PROJECT NAME:

THE PROPOSED REPLACEMENT OF QUAY WALL 3 & 4 AND FERRY LANDING AT THE PORT OF EAST LONDON WITHIN BUFFALO CITY METROPOLITAN MUNICIPALITY IN THE EASTERN CAPE PROVINCE.

DFFE REFERENCE NUMBER: 14/12/16/3/3/2/2329

REPORT TITLE:

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

DATE: JULY 2023

PREPARED BY:

ABANTU ENVIRONMENTAL CONSULTANTS (PTY) LTD

PREPARED FOR:
TRANSNET SOC LIMITED

OFFICE	ADDRESS	CONTACT DETAILS
East London	10 Liddiard Street, Saxilby, East London, 5247	**Contact Person:** Mrs Zona Quvile (Professional EAP; Pr.Sci.Nat) **Cell:** 074 488 9784 **Fax:** 086 685 9536 **Email:** EL-EIA@abantuenvironmental.co.za **Website:** www.abantuenvironmental.co.za

DOCUMENT REVISION STATUS

REVISION	PREPARED BY:	REVIEWED BY:	APPROVED BY
01	Mrs Zona Quvile	Mr Sive Mlamla	Mr Sive Mlamla
DATE	July 2023		
01			
02			
03			

EXECUTIVE SUMMARY

Quay 3 is a mass gravity structure that was constructed in the 1920s, whilst the landing is a sheet pile wall constructed in the 1900s. Both quays have served well beyond their respective design lives. A condition assessment report for the repairs (replacement) of quay 3 by Transnet (2020) details the need and desirability of the project as detailed in the discussion below.

Cavities were first discovered in 1993 within the section of Quay 3 below sea level. Repairs were made thereafter, however, in 2012 the CSIR conducted a multibeam survey to ascertain the condition of the concrete structure. The CSIR report showed that the damage to Quay Wall 3 was extensive. Cavities as deep as 1.4 m were identified from the waterline to just below the toe, and the concrete had reached an advanced stage of deterioration.

A Ferry Landing (FEL) 2 prefeasibility study conducted in 2017 indicated that the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse. Given the advanced state of deterioration, the ability of the structure to fulfil its functional requirement is uncertain. Therefore, Transnet SOC Limited (Transnet) proposes to repair / replace Quay walls at the Port of East London.

A number of options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

Several listed activities are triggered by the proposed development and as such Environmental Authorisation is required prior to commencement of the activities detailed in Section 5 of this report. Abantu Environmental Consultants (AEC) has been appointed as the independent environmental assessment practitioners to facilitate the EIA process and obtain the relevant authorisations. The Environmental Authorisation application is subject to a Full Scoping and Environmental Impact Assessment (EIA) Process and will be adjudicated by the identified competent authority, Department of Forestry, Fisheries and Environment (DFFE).

This draft EIA Report is prepared in accordance with the requirements of Appendix 3 of the Environmental Impact Assessment Regulations, 2014, as part of the National Environmental Management Act (NEMA- Act 107 of 1998).

Motivation

As stated previously, the ferry landing is a sheet pile wall constructed in the 1900s that has since collapsed. Quay 3 is a mass gravity structure that was constructed in the 1920s and has since reached an advanced stage of deterioration and cannot fully perform its function. Cavities found along the length of the quay, were up to 140cm deep and Geotechnical investigation showed that concrete was in an advanced state of concrete deterioration. The 4 cores were taken at 500-750 mm from the cope line and showed significant deterioration throughout the depth of cores. X-ray diffraction and electron microscopy showed that the cement had suffered attack by sea water. There is high variability in the condition of concrete and visual signs of deterioration. These include:

- Softening of mortar;
- Formation of voids under coarse aggregate;

- Splintering of the coarse aggregate above the cavities; and
- Soft, white gel.

The scope of this project includes Quay 3 and the Ferry Landing. The proposed quay wall solutions will allow for the inclusion of the Ferry Landing length, which effectively increases the useable quay length from 378 m to 416 m. The project scope also includes the upgrading of the adjacent Quay 4 to alleviate alignment issues. This infrastructure needs to be replaced to ensure its functioning into the future.

Alternatives

A detailed assessment of alternatives was undertaken during the feasibility study conducted by PRDW (2017) on behalf of Transnet. A copy of this report is included as Appendix D5. It is the EAP's request that this report be accepted by the Department as a written proof of an investigation undertaken and motivation since no reasonable or feasible alternatives exist in terms of Appendix 2.

The mass concrete gravity Quay Wall 3 was constructed in the 1920's and has since reached an advanced stage of deterioration. The quay has historically been used for berthing and offloading general cargo vessels. The landing collapsed in 2019 and is to be upgraded as part of the Quay 3 Project. The project scope also includes the adjacent Quay 4 to alleviate alignment issues. A FEL 2 prefeasibility study conducted in 2017 indicated that the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse. Given the advanced state of deterioration, the ability of the structure to fulfil its functional requirement is uncertain.

The options for rehabilitation of the deteriorating structure were complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. Several options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

Preferred rehabilitation option (proposed upgrade)

The preferred method is the use of Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.

This preferred option has been designed according to EN 1997, Design Approach 1 Combinations 1 and 2, using recommendations from BS6349-2:2010. The piles, and tie rod sections have been verified against structural failure according to the provisions in EN 1993. The selection of a tubular combi-wall section was governed by the installation requirements. The anticipated presence of shallow hard Hornfels layers in the soil profile requires a section that can withstand the high installation stresses resulting from heavy driving and allow for socketing into the hard layers to achieve the required embedment. The combi-wall has been designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance over its design working life.

The design of the primary (tubular piles) and secondary (sheet piles) elements is based on their functionality:

- The primary elements act as retaining elements against the earth and water pressures and may act as bearing piles for vertical loads;
- The secondary elements only fill the gap between the primary elements and transmit the loads resulting from earth and water pressures to the primary elements.

The focus of the design effort has been to limit the extent of any temporary works and limit the new cope line offset ahead of the existing wall and hence limit the loss of water area in the river.

DECLARATION

I… Ms Zona Quvile …., on behalf of **AEC,** as the appointed independent environmental practitioner (“EAP”) hereby declare that I:

- am the independent EAP in this application and
- the information in this report is true and correct;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- have and will not have any vested interest in the proposed activity proceedings;
- have disclosed, to the applicant and competent authority any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or documents required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and comply with the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information with all the relevant facts, in respect of the application, was distributed or made available to the public, all interested and affected parties; including facilitating for their participation with reasonable opportunity for comments.
- have ensured that all interested and affected parties were considered, recorded and submitted to the competent authority in respect of the application;
- have kept a register of all interested and affected parties that participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of the EIA regulations.

Signature of the Environmental Assessment Practitioner:

Name of company: AEC

Date: 27/07/2023

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

ABBREVIATIONS

ADM	Amathole District Municipality
BCMM	Buffalo City Metropolitan Municipality
BID	Background Information Document
CBA	Critical Biodiversity Area
DEA	Department of Environmental Affairs

DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DWS	Department of Water and Sanitation
DFFE	Department of Forestry, Fisheries and Environment
DSR	Draft Scoping Report
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIR	Environmental Impact Report
ESA	Ecological Support Area
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EXT	Extension
FSR	Final Scoping Report
IUCN	International Union for Conservation of Nature
I&APs	Interested & Affected Parties
IDP	Integrated Development Plan
LSDF	Local Spatial Development Framework
NEMA	National Environmental Management Act 107 of 1998
NEMBA	National Environmental Management Biodiversity Act 10 of 2004
PPP	Public Participation Process
SAHR	South African Heritage Resources Act 25 of 1999
SAHRA	South African Heritage Resource Agency
SANBI	South African National Biodiversity Institute
SDF	Strategic Development Framework
ToR	Terms of Reference

1. INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

The National Environment Management Act, 1998 (Act No. 107 of 1998) (the NEMA) introduced the environmental impact management regime, in particular the Environmental Impact Assessment (EIA) process. The EIA process is a tool which requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves the present and future generations. The EIA is South Africa's key regulatory instrument to mitigate and/or manage the impacts of new developments and activities that are considered to potentially impact on the right to an environment that is not harmful to health and well-being. It is considered to be one of the processes that actively promotes or ensures sustainable development. The EIA process is outlined in the Environmental Impact Assessment Regulations and Listing Notices aimed at implementing chapter 5 of the NEMA.

