an increased possibility of road traffic accidents and, thus, reduced road safety for all road users. Of concern, is reduced road safety as a result of the increase in the number of heavy duty vehicles on the already congested N2 (particularly to the north of Richards Bay) and other major roads connecting the hinterland and the Richards Bay Port.

12.2.3 Increase in informal dwellers and/or destitute people –

- It is anticipated that there will be a significant influx of job seekers into the area during the construction phase of the project. Considering the size of the proposed project and the long period of time over which the proposed expansion will take place, it is likely that a large percentage of job seekers will migrate not only from the secondary study area (surrounding rural areas which are characterised by high levels of poverty) but from throughout KwaZulu-Natal, other provinces in South Africa and potentially other countries, in particular Swaziland and Mozambique.
- A point raised by a representative of Zululand Business Against Crime, stating that, at present, there are an undisclosed number of people living in the bush on the periphery of Richards Bay who arrived from the outlying rural areas in search of work but have not found any and do not have sufficient funds to return to their original homes (Whittaker. D., pers. comm., 2014). These people are likely to set up informal settlements in and around the city which may lead to further social problems such as increased petty crime, reduced property value, health concerns due to a lack of sanitation and drinking water, and ultimately an increased financial burden for local government.

12.2.4 Increased noise

- Construction activities, especially the construction of the railway and 'rail balloon' due to its close proximity to residential areas and the Tuzi Gazi Water Front, are likely to increase the amount of noise experienced by people in the area. Likely sources of noise include construction machinery, such as jack hammers, earth moving equipment, etc.
- As a result of the port expansion there will be an increase in the number of vessels within the port, an increase in the number of vessels being loaded and unloaded and an increase in road traffic within the port. All of these factors are likely to increase the amount of noise being generated by the port. The most likely parties to be affected are within the primary and secondary study areas and particularly those residing in the residential areas close to the small craft harbour as well as businesses based at the Tuzi Gazi Water.

12.2.5 Increased pressure on road and services infrastructure –

- During construction, it is likely that there will be an increase in the number of vehicles making use of public roads, in particular heavy duty vehicles. The increase in heavy duty vehicles will place increased pressure on the existing road infrastructure.

If not suitably dealt with damage to the road infrastructure may reduce overall road safety for all road users in the area.

- Services such as water, sanitation and electricity, the influx of people into the area (both workers and job seekers) will place increased pressure on an already stretched water and sanitation system. In addition, it is anticipated that during the construction period, the demand for electricity will increase. Considering the current power supply crisis in South Africa, any additional strain on the existing system could cause system failure and increased load shedding events.

12.2.6 Increased air emissions and dust –

Due to the amount of industry in Richards Bay, air emissions are an issue which is of particular concern to local residents. Of particular concern, and raised by the Environmental Planning Department from the City of uMhlatuze, is the potential increase in PM10 as a result of an increase in the loading and offloading of vessels within the port (Govender, S., and Strachan, B., pers. comm., 2015). This is of particular concern during times of southerly winds as the particulate matter and dust will be blown towards residential areas of Richards Bay. The port expansion is also expected to lead to an increase in the number of vessels utilising the port, which, in turn, is likely to lead to an increase in CO_2 emissions.

12.2.7 Increased criminal activity

An increase in criminal activity is often associated with large developments and/or projects where there is likely to be an in-migration of construction workers, job seekers and criminal opportunists. In the case of the proposed project, the possibility of an increase in crime should not be under-estimated. It is anticipated that there will be a significant movement of people into the area some of whom are likely to be criminal opportunists.

12.2.8 Loss of recreational areas

In the event of the proposed expansion taking place, the area referred to as the 'Casuarinas', which is currently open to and used by the public for recreational purposes, will no longer be available for recreational activities. Presently, the area is utilised by families and individuals from in and around the Richards Bay for fishing, walking, picnicking, etc. The loss of the area could potentially lead to opposition from the public who have used the area for an extended period of time.

12.2.9 Disruption to port activities

It has been confirmed by Transnet Capital Projects that during the expansion programme there is potential for disruption to current port activities. During construction, the utilisation of berths 606, 801 and 804 will be disrupted and it is believed by Transnet that there may be potential navigation difficulties as a result of the extension of the 800 series finger jetty. In addition, the woodchip conveyor will need to be relocated. Such disruptions could have economic impacts for the port itself as the number of vessels it is able to receive may decrease or alternatively the vessel 'turnaround' time may increase which could lead to shipping companies looking at alternative ports. This, in turn, may have implications for local businesses.