The Regulations provide for listing of activities which may not commence without an environmental authorisation and also identifies a process and reports to be submitted to the Competent Authority for decision making purposes. The process provides the proponent with an opportunity to assess the potential environmental impacts of the proposed development as well as provide for identification of mitigation measures to be in place to ensure that environmental impacts are avoided, minimised or mitigated. Key to this process, is the public participation element, which is also legislated. It forms the integral part of the EIA process and comments and inputs from the interested and/or affected are taken into consideration by the competent authority when making decisions on applications (DEA, 2018).

The environmental assessment process is used to understand the potential environmental impacts of a development, and to inform environmental decision-making before the development (and more particularly, the listed activities that require environmental authorisation under NEMA) is authorised. The information recorded during the EIA process provides the basis for a decision to grant (with or without conditions) or refuse authorization in respect of a given application, and with regard to the authorisation of an application, informs the selection of the most appropriate alternative (DEA, 2019).

In terms of the NEMA EIA Regulations, 2014 as amended, the purpose of the EIA Report is as follows:

(1) The environmental impact assessment process must be undertaken in line with the approved plan of study for environmental impact assessment.

(2) The environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the environmental impact assessment report.

1.2 OBJECTIVE OF THE ENVIRNMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative

process—

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted scoping report;

(c) identify the location of the development footprint within the approved site as contemplated in the accepted scoping report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—

(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted scoping report based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity;

(g) identify suitable measures to avoid, manage or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

1.3 EIA STUDY APPROACH

The study has been guided by the requirements of the EIA Regulations set out in terms of the NEMA. The study will also be guided by the requirements of the EIA Regulations, 2014, which are more specific in their focus and define the detailed approach to the S&EIR process, as well as relevant guidelines published by the Department of Environmental Affairs, including:

- DEA's Public Participation Guideline in terms of NEMA EIA Regulations (DEA, 2017); and
- DEA's Guideline on Need and Desirability (DEA, 2017a).

As per the requirements of Appendix 3 of GN R.982 (EIA Regulations, 2014), the EIR contains the following:

a) Details and the expertise of the EAP, including some curriculum vitae;
b) Location of the activity;
c) A plan showing the proposed activities and infrastructure at an appropriate scale;
d) A description of the scope of the proposed activity;
e) A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;
f) A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location; and

g) A motivation for the preferred development footprint within the approved site.

h) A full description of the process followed to reach the development footprint within the site, including:

- Details of the development footprint considered;
- Details of the public participation process undertaken in terms of regulation 41;
- A summary of issues raised by interested and affected parties and how they were addressed;
- The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical and biological, social, economic, heritage and cultural aspects;
- The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed or mitigated;
- The methodology used in determining and ranking the nature, significance, consequence, extent, duration and probability of environmental impacts and risks;
- Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected;
- The possible mitigation measures that could be applied and level of residual risk;
- A concluding statement indicating the preferred alternative development location within the approved site.

i) A full description of the process undertaken to identify, assess and rank the impacts of the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity;

j) An assessment of each identified and potentially significant impact and risk;

k) A summary of the findings and recommendations of specialist reports and indications as to how the findings and recommendations have been included in the final assessment report;

l) An environmental impact statement; and

m) Information required by the competent authority.

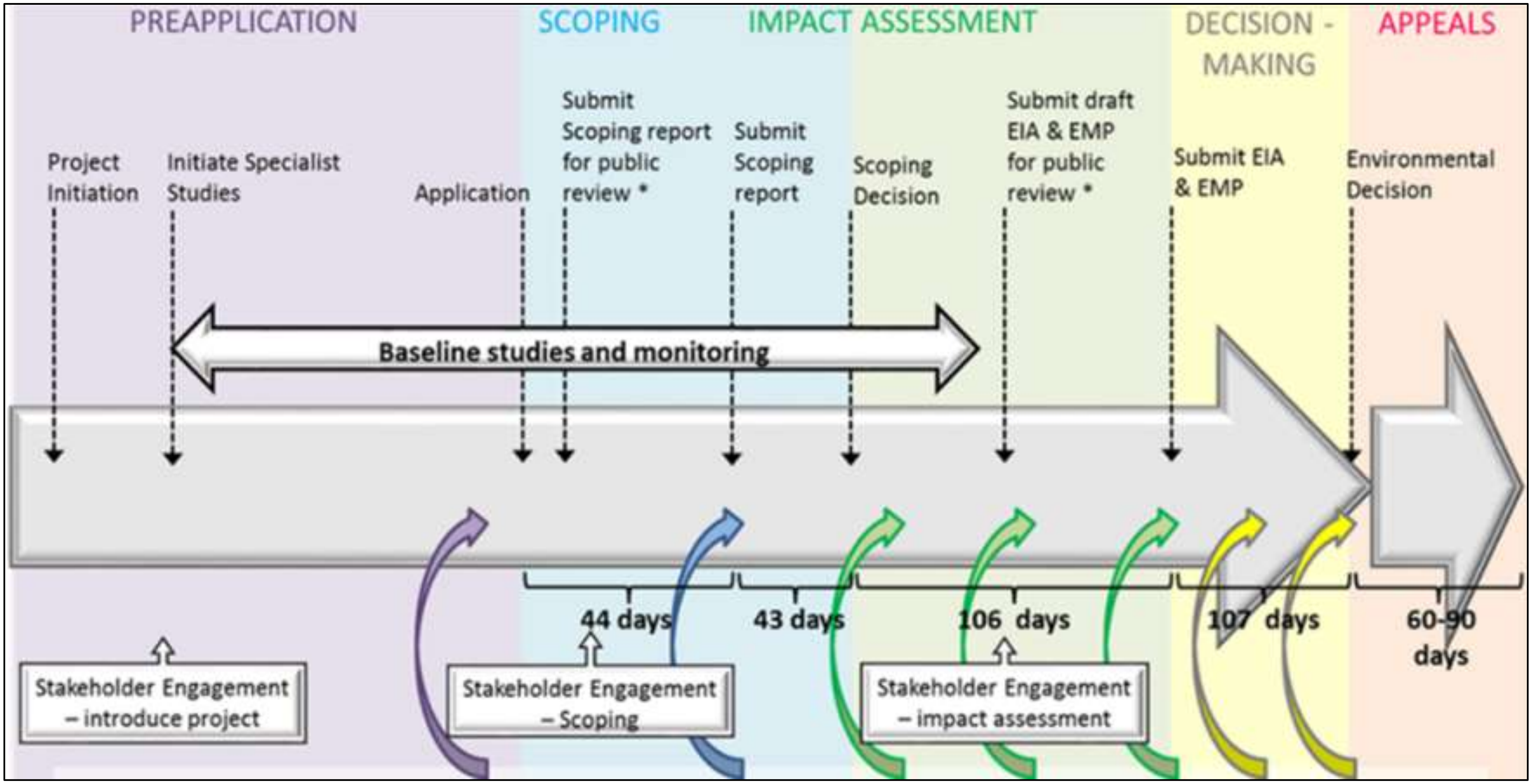


Figure 1-1: Schematic Representation of the Environmental Impact Assessment (EIA) Process (adapted from Earthguard Consulting)

The diagram above (Figure 1-1) is explained in detail below:

The main function of an EIA is to inform the decision-making process by clearly presenting adequate information. This process would take 300 days, but if the report needs to be corrected and re-distributed, 50 days will be provided additionally to do so, making the duration of the process 350 days (Botha, 2017). There are detailed provisions for steps and different phases in an EIA procedure including scoping, screening of important concerns which must be addressed, the preparation and research of environmental impact statements, review processes and public consultation, decision-making along with implementation. The mandatory steps for conformity for the EIA are defined in detail below.

Step 1: Initiation of a project

An applicant must appoint an EAP conforming to Regulation 12 of GN No R. 326 to conduct the application procedure for the Environmental Authorisation (EA). As stated by Regulation 6 of GN No R. 326 the application should be accepted by the applicable Competent Authority (CA) for authorisation (South Africa, 2017).

Step 2: Application submission to the CA

The EAP must complete and submit the form for application as stated in Regulation 16(1) (b) of GN No R. 326 with valid information to the CA before operating and managing a Scoping and EIA process.

Step 3: Deliberation of the application

The CA needs to review the application according to Regulation 17 of GN No R. 326 together with a declaration of the receiving application in less than 14 days by acknowledging if the application is permitted and if it is rejected or accepted.

Step 4: Conditions following the submission of an application

The Scoping report is composed, after the acknowledgment and submission of the application by the EAP and then passed on to ensure that the Public Participation (PP) fulfilled the requirements as specified in Regulation 41 – 44 (South Africa, 2017). This report should consist of information specified in Appendix 2 of GN No R. 326 (South Africa, 2017).

Step 5: Submission of Scoping report to the CA

The Scoping report must be submitted to the CA after it was distributed for PP within 44 days following the submission of the application form (Botha, 2017:79). The report must contain the information specified in Appendix 2 of GN No R. 326 (South Africa, 2017).

Step 6: Contemplation of the Scoping report

According to Regulation 22 of GN No R. 326 the CA has 43 days after receipt of the report to review the content of the report to accept or decline the report in writing. The process may move forward provided that the report is accepted or pursue with the responsibilities set out in the Plan of Study permitted, but a new application must be submitted if the report is rejected.

Step 7: Environmental Impact Assessment Report

An Environmental Impact Report (EIR) should be arranged shortly after the approval of the scoping report. The EIA report should have the information specified in Appendix 3 of GN No R. 326. According to Regulation 3 (8) and 41 to

44 of the GN No R. 326, the EIA report must be issued for PP no less than 30 days (South Africa, 2017). An Environmental Management Programme must be linked with an EIA report and must contain the necessary documentation that is required by Appendix 4 of GN. No. R. 326.

Step 8: EIA report submission to the CA

As stated by Regulation 23 (1), the final report must be issued to the CA after receiving the Scoping Report in under 106 days after the distribution for PP (South Africa, 2017).

Step 9: Contemplation and conclusion of the EIA report

The CA must contemplate, reject or accept the report after it has been issued within 107 days. The CA must recognise the receipt of the report in less than 10 days by written notification as set out in Regulation 3(6) (South Africa, 2017:220).

Step 10: Announcement of the decision

Regulation 25 and 4 (1) of GN No R. 326 requires written motives for the decision on the application after the CA has reached a conclusion within 5 days and inform the applicant of the result and notify the applicant of an appeal opposed to the outcome regarding the National Appeal Regulations, amended in 2017 (South Africa, 2017).

Step 11: I&APs informed by the applicant of a decision

Within 14 days of the decision, I&APs need to be informed about the decision through the application thereafter. The notification must contain the outcomes of the application, the motives regarding the decision and that "*an appeal may be filed against the decision in terms of the National Appeal Regulations, amended in 2017*" (South Africa, 2017:220-221).

1.4 STRUCTURE OF THE EIA REPORT

The content of this EIA Report has been structured in accordance with the requirements contained in Appendix 3 of the 2014 EIA Regulations Government Notice No. R.326.

Table 1: The content of this EIA Report

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(1)	An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include—	Section **Error! Reference source not found.**
(a)	details of— (iii) the EAP who prepared the report; and (iv) the expertise of the EAP, including a curriculum vitae;	
(b)	the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section **Error! Reference source not found.**

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(c)	a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is— (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section **Error! Reference source not found.**
(d)	a description of the scope of the proposed activity, including— (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	Section **Error! Reference source not found.** and **Error! Reference source not found.**
(e)	a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section **Error! Reference source not found.**
(f)	a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section **Error! Reference source not found.**
(g)	a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section **Error! Reference source not found.**
(h)	a full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including:	Section **Error! Reference source not found.**
	(i) details of the development footprint alternatives considered;	
	(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section **Error! Reference source not found.**
	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section **Error! Reference source not found.**
	(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section **Error! Reference source not found.**
	(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts— (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section **Error! Reference source not found.**

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
	(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section **Error! Reference source not found.**
	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section **Error! Reference source not found.**
	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section **Error! Reference source not found.**
	(ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Section **Error! Reference source not found.**
	(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Section **Error! Reference source not found.**
(i)	a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including—	Section **Error! Reference source not found.**
	(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section **Error! Reference source not found.**
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section **Error! Reference source not found.**
(j)	an assessment of each identified potentially significant impact and risk, including— (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section **Error! Reference source not found.**
(k)	where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section **Error! Reference source not found.**

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
(l)	an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section **Error! Reference source not found.**
(m)	based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section **Error! Reference source not found.**
(n)	the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section **Error! Reference source not found.**
(o)	any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section **Error! Reference source not found.**
(p)	a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section **Error! Reference source not found.**
(q)	a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section **Error! Reference source not found.**
(r)	where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	N/A
(s)	an undertaking under oath or affirmation by the EAP in relation to— (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section **Error! Reference source not found.**
(t)	where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
(u)	an indication of any deviation from the approved scoping report, including the plan of study, including—	N/A

APPENDIX 3	CONTENT AS REQUIRED BY NEMA	SECTION/CHAPTER
	(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	
(v)	any specific information that may be required by the competent authority; and	N/A
(w)	any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A
(2)	Where a government notice gazette by the Minister provides for any protocol or minimum information requirement to be applied to an environmental impact assessment report the requirements as indicated in such notice will apply.	N/A

1.5 DETAILS OF THE APPLICANT

Table 2 below provides details of the applicant.

Table 2: Applicant details

Aspect	Details
Company name	Transnet SOC Limited (Pty) Ltd
Contact person	Nosicelo Biyana
Postal address	PO Box 61032. Blue Water Bay Port Elizabeth
Contact no.	+27 41 507 1800
Email address	nosicelo.biyana@transnet.net

2. DETAILS OF THE EAP

To ensure compliance with the EIA Regulations (2014) promulgated under section 24 (5) of the National Environmental Management Act, 1998 NEMA (Act No. 107 of 1998) (NEMA) and environmental best practice, the applicant appointed Abantu Environmental Consultants (Pty) Ltd to manage the Environmental Authorisation process for the proposed project.

2.1 EAP CONTACT DETAILS

As per the requirements of the NEMA Regulations, the details of the Environmental Assessment Practitioner (EAP) are found in Table 3.

Table 3: EAP contact details

Aspect	Details
Company name	Abantu Environmental Consultants (Pty) Ltd
Representative	Zona Quvile [Reg EAP (EAPASA), Cert.Sci.Nat (SACNASP)]
Physical address	10 Liddiard Street, Saxilby, East London, 5247
Other contact details	Email: El-EIA@abantuenvironmental.co.za

2.2 EXPERTISE OF THE EAP

Zona Quvile holds a Master's degree in Environmental Education, an Honours degree in Biodiversity and Conservation from Rhodes University. She is registered as a Certified Scientist with the South African Council of Natural Scientific Profession (SACNASP). She is also registered as a Professional EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA).

She has 8 years working experience in the field of Environmental Sciences. She has worked on various projects in the mining, construction, water, waste sectors for both private and public client. She has experience in environmental authorisations (Basic Assessments (BARs), Environmental Impact Assessments (EIAs), water use licence applications (WULA)), wetland delineation and assessments, public participation (PPP) and stakeholder engagement, fauna and flora studies, social baseline studies, Due Diligences, environmental and social screening.

2.3 DETAILS OF THE INDEPENDENT SPECIALISTS

Details of the project team, including the appointed independent specialists are presented in Table 4.

Table 4. Project team

Name and Surname	Role	Years of Experience	Qualifications	Professional registrations	Project Functions
Project Management					
Mr Sive Mlamla	Project Manager	7	MSc Geography	• Pr.Sci.Nat Reg No. 118495 (SACNASP)	• Overall project management • Site assessments • Management of specialists • Report writing

Name and Surname	Role	Years of Experience	Qualifications	Professional registrations	Project Functions
Technical staff					
Mrs Aphiwe-Zona Quvile	Registered Environmental Assessment Practitioner	8	Masters Environmental Education	• Registered Environmental Assessment Practitioner (EAPASA) • Cert.Sci.Nat Reg No. (115598)	• Environmental Impact Assessment • Site assessments • Public Participation • Technical report writing
Dr. Patrick Sithole	Registered Environmental Assessment Practitioner and Technical Reviewer	23	PhD Environmental Sciences	• Registered Environmental Assessment Practitioner (EAPASA) • Pr.Sci.Nat Reg No. (26/09/2007)	• Environmental Impact Assessment • Site assessments • Public Participation • Technical report writing and reviews and approvals
Mrs Andisiwe Xuma	Senior Environmental Consultant	10	MSc Environmental Sciences	Pr.Sci.Nat Reg No.114735 (SACNASP)	• Site assessments, report writing and reviews
Ms Mongikazi Gxilishe	Junior Environmental Consultant	2	BSc Hons Environmental Geography	Cand.Sci.Nat	• Site assessments, report writing and mapping
Specialists					
Dr Brent Newman	Estuarine Ecology, Water and Sediment Quality Specialist	33	PhD Zoology (Marine)	Pr.Sci.Nat Reg No. 123899 (SACNASP)	• Estuarine Ecology Specialist Study (including) water and sediment quality impact assessment Water sampling and analysis
Mrs Jennifer Mokakabye	Heritage Specialist	14	M. Arts Archaeology	ASAPA Professional (No. 299)	• Marine heritage impact assessment • Site and desktop investigation
Dr Solomon Owolabi	Palaeontological Specialist	21	PhD Geology		• Palaeontological Impact assessment • Site and desktop investigation
Dr Anton De Wit	Social Impact Assessment	30	PhD Geography		• SIA