12.3 POTENTIAL IMPACTS OF THE PROPOSED RICHARDS BAY PORT EXPANSION DEVELOPMENT INCLUDE THE FOLLOWING:

12.3.1 Social impacts during decommissioning –

Considering the nature of the project, it is unlikely that the complete decommissioning of the port will take place in the foreseeable future but rather that specific sections may be decommissioned or upgraded overtime. In this regard, it is likely that the social impacts that may occur will be similar in nature to those that occur during construction. However, it is anticipated that the socio-economic conditions prevailing in the project area would have changed significantly by the time decommissioning of port components occurs and, therefore, it is not possible to accurately quantify the significance of identified social impacts.

12.3.2 Noise Impacts –

Increased sound levels are directly linked with the various activities associated with the construction, as well as the operational phase of the activity. Potential maximum noise levels generated by construction equipment as well as the potential extent are presented in the noise specialist report. The potential extent depends on a number of factors, including the prevailing ambient sound levels during the instance the maximum noise event occurred, as well as the spectral character of the noise and the ambient surroundings. Rail traffic is considered as a line source of noise with a continuous area of impact both sides of and parallel to the railway line. Railway related noise is general acoustically characterised by high noise levels of relatively short duration.

Although not significantly and generally far less than sources of noise mentioned above, other sources noises include:

- Ancillary equipment at rail passing loops (substations, compressors, refuelling, etc.).
- Railway maintenance operations.
- Workshops and other equipment maintenance.

Heritage Impacts - The survey recorded nine archaeological sites of varying significance, and the potential for palaeontological remains that are of high significance. Out of these nine sites, three areas will need to be monitored, sampled and/or excavated if they are effected in any manner.

12.3.3 Air Quality –

Areas that are likely to experience increases and occasional spikes in pollution are the area immediately to the west of the harbour (fortuitously, where the Bayside SO2 monitoring station is already situated) and along the northern edge of the harbour mouth. These spikes may be exacerbated by the periodic nature of real ship emissions rather than the long term steady emissions that can be modelled here.

12.3.4 Biodiversity Impacts –

The following biodiversity were assessed:

- AviFauna: In terms of the bird fauna present in the three broad based habitats identified in the Rail Balloon Area it is concluded as follows:
- Despite the Secondary Woodland habitat having a well-established bird fauna the loss of this area to development would have no major effects on the fauna of the greater uMhlathuze area.
- Due to the current low water levels in the area no data of any substance was obtained from the Freshwater Wetland habitat. However this type of habitat is ecologically important and declining across KwaZulu-Natal. It is considered that the implementation of some form of Offset related to the nearby Thulazihleka Pan might be an option for the loss of this area to development.
- The Intertidal Mangrove and Sandflats was the only area where Red Data were present or considered to potentially occur. The intertidal areas are of importance to waders, terns and gulls and the loss of this habitat could be of some significance from a bird perspective.

12.3.5 Flora and Wetlands

The proposed developments within Site A (Rail Balloon) and Site B (600 Series) of the study area will have far reaching effects on its vegetation and wetland ecosystems.

- The flat landscape, extremely shallow water table, large bodies of surface water and porous substrates result in very high levels of hydrological interconnectedness between ecosystems. Interference with water drainage, including tidal interchange, will have adverse effects on established and maintenance of mangroves and other wetland ecosystems. Compaction of the porous substrate under the proposed infrastructure will further restrict the movement of subsurface water, altering the dynamic hydrological patterns within the study area. Likewise, the use of filling material to stabilise soft soils will impede water movement through these interconnected wetland landscapes.

- Construction within mangroves and wetlands will result in the direct loss of nationally protected mangrove and wetland habitat within the foot-print area of the proposed development. Direct loss of plant communities will occur within the footprint of the proposed development. Construction within terrestrial non-wetland plant communities may further have major impacts on the hydrology of nearby wetlands, such as can currently be seen from numerous artificial structures within the study area.

12.3.6 Frogs

Based on sophisticated recording equipment and scientific experience with the group of organisms the study concluded that:

- The study area is not a particularly good site for frogs.
- After prolonged rains the wetland will most likely gather water and will provide suitable breeding habitat for several species including Painted Reed Frogs (H. marmoratus), Tinker Reed Frogs (H. tuberilinguis) and Water Lily Frogs (H. pusillus).
- None of the threatened frog species known to occur in the Richards Bay area would be expected to occur in the area studied.
- Loosing this site will not affect the population of frogs in the greater Richards Bay area.

12.3.7 Fish

In terms of the fish fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area it is concluded as follows:

- The loss of these Intertidal Mangrove and Sand Bank habitats could potentially have a significant effect on the fish fauna as intertidal sand banks are limited in their occurrence in Richards Bay Harbour.
- The loss of the Intertidal Mangroves will also have an impact on the fish fauna, however this habitat is of far greater significance in the broader sense of ecosystem functioning than just to the fish fauna.

12.3.8 Macrobenthic Fauna

In terms of the macrobenthic fauna present in the Intertidal Mangrove & Sandflats of the Rail Balloon area it is concluded as follows:

- The area is characterised by relatively low macrobenthic diversity which is related to the sandy substrate and low organic content in both areas.

- The low macrobenthic diversity in the intertidal mangroves area was related to the unusually sandy, low organic content substrate in the area, which support primary suspension feeding macrobenthic organisms.
- Despite the relatively low benthic diversity and other issues mentioned in 1 and 2 above, this habitat is ecologically important in an estuarine intertidal context and the loss of which will affect the functioning of intertidal habitat in Richards Bay Harbour.

12.3.9 Aquatic Vegetation

The discovery of well-established stands of Zostera capensis in the Intertidal Shallows area, which is being extensively utilized by the fauna, is of great significance due to the contribution it is making in terms estuarine ecosystem functioning within Richards Bay Harbour. It is also significant due to this species having been absent from the harbour for more than 30 years and the fact that it is now on the IUCN Red List of Threatened Species and designated as Vulnerable.

In terms of the fauna and flora present in the Shallow Intertidal area of the Berth 600 Series Extension area it is concluded as follows:

- There is need for an in depth investigation of this ecosystem to more fully understand its current status and significance to the harbour ecosystem.
- There is a need to establish if there are any other stands of Z.capensis that may have developed within Richards Bay Harbour and which remain as yet undiscovered.
- There is a need to establish if there are any other comparable areas of this nature in the port which could be used for offset purposes.
- There is a need to establish if Z.capensis has indeed made a recovery in the Mhlathuze Estuary and to what extent this has taken place.

In terms of the macrobenthic faunal composition, it can be concluded that:

- Extension of the Finger Jetty will have limited direct risk associated with the macroinvertebrate fauna in the deep-water environment other than the direct loss of the habitat under the footprint of the extended quay. The deepwater habitat was found to typically host a low diversity of macrobenthic fauna.
- The off-channel muddy sand habitat to the south of the shipping channel revealed higher benthic densities and a higher number of taxa. Although not directly impacted on by construction of the Finger Jetty extension, the benthic fauna in these areas could be subjected to indirect toxicological impacts related to re-suspension of contaminated fine sediments during dredging.

- Highest macrobenthic diversity was observed in the subtidal Kabeljous mudflats. Intertidal mudflats are regarded as of high conservation importance and should be the focus of concerted efforts to avoid any impacts during the development.

12.3.10 DREDGE SPOIL DISPOSAL SITES REVIEW:

While the review of options for dredge spoil disposal are treated comprehensively, the BKS (2013) report falls well short on matters associated with land based disposal. This particularly as an old 'Full Development Plan of the Port' assessed by CSIR (2004) was used as the basis of the assessment. In addition CRUZ-E believe that the assessment of environmental impacts related to spoil disposal may not be as comprehensive as they should be in line with the significance of the ecosystems in the Port of Richards Bay and the adjacent Mhlathuze Estuary that may be impacted by these activities. Furthermore land based dispersal of spoil containing a high salt content would have substantial impacts on the fauna and flora. Based on the selected sites in BKS (2013) study and results of previous investigations into dredge spoil disposal, it is concluded that offshore disposal would ecologically be the best option.