3. PROJECT LOCATION AND LAND OWNERSHIP

3.1 PROJECT LOCATION

The Port of East London is situated at the mouth of the Buffalo River in the city of East London, as shown in Figure 2A and Figure 2B. The harbour is protected by two breakwaters, namely, the East Breakwater (Orient Pier) and the South Main Breakwater. The Port's quays are located along the banks of the Buffalo River. Quay 3 is situated on the East Bank Multi-Purpose Terminal (MPT). The project site is located within the Port boundary. Access to the site is through the port entrance on Hely Hutchinson Road. Table 5 provides details of the location of the application site:

Table 5: Project location details

Province/s	Eastern Cape
District Municipality/ies	Amathole District Municipality
Local Municipality/ies	Buffalo City Metropolitan Municipality
Ward number/s	Ward 47
Nearest town/s	East London
Farm name/s and number/s	Farm 33367
Portion number/s	0
Coordinates	33°1'32" S, 25°55'31"E

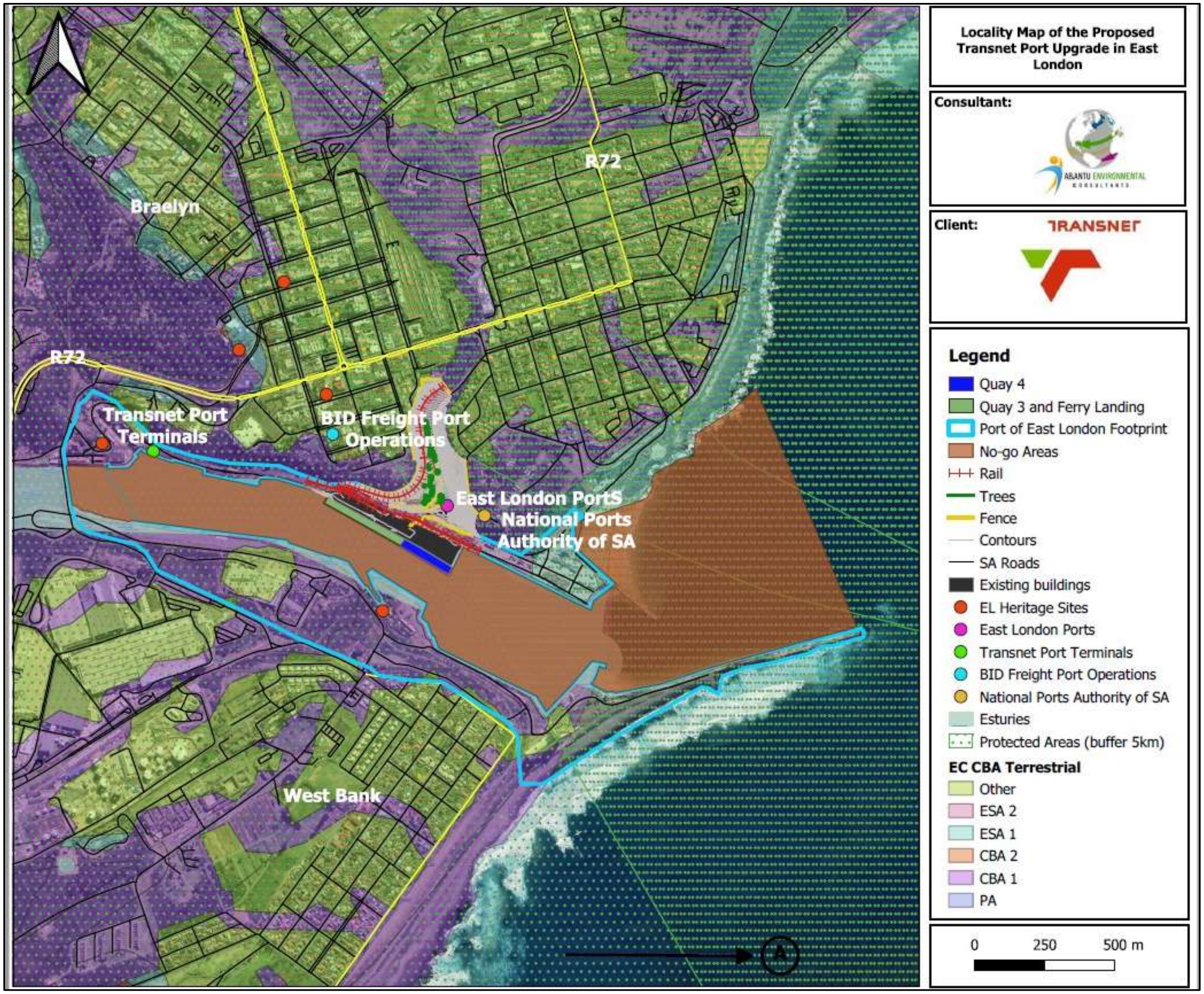


Figure 2A: Project locality

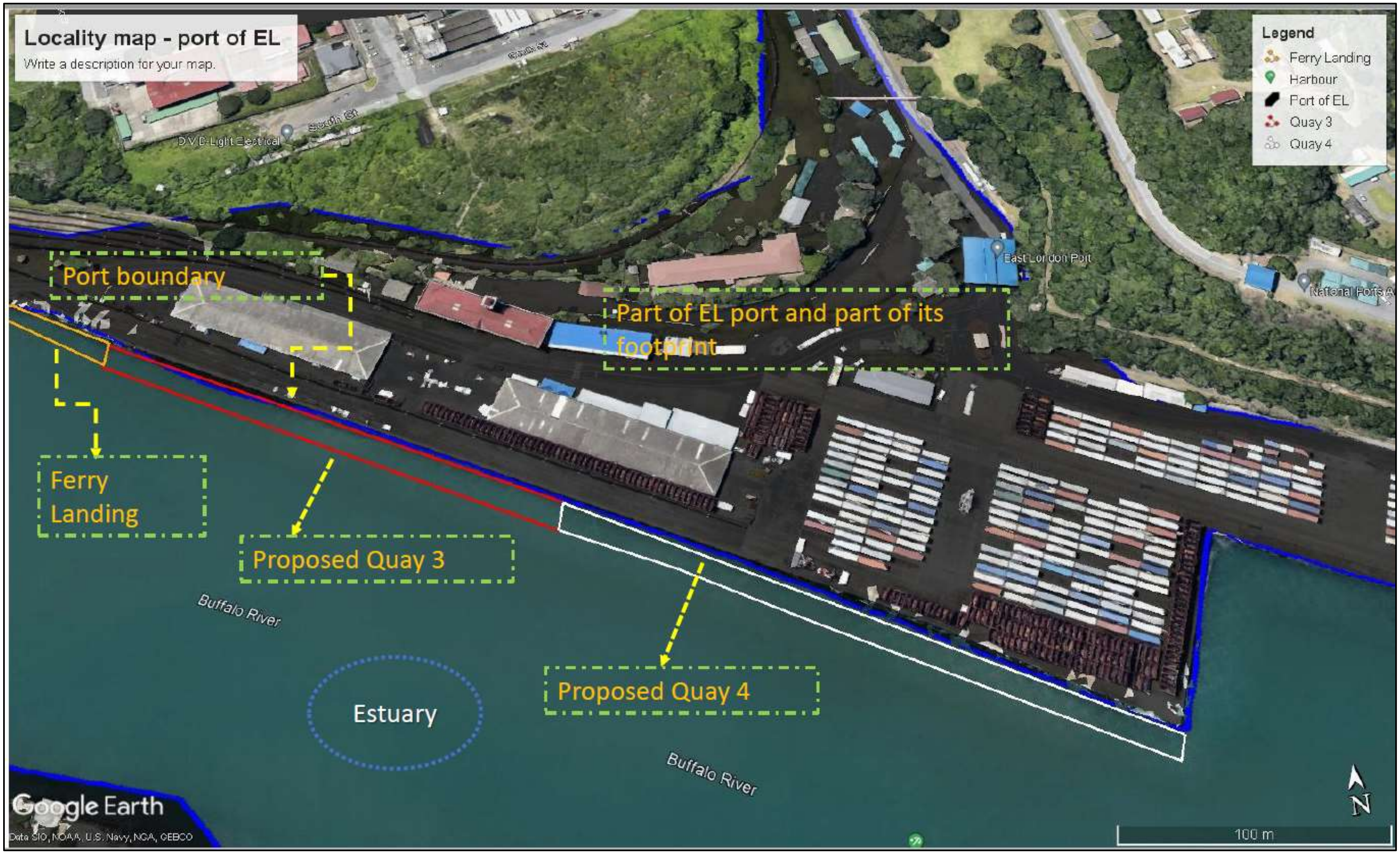


Figure 2B: Project Locality and proposed structures

4. PROJECT OVERVIEW

4.1 PROJECT BACKGROUND

Quay 3 is a mass gravity structure that was constructed in the 1920s, whilst the landing is a sheet pile wall constructed in the 1900s. Both quays have served well beyond their respective design lives. A condition assessment report for the repairs (replacement) of quay 3 by Transnet (2020) details the need and desirability of the project as detailed in the discussion below.

Cavities were first discovered in 1993 within the section of Quay 3 below sea level. Repairs were made thereafter, however, in 2012 the CSIR conducted a multibeam survey to ascertain the condition of the concrete structure. The CSIR report showed that the damage to Quay Wall 3 was extensive. Cavities as deep as 1.4 m were identified from the waterline to just below the toe, and the concrete had reached an advanced stage of deterioration.

A Ferry Landing (FEL) 2 prefeasibility study conducted in 2017 indicated that the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse. Given the advanced state of deterioration, the ability of the structure to fulfil its functional requirement is uncertain.

A number of options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

According to the FEL 2 prefeasibility study, a steel tubular combi-wall is the preferred design solution as it requires only a 4m step-out from the existing cope line; thereby limiting the narrowing of the navigation channel. The proposed solution will also address the collapsed Ferry Landing area. Concrete-filled tubular piles are the preferred king piles, with AZ (steel combined wall system) infill sheets between them. Structural stability of the combi-wall will be ensured through the installation of ground anchors to tie back the pile head.