Impacts associated with Dredge Spoil Disposal:

- The impact will be the loss of the entire northern half of the site. Mostert (2014) has indicated that disturbances during construction in non-wetland habitats may have far reaching effects on the wetland and mangrove habitats themselves due to disturbance of the hydrological structure of the subsurface area. It is considered that the loss of the two habitats will result in a direct loss of nationally protected habitats in an area considered as a whole to have a very good potential to be rehabilitated back to a highly functional wetland and estuarine habitat (Mostert 2014).
- While the impacts of piling for the development will be limited to the immediate area of construction, any dredging activities have the potential to affect a wider area. The effective opportunity is that from an ecological perspective the loss of fauna in the deep channel will have a negligible impact on the macrobenthic community of the harbour as a whole.
- The impact of the Berth 600 Series Extension will be total as the area assessed will all be dredged, this will result in the loss of the Shallow Intertidal habitat which holds established stands of the Red Data species Zostera capensis. In addition to this there will be additional impacts, which were not assessed as part of this study; these will be in the Quay footprint that will be developed for the berth extension around the dredged channel. In addition impacts relating to re-routing of the coal terminal access road have not been covered. Furthermore it appears from the Final Scoping Report (AECOM 2014), that there will be impacts on the Sand Spit which forms the

northern boundary of the Kabeljous Flats. These have been identified as potentially having significant impacts on ecosystem functioning in Richards Bay Harbour.

12.3.11 Potential Impacts of Dredging

The detail of the potential ecological impacts and impacts on the existing beneficial uses of capital dredging has been discussed in detail (e.g. Dankers, 2002; Bray, 2008: CSIR, 2013c). However to provide context this study, the potential impacts of capital dredging are summarised below:

- Long-term changes in hydronamics and water quality due to changes in port layout or deepening of channels or other areas within the port;
- Habitat destruction due to the removal of sediments;
- Smothering effects on benthos;
- Suppression of primary productivity due to light limitation due to increased water column turbidity;
- Effects of excessive suspended particulate matter on the feeding rate of invertebrate filter feeders, reducing their growth and productivity;
- Clogging of gills;
- Effects of increased turbidity on the feeding success of visual predators;
- Potential toxicity effects should the sediments to be dredged by contaminated with trace metals; and
- Aesthetic impacts of dredge plumes.

12.3.12 Ecological impacts associated with elevated turbidity

- For the assessment of potential ecological impacts, the model results are presented as contours of the number of days that the 20 mg/ℓ guideline is exceeded in the surface layer and near the bottom;
- The exceedance of this guideline in the surface waters represents potential impacts of concern in terms of light in the water column and associated effects on primary productivity, while in the deeper waters this indicates the lower threshold for effects should this exceedance occur for a continuous 2-3 days or more;
- It should be noted here that the results are plotted as total days of exceedance of the relevant threshold per season. A day of exceedance of 3 days in the plots typically does not indicate that the guidelines have been exceeded for 3 continuous days. Rather it indicates that the threshold is exceeded on a number of occasions during these seasons but for a much shorter duration, typically a day at most;

- The exceedance of 80 mg/ℓ in surface waters and near the seabed and 100 mg/ℓ in surface waters and near the seabed for even short periods of time indicates that ecological impacts are likely where this occurs;
- A plot of the days of exceedance of the 20 mg/ℓ threshold indicate that this value is exceeded in the surface layers over a fairly extensive region extending 2 to 3 km beyond the confines of the dredge spoil disposal site for between 20 and 30 days per season. Near the seabed the days of exceedance range between 30 and 50 days per season over a similar extent. In the port the extent of the area over which this threshold is exceeded in the surface layers spatially co-incide approximately with the dredging footprint, the number of days of exceedance of the threshold (a maximum of 30 days per season) closely mirroring the duration of dredging at the relevant locations. The days of exceedance of the 20 mg/ℓ threshold near the seabed increases to a maximum of between 50 and 75 days at the far recesses of the area being dredged. Furthermore, the area over which there is exceedance of this guideline is somewhat larger near the seabed with evidence of the area of exceedance extending beyond the actively dredged areas. However in these area the guideline is only exceed at most between 2 and 5 days per season;
- The day for which an 80 mg/ℓ threshold is exceeded in the surface layers is minimal both offshore and within the port. However near the seabed this threshold is exceeded over a more extensive area. The threshold can be exceeded up to 5 days total duration per season at distances of up to 2 km beyond the confines of the dredge spoil disposal site. It is expected that these observations represent a limited number of major resuspension events having duration of one day or two at most;
- The exceedance of higher thresholds is not observed in the surface layers. At depth however these thresholds are exceed beyond the confines of the dredge spoil disposal site. The 100 mg/ℓ is exceeded near the seabed up to 4 km beyond the dredge spoil disposal site; however the total duration of this exceedance is typically less than 2 days per season. The area over which the 150 mg/ℓ extends beyond the confines of the dredge spoil disposal site, however exceedances having a total duration of greater than 5 days per season does not extend more than 500 m beyond the confines of the dredge spoil and exceedances of greater than one day beyond approximately 1 km beyond the confines of the dredge spoil disposal site.
- These results are consistent with the OBS mooring data from sites located both to the north and south of the dredge spoil disposal site, however the days of exceedance for particular the lower thresholds are significantly higher in the modelling results. This could partially be due to the fact that the dredging and dredge spoil disposal rates are significantly higher in the modelling study that occurred during the Berth 306 capital dredging programme. It may also however be

that the model simulations tend to overestimate water column turbidity in this offshore domain.

12.3.13 Ecological impacts associated with distribution of contaminated sediments and smothering effects

To assess the potential marine ecological impacts associated with distribution of contaminated sediments and smothering effects the model results are presented as the near maximum (99th percentile value) thickness of sediments deposited at the seabed , the 95th percentile thickness of sediments deposited at the seabed. The 99th percentile and 95th percentile values indicate the maximum and near maximum "footprint" of sediment re-mobilised from the dredge spoil disposal site, while the mean sediment thickness represent the more persistent "footprint" of the sediments re-mobilised from the dredge spoil disposal site (*i.e*. excludes more temporary deposition of sediments around the dredge spoil disposal site). The limitation of the latter metric (*i.e*. the mean) is that, should deposition occur during the latter half of the simulation, it will largely be discounted.

Negative impacts associated with the proposed Richards Bay Port Expansion were determined and assessed and it was found that, with implementation of specialist recommended mitigation measures, all potential impacts can be reduced to a "very low", "low" or "medium" negative and/or positive significance (as per summary presented in Table 12-1).

Table 12-1: Summary of Impacts

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Increased spread of disease		
Level of significance before mitigation	**High**	
Level of significance after mitigation	**Medium**	**N/A**
Reduced road safety		
Level of significance before mitigation	**Medium**	**Medium**
Level of significance after mitigation	**Medium**	**Medium**
Increase in informal dwellers		
Level of significance after mitigation	**Medium**	**N/A**
Level of significance after mitigation	**Low**	**N/A**
Increased noise		
Level of significance before mitigation	**Medium**	**Medium**

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Level of significance after mitigation	Medium	Medium
Increased pressure on road and services infrastructure		
Level of significance before mitigation	Medium	Low
Level of significance after mitigation	Low	Low
Increased air emissions and dust		
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Low	Low
Increased criminal activity		
Level of significance before mitigation	Medium	N/A
Level of significance after mitigation	Low	N/A
Loss of recreational areas		
Level of significance before mitigation	High	N/A
Level of significance after mitigation	Medium	N/A
Increased employment opportunities		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Increased opportunities for local service providers		
Level of significance before mitigation	Low	N/A
Level of significance after mitigation	Medium	N/A
Increased investment		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Disruption of port activities		
Level of significance before mitigation	High	
Level of significance after mitigation	Medium- High	N/A
Opposition to the public participation process		
Level of significance before mitigation	Medium	
Level of significance after mitigation	Medium	N/A
Noise impact from construction and operation of railway balloon on receptors during daytime		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on heritage resources: 4) RBP01 - Ephemeral scatter of LIA pottery 5) RBP 03 - MSA and LSA stone tools 6) RBP04 - Ephemeral scatter of ESA and MSA stone tools RBP06 - ephemeral scatter of MSA tools		
Level of significance before mitigation	Low	
Level of significance after mitigation	N/A	N/A
Impact on heritage resources:		

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
RBP09 - several shell species of which some have been burnt, as well as a three weathered stone tools.		
Level of significance before mitigation	Medium	N/A
Level of significance after mitigation	Low	N/A
Impact on heritage resources: RBP08 – geological formation that has formed a shelf protruding from the sand dunes, as the dunes are eroded		
Level of significance before mitigation	High	N/A
Level of significance after mitigation	Medium	N/A
Effect of increased SO2 due to shipping		
Level of significance before mitigation		Medium
Level of significance after mitigation	N/A	N/A
Effect of increased NOx due to shipping		
Level of significance before mitigation		Medium
Level of significance after mitigation	N/A	N/A
Effect of increased PM		
Level of significance before mitigation		Low
Level of significance after mitigation	N/A	N/A
Impact on Avi-fauna at Site A – Rail Balloon Area, Secondary Woodland		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Impact on Avi-fauna at Site A – Rail Balloon Area, Freshwater Wetland		
Level of significance before mitigation	Medium	Medium
Level of significance after mitigation	Medium	Medium
Impact on Avi-fauna at Site A – Rail Balloon Area, Mangrove and Sandflats		
Level of significance before mitigation	High	High
Level of significance after mitigation	Medium - High	Medium - High
Impact on Avi-fauna at Site C – Berth 600 Series Extension		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on vegetation and wetland systems		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on amphibians within the study area		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on fish fauna		