Several listed activities are triggered by the proposed development and as such Environmental Authorisation is required prior to commencement of the activities detailed in Section 5 of this report. Abantu Environmental Consultants (AEC) has been appointed as the independent environmental assessment practitioners to facilitate the EIA process and obtain the relevant authorisations. The Environmental Authorisation application is subject to a Full Scoping and Environmental Impact Assessment (EIA) Process and will be adjudicated by the identified competent authority, Department of Forestry, Fisheries and Environment (DFFE).

This draft EIA Report is prepared in accordance with the requirements of Appendix 3 of the Environmental Impact Assessment Regulations, 2014, as part of the National Environmental Management Act (NEMA- Act 107 of 1998).

4.2 PROJECT DESCRIPTION

Quay 3 is situated on the East Bank Multi-Purpose Terminal (MPT) in the port of East London. The quay wall in 378m long and has a draft of – 9.8m deadweight coefficient CD. The mass concrete gravity quay was constructed in the 1920’s and has since reached an advanced stage of deterioration. The quay has historically been used for berthing and offloading general cargo vessels. The quay wall is equipped with tyre fenders as well as bollards equally spaced at approximately 18.3m centres.

The Ferry Landing is situated at the west end of Quay 3 and has the same draft as the quay wall. The landing collapsed in 2019 and is to be upgraded as part of the Quay 3 Project. The project scope also includes the upgrading of the adjacent Quay 4 to alleviate alignment issues. Quay 4 is 110 m long and has the same maintained depth as Quay 3 of -9.8 m CD. The total length of the combi-wall is 526 m.

4.2.1 Motivation

As stated previously, the ferry landing is a sheet pile wall constructed in the 1900s that has since collapsed. Quay 3 is a mass gravity structure that was constructed in the 1920s and has since reached an advanced stage of deterioration and cannot fully perform its function. Cavities found along the length of the quay, were up to 140cm deep and Geotechnical investigation showed that concrete was in an advanced state of concrete deterioration. The 4 cores were taken at 500-750 mm from the cope line and showed significant deterioration throughout the depth of cores. X-ray diffraction and electron microscopy showed that the cement had suffered attack by sea water. There is high variability in the condition of concrete and visual signs of deterioration. These include:

- Softening of mortar;
- Formation of voids under coarse aggregate;
- Splintering of the coarse aggregate above the cavities; and
- Soft, white gel.

The scope of this project includes Quay 3 and the Ferry Landing. The proposed quay wall solutions will allow for the inclusion of the Ferry Landing length, which effectively increases the useable quay length from 378 m to 416 m. The project scope also includes the upgrading of the adjacent Quay 4 to alleviate alignment issues. This infrastructure needs to be replaced to ensure its functioning into the future.

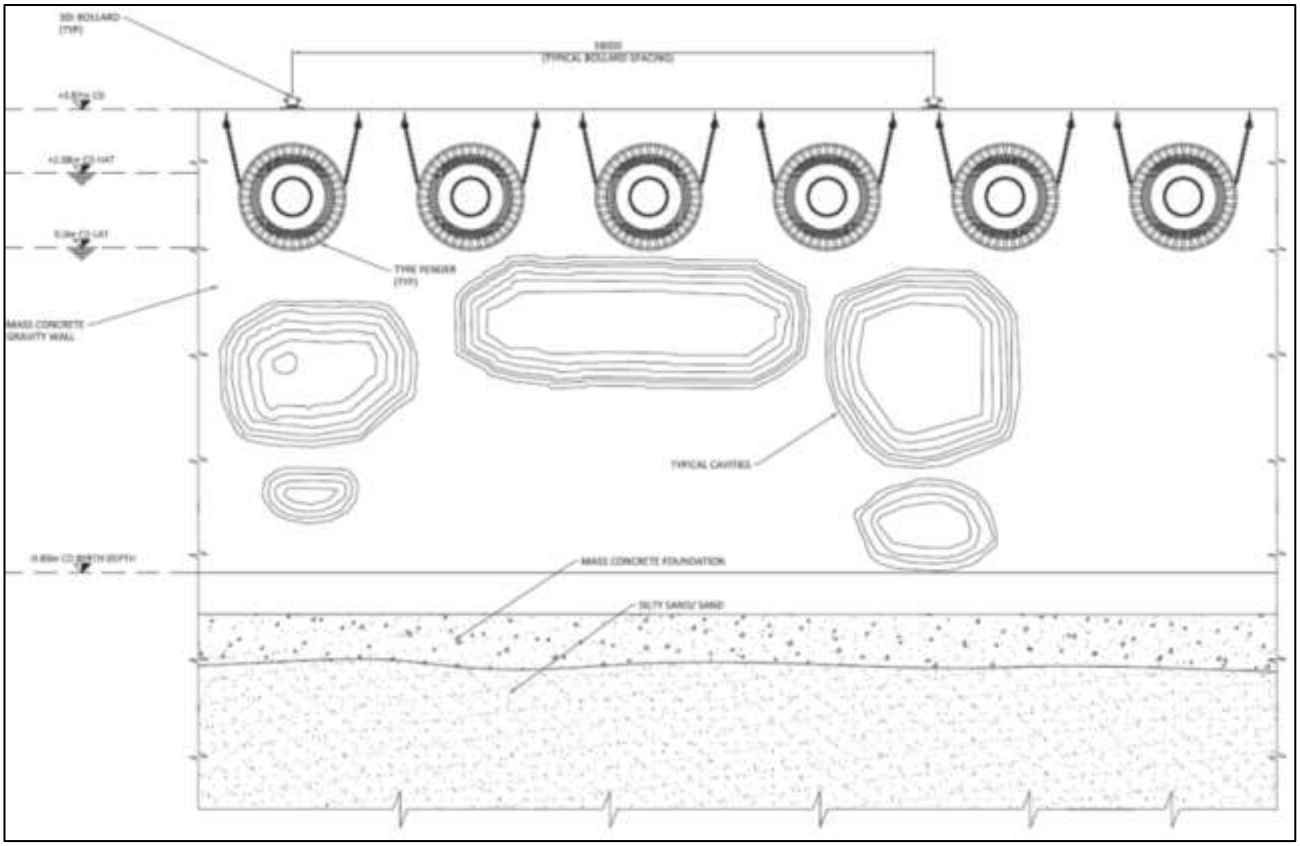


Figure 3: Quay 3 is a mass gravity structure that was constructed in the 1920s

Figure 4: The ferry landing is a sheet pile wall constructed in the 1900s.

4.2.2 Alternatives

Appendix 2 Sections 2 (1) (h) (i) and (x) Appendix 3 Sections 3 (1) (h) (i) and (ix) of the EIA Regulations, 2014 require that S&EIR processes must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives can be identified, e.g., location alternatives, type of activity, design or layout alternatives and technology alternatives. Not all categories of alternatives are applicable to all projects. However, the consideration of alternatives is inherent in the detailed design and the identification of mitigation measures, and therefore, alternatives have been and will be taken into account in the design and S&EIR processes.

A detailed assessment of alternatives was undertaken during the feasibility study conducted by PRDW (2017) on behalf of Transnet. A copy of this report is included as Appendix D5. It is the EAP's request that this report be accepted by the Department as a written proof of an investigation undertaken and motivation since no reasonable or feasible alternatives exist in terms of Appendix 2.

The mass concrete gravity Quay Wall 3 was constructed in the 1920's and has since reached an advanced stage of deterioration. The quay has historically been used for berthing and offloading general cargo vessels. The landing collapsed in 2019 and is to be upgraded as part of the Quay 3 Project. The project scope also includes the adjacent Quay 4 to alleviate alignment issues. A FEL 2 prefeasibility study conducted in 2017 indicated that the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse. Given the advanced state of deterioration, the ability of the structure to fulfil its functional requirement is uncertain.

The options for rehabilitation of the deteriorating structure were complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. Several options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

4.2.3 Preferred rehabilitation option (proposed replacement of infrastructure)

The preferred method is the use of Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.

This preferred option has been designed according to EN 1997, Design Approach 1 Combinations 1 and 2, using recommendations from BS6349-2:2010. The piles, and tie rod sections have been verified against structural failure according to the provisions in EN 1993. The selection of a tubular combi-wall section was governed by the installation requirements. The anticipated presence of shallow hard Hornfels layers in the soil profile requires a section that can withstand the high installation stresses resulting from heavy driving and allow for socketing into the hard layers to achieve the required embedment. The combi-wall has been designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance over its design working life.

The design of the primary (tubular piles) and secondary (sheet piles) elements is based on their functionality (Figure 5):

- The primary elements act as retaining elements against the earth and water pressures and may act as bearing piles for vertical loads;
- The secondary elements only fill the gap between the primary elements and transmit the loads resulting from earth and water pressures to the primary elements.

The focus of the design effort has been to limit the extent of any temporary works and limit the new cope line offset ahead of the existing wall and hence limit the loss of water area in the river.

CONSTRUCTABILITY

Use of the existing wall

One of the major cost drivers on marine construction sites is the mobilisation of specialist marine floating plant and equipment. Although the existing wall is deteriorating the opportunity to use it as a construction platform to drive the new combi wall is a significant cost saver. The Contractor will need to be made aware of any loading and other limitations in particular to the area around the Ferry Landing.

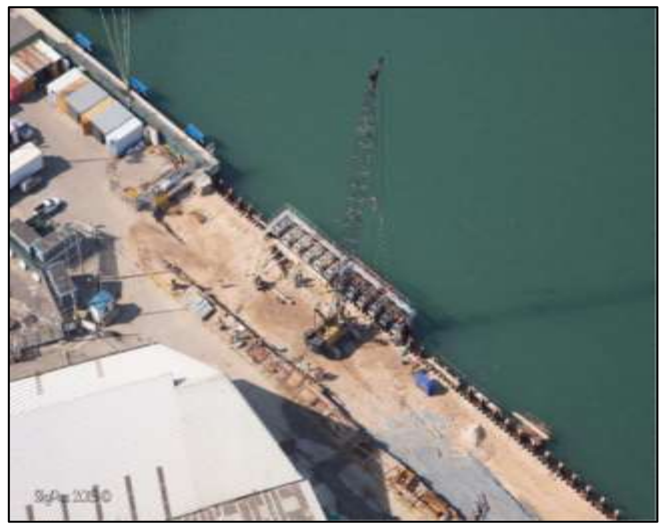
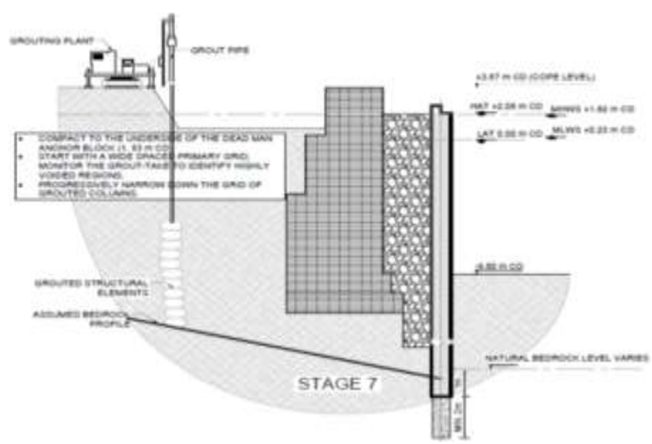
Proposed Construction Sequence

The following is a proposed sequence for the construction. The exact sequence around when anchors are installed and tensioned and when backfilling occurs will need to be defined in FEL 3 and will be a function of the deflections the combi wall can tolerate in the temporary condition.

- Decommission Quay 3
- Site establishment
- Procurement of materials – piles assumed from Europe
- Demolish existing structures that obstruct the new works
- Remove all the existing quay furniture – store for reuse on the new quay
- Once piles are delivered weld anode cleats
- Pile installation
    - Install guide frame with required temporary support
    - Install tubular king pile through overlaying sediments using vibro hammer
    - Drive tubular king pile to set using hydraulic hammer
    - Use rock auger to bore rock socket below end of casing
    - Clean out using grab and airlift
    - Insert reinforcing cage for rock socket
    - Tremie concrete to form socket and pile plug
- Install temporary tie back to existing wall
- Back fill between new and existing walls
- Concrete capping beam
    - Place precast cope units with temporary fixing
    - Fix forms for in-situ capping cast
    - Cast capping beam

- Ground Anchors
  - Drill anchor holes through existing wall and into competent material – lined
  - Insert cables and grouting tubes
  - Grout up anchors
  - Tension anchors
  - Seal anchor heads
- Install quay furniture
- Paving to final levels and services fit out
- Commissioning

Table 6: Construction sequence

1. Excavation of the back of quay 	2. Set-up the piling guide frame for piling 
3. Driving piles 	4. Backfill & install civil services 

5. Cast deadman and insert tie rods 	6. Cast capping beam and fender panel 
7. Pave the back of quay 	8. Install civil services & place stitching concrete 
9. Place precast elements 	10. Install quay furniture 