PHASE	CONSTRUCTION PHASE	OPERATIONAL PHASE
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on macrobenthic fauna		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Low	Low
Impact on Aquatic Vegetation		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on habitat for aquatic vegetation		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Impact on Benthic Invertebrates		
Level of significance before mitigation	High	High
Level of significance after mitigation	High	High
Visual Impacts of visibility of Sediment Plumes		
LEVEL OF SIGNIFICANCE BEFORE MITIGATION	LOW	LOW
Level of significance after mitigation	Low	Low
Ecological impacts associated with elevated turbidity		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium
Ecological impacts associated with distribution of contaminated sediments and smothering effects		
Level of significance before mitigation	Low	Low
Level of significance after mitigation	Medium	Medium

13 CONCLUSION AND RECOMMENDATIONS

Based on the findings documented in this report, the EAP is of the opinion that the proposed Transnet Port Terminals in Richards Bay are a target for major demand growth in bulk products up to 2014. the demand forecast for rail, road and harbour bound conveyor linked industry, is expected to grow from 23 million tonnes per annum in 2012 to over 59 by year 2040; with the bulk of demand expected to be realized in the next 10 years.

It is therefore evident that Transnet needs to expand the Port and recapitalise facilities in the Port of Richards Bay to cater for the increase in general freight demand.

An Operational Management Plan has been drafted to ensure the site is operated in an environmentally sound manner across its entire life cycle. It is noted that this plan will be updated as required by the competent authority so as to ensure that the site remains operating at best practice level.

The assessment of the issues identified in the Scoping Report or as raised by I&APs, and considered in greater detail in the EIA Report with its related specialists studies, indicated that the significance of potential impacts associated with the proposed development can largely be reduced to a “low”/”medium”, if the recommended mitigation measures are implemented. In some cases, mainly in terms of the biological impacts, further work is required to offsets, rehabilitation plans and other similar detailed management plans for these highly sensitive ecosystem functionality and critically endangered habitats.

Conditions of the environmental authorisation should include the implementation of mitigation measures in the draft Site-Specific EMPr and the appointment of an independent Environmental Control Officer to monitor compliance with the draft Site-Specific EMPr. It is also recommended that a condition of environmental authorisation be that construction should not begin until written consent for the activities proposed for the Richards Bay Port Expansion Project.

It is noted that further work in terms of the required Water Use Licence and Air Emissions Licence are ongoing and that construction activities that will impact on these licences should also not be started prior to the corresponding licences being issued.

Conditions of the environmental authorisation should include the implementation of mitigation measures in the draft Site-Specific EMPr and the appointment of an independent Environmental Control Officer to monitor compliance with the draft Site-Specific EMPr. It is also recommended that a condition of environmental authorisation be that construction should not begin until written consent for the activities proposed for the Richards Bay Port Expansion Project.

It is noted that further work in terms of the required Water Use Licence and Air Emissions Licence are ongoing and that construction activities that will impact on these licences should also not be started prior to the corresponding licences being issued.

Further to the above, the EAP recommends that the project be rejected pending further studies be conducted or a partial approval be given excluding the rail balloon loop and the Berth construction which require additional studies to be included as an amendment to the EIA at a later stage.

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15 APPENDICES

EIA process related:

Appendix 1:	**Authority Correspondence**
Appendix 2:	**Public Participation Report**

Management Control Mechanisms:

Appendix 3:	**Draft Site-Specific Environmental Management Programme**

Specialist Studies

Appendix 4:	**Marine and Terrestrial Assessments**
Appendix 4-1:	**Vegetation and Wetland Assessment**
Appendix 4-2:	**Bird Fauna of Priority Habitats**
Appendix 4-3:	**Frog Fauna Assessment**
Appendix 4-4:	**Fish and Benthic Inverts Assessment**
Appendix 4-5:	**Macrobenthic Fauna – Finger Jetty Assessment**
Appendix 4-6:	**Aquatic Vegetation and Fish – Berth 600 Extension**
Appendix 5:	**Noise Impact Assessment**
Appendix 6:	**Air Quality**
Appendix 7:	**Heritage Study**
Appendix 8:	**Turbidity Modelling Study**
Appendix 9:	**Socio- Economic Assessment**