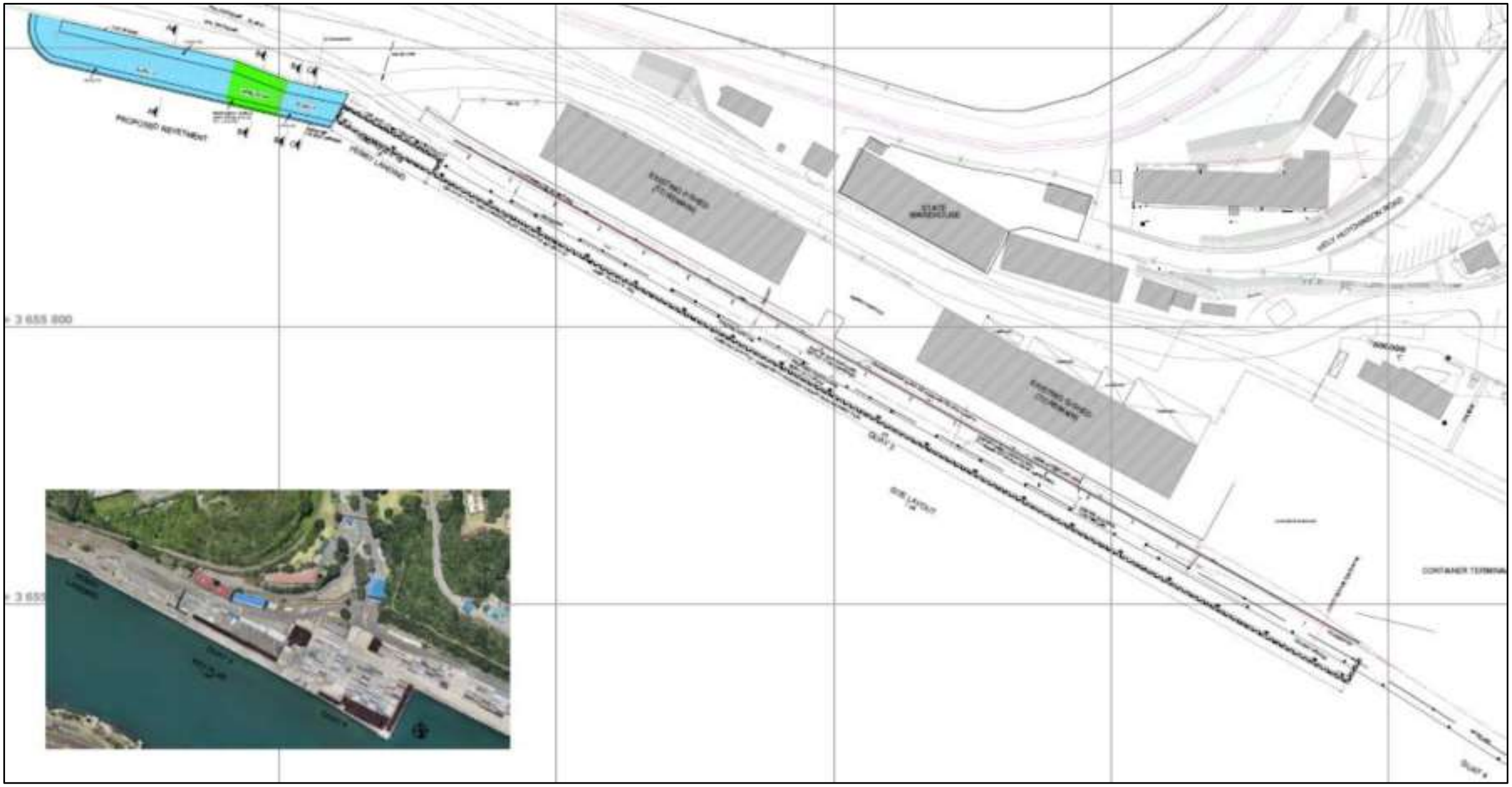


Figure 5: Overall layout

4.3 PROJECT PHASES

4.3.1 Pre-Construction (Planning Phase)

The planning phase of the project involves undertaking studies and submission of various applications that are required in order for the project to proceed. The proponent also undertakes feasibility studies and detailed designs to allow for seamless execution once all authorizations are obtained. There are minimal environmental impacts anticipated during the pre-construction phase however this phase is important to ensure that the project complies with the legislative and policy framework. Some economic benefit can be derived from appointment of environmental professionals, engineers and other skilled personnel required during this phase.

4.3.2 Construction Phase

Once the Environmental Authorization and any other required permits are obtained, the construction phase can commence.

The construction phase will involve the transportation of personnel, construction material and equipment to the site, and personnel away from the site. In terms of site establishment, laydown areas will be required at the outset of the construction phase, as well as dedicated access routes from the laydown areas to the working areas.

The laydown area will either be located adjacent to or at the project site. It is expected that the laydown area will be temporary in nature (for the duration of the construction phase) and will include the establishment of the construction site camp (including site offices and other temporary facilities for the appointed Contractors).

All efforts will be made to ensure that all construction work will be undertaken in compliance with local, provincial and national legislation, local and international best practice, as well as the Environmental Management Programme (EMPr), which will be compiled during the EIA Phase and included in the EIA Report. During the construction phase, both skilled and unskilled temporary employment opportunities will be created. It is also anticipated that the normal activities at the Port of East London may be interrupted during construction especially the vessels and surrounding businesses, however the scheduled will be communicated and all interested and affected parties will be notified of the project as it progresses.

4.3.3 Rehabilitation Phase

Rehabilitation Phase will involve removal of all temporary structures from the site, disposal of waste and cleanup of all spills and excess materials. All effort will be made to return the site as close to its state prior to construction as possible. No revegetation is envisaged since there is currently no vegetation in the site.

4.3.4 Operation Phase

It is anticipated that once all construction and rehabilitation activities are completed, the Port of EL will return to its normal and optimal operations. The new structures will allow these activities to take place in a safe manner.

5. LEGAL AND POLICY FRAMEWORK

The environmental legislation which is applicable to the authorisation of the proposed project is summarised in this Section and presented in Table 7.

Table 7: Legal and policy framework

LEGISLATION AND GUIDELINES	DESCRIPTION	LEGAL REQUIREMENTS FOR THIS PROJECT
CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA (NO. 108 OF 1996)	All environmental aspects should be interpreted within the context of the Constitution. The Constitution has enhanced the status of the environment by virtue of the fact that environmental rights have been established (Section 24) and because other rights created in the Bill of Rights may impact on environmental management. An objective of local government is to provide a safe and healthy environment (Section 152) and public administration must be accountable, transparent and encourage participation (Section 195(1)(e) to (g)).	Obligation to ensure that proposed activity will not result in pollution and/or ecological degradation. Obligation to ensure that where possible conservation is promoted. Obligation to ensure that the proposed activity is ecologically sustainable, while demonstrating economic and social benefits.
NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NO. 107 OF 1998) (NEMA)	NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of the State, as well as to provide for matters connected therewith. Section 2 of NEMA establishes a set of principles that apply to the activities of all organs of state that may significantly affect the environment. These include the following: • Development must be sustainable; • Pollution must be avoided or minimised and remedied; • Waste must be avoided or minimised, reused or recycled; • Negative impacts must be minimised; and • Responsibility for the environmental health and safety consequences of a policy, project, product or service exists throughout its life cycle. *Section 28(1) states that:*	The proponent is obliged to take action to prevent pollution or degradation of the environment in terms of Section 28 of NEMA.

LEGISLATION AND GUIDELINES	DESCRIPTION	LEGAL REQUIREMENTS FOR THIS PROJECT
	"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring." If such degradation/pollution cannot be prevented, then appropriate measures must be taken to minimise or rectify such pollution. These measures may include: • Assessing the impact on the environment; • Informing and educating employees about the environmental risks of their work and ways of minimising these risks; • Ceasing, modifying or controlling actions which cause pollution/degradation; • Containing pollutants or preventing movement of pollutants; • Eliminating the source of pollution; and • Remedying the effects of the pollution	
NATIONAL HERITAGE RESOURCES ACT (NO. 25 OF 1999)	The protection and management of South Africa's heritage resources is controlled by the National Heritage Resources Act 25 of 1999. The enforcing authority for this act is the South African Heritage Resources Agency (SAHRA). In terms of the Act, historically important features such as graves, trees, archaeological artefacts/sites and fossil beds are protected. Similarly, culturally significant symbols, spaces and landscapes are also afforded protection. In terms of Section 38 of the National Heritage Resources Act, SAHRA can call for a Heritage Impact Assessment (HIA) where certain categories of development are proposed. The Act also makes provision for the assessment of heritage impacts as part of an EIA process and indicates that if such an assessment is deemed adequate, a separate HIA is not required. The Act requires that:	A heritage impact study was undertaken. A chance finds procedure will be included in the Environmental Management Programme for the development.

LEGISLATION AND GUIDELINES	DESCRIPTION	LEGAL REQUIREMENTS FOR THIS PROJECT
	"…any person who intends to undertake a development categorised as the ... or any development or other activity which will change the character of a site exceeding 5 000 m² in extent or involving three or more existing erven or subdivisions thereof must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development..."	
NATIONAL WATER ACT (NO. 36 OF 1998)	The National Water Act 36 of 1998 provides for the promotion of efficient, sustainable and beneficial use of water in the public interest; for the facilitation of social and economic development; for the protection of aquatic and associated ecosystems and their biological diversity; and for the reduction and prevention of pollution and degradation of water resources. The Act also provides for emergency situations where pollution of water resources occurs. Section 21 of the Act describes activities that will require prior permitting before these activities may be implemented, including any changes to the river course and banks, changes to water flows and the discharge of water containing waste.	A Water Use Authorisation is not required for this project.
NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (NO. 10 OF 2004)	This Act provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of the Biodiversity Act, the developer has a responsibility for: a. The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations); b. Application of appropriate environmental management tools to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity; and	Protected species may be impacted on and as such the relevant permits must be applied for prior to construction. Any areas on site confirmed to be of high biodiversity need to be protected.

LEGISLATION AND GUIDELINES	DESCRIPTION	LEGAL REQUIREMENTS FOR THIS PROJECT
	c. Limit further loss of biodiversity and conserve endangered ecosystems. The objectives of this Act are: To provide, within the framework of the NEMA, for – (i) The management and conservation of biological diversity within the Republic; and (ii) The use of indigenous biological resources in a sustainable manner. The Act's permit system is further regulated in the Act's Threatened or Protected Species Regulations (GN 255), which were promulgated in March 2015, the National List of threatened ecosystems (GN 1002) promulgated in December 2011 and the Alien Invasive Species regulations (GNR 598) of August 2014.	
NATIONAL ENVIRONMENTAL MANAGEMENT: INTEGRATED COASTAL MANAGEMENT ACT (NO. 24 OF 2008)	The National Environmental Management Act: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) governs the open water disposal of dredged material. Open water disposal requires a permit. The National Environmental Management: Integrated Coastal Management Act 24 of 2008 aims: • to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and • to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and ecologically sustainable; • to define rights and duties in relation to coastal areas;	To comply with the Act, Transnet National Ports Authority annually makes an application to the Department of Environmental Affairs to dispose sediment maintenance dredged in the Port of East London at a registered openwater disposal site off East London. For this proposed project, a sediment quality assessment was also undertaken.

LEGISLATION AND GUIDELINES	DESCRIPTION	LEGAL REQUIREMENTS FOR THIS PROJECT
	• to determine the responsibilities of organs of state in relation to coastal areas; • to prohibit incineration at sea; • to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; • to give effect to South Africa's international obligations in relation to coastal matters; and • to provide for matters connected therewith.	
NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT (NO. 59 OF 2008)	The purpose of this Act relates to the proper disposal of waste. The Act also provides for the waste related activities where a Waste Licence is required. This includes the recycling and refining of waste.	The applicant to adhere to the waste management and disposal regulations.
NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (NO.39 OF 2004)	This Act requires that listed activities be operated within the conditions of an Air Emissions License, which has implications related to emissions monitoring and minimisation.	The applicant to adhere to air quality regulations.
EASTERN CAPE COASTAL MANAGEMENT PLAN (2014)	Broadly, the aim of a provincial CMP is to achieve the integrated coastal management objectives in the coastal area under provincial jurisdiction, part of which means ensuring consistency with national objectives	The applicant must comply to all provincial coastal regulations.
NEMA: ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 (AS AMENDED)	Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities that may not commence without an EA issued by the competent authority (Department of Environmental Affairs). In this context, the EIA Regulations, as amended GN R326, promulgated in terms of NEMA, govern the process, methodologies, and requirements for the undertaking of EIAs in support of EA applications. Listing Notices 1-3 in terms of NEMA listed activities that require EA (“NEMA listed activities”). GN R326 as amended of the EIA Regulations lays out two alternative authorisation processes. Depending on the type of activity that is proposed, either a Basic Assessment (BA) process or a Scoping &EIR process is required to obtain EA. Listing Notice 1 (GN R327) lists activities that require a	The applicant to adhere to EIA Regulations, as amended. The applicant to follow methodologies, and requirements for the undertaking of EIAs in support of EA applications. Listing Notices 1-3 in terms of NEMA listed activities that require EA (“NEMA listed activities”) must be applied for.

<table>
<tr><th>LEGISLATION AND GUIDELINES</th><th>DESCRIPTION</th><th>LEGAL REQUIREMENTS FOR THIS PROJECT</th></tr>
<tr><td></td><td>BA process, while Listing Notice 2 (GN R325) lists activities that require S&EIR. Listing Notice 3 (GN R324) lists activities in certain sensitive geographic areas that require a BA process.

The regulations for both processes – BA and S&EIR - stipulate that:
Public participation must be undertaken as part of the assessment process;
The assessment must be conducted by an independent EAP;
The relevant authorities respond to applications and submissions within stipulated time frames;
Decisions taken by the authorities can be appealed by the proponent or any other Interested and Affected Party (IAP); and
A draft EMPr must be compiled and released for public comment.
GN R326 sets out the procedures to be followed and content of reports compiled during the BA and S&EIR processes.

The NEMA National Appeal Regulations (GN R993 of 2014, as amended by GN R2015 of 2015) make provision for appeal against any decision issued by the relevant authorities. In terms of the Regulations, an appeal must be lodged with the relevant authority in writing within 20 days of the date on which notification of the decision (EA) was sent to the applicant or IAP (as applicable). The applicant, the decision-maker, interested and affected parties and organs of state must submit their responding statement, if any, to the appeal authority and the appellant within 20 days from the date of receipt of the appeal submission.</td><td></td></tr>
<tr><td>BUFFALO RIVER ESTUARY MANAGEMENT PLAN (2016)</td><td>The Buffalo River Estuary Management Plan provides a comprehensive assessment of the state of the estuary and makes management recommendations relating to high priority issues.</td><td>The applicant to be cognisant of the outcomes of this management plan to assist in appropriate decision-making.</td></tr>
</table>

5.1 NEMA: ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2014 (AS AMENDED)

Table 8 lists the NEMA listed activities in terms of the 2014 EIA regulations, as amended, that are triggered by the proposed project.

Table 8: NEMA Listed Activities (2014 EIA regulations, as amended) applicable to the proposed project

Activity No(s):	Provide the relevant **Basic Assessment Activity(ies)** as set out in **Listing Notice 1** of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GN. R327 Activity 12 (xii) (a) (b) (c) (d)	The development of— (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— (a) within a watercourse; (b) if no development setback exists, within 32 metres of a watercourse, measured (c) from the edge of a watercourse; — excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area**; [or]** (ee) where such development occurs within existing roads, **[or]** road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	The proposed replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 100 square meters and will be developed within 32m of the Buffalo Estuary (watercourse). The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2.
GNR 327 Activity 17 (ii) (iii)m(iv) (v)(a)(c)(d)	Development— (ii) in an estuary; (iii) within the littoral active zone;	The replacement of Quay wall 3 and 4 as well as the Ferry Landing within an estuary, Buffalo River mouth, where the existing structures will be increased by 4 m outwards from

	(iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater; in respect of— (a) fixed or floating jetties and slipways; (c) embankments; (d) rock revetments or stabilising structures including stabilising walls; or (f) infrastructure or structures with a development footprint of 50 square metres or more — but excluding— (aa) the development of infrastructure and structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) the development of temporary infrastructure or structures where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared; or (dd) where such development occurs within an urban area.	the existing port structures, thus, increasing the footprint of the port by more than 50 square metres outwards.
GNR No. 327 Activity No. 19 (III)	The infilling or depositing of any material of more than **[5]** 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than [5] 10 cubic metres from (iii)the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or estuary, whichever distance is the greater—] but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback;	The proposed replacement of the quay wall 3 and 4 and the ferry landing will require the installation of concrete-filled tubular piles, with AZ infill sheets between them and structural stability of the combi-wall will be ensured through the installation of ground anchors to tie back the pile head. The installation of this infrastructure will require the dredging, excavation, removal or moving of soil, sand, pebbles or rock of more than 10 cubic metres from an estuary, Buffalo River mouth).

	(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; [or] (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	In addition, the existing structures will be increased by 4 m outwards from the existing structures, thus, increasing the footprint of the port (The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2).
GNR 327 Activity 19 A (ii)	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from— (ii) the littoral active zone, an estuary or a distance of 100 metres inland of the highwater mark of the sea or an estuary, whichever distance is the greater; but excluding where such infilling, depositing, dredging, excavation, removal or moving— (f) will occur behind a development setback; (g) is for maintenance purposes undertaken in accordance with a maintenance management plan; (h) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	The proposed replacement of the quay wall 3 and 4 and the ferry landing will require the installation of concrete-filled tubular piles, with AZ infill sheets between them and structural stability of the combi-wall will be ensured through the installation of ground anchors to tie back the pile head. The installation of this infrastructure will require the dredging, excavation, removal or moving of soil, sand, pebbles or rock of more than 10 cubic metres from a watercourse (estuary, Buffalo River mouth). In addition, the proposed repair/replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 5 cubic metres and will be developed within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing port and will stretch by approximately 684.34 m, thus, has a footprint of ~ 2 592 square meters. Therefore, the footprint of the existing port will be increased towards the estuary (The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2).

GNR 327 Activity 31 (i) (ii) (iv) (a)	The decommissioning of existing facilities, structures or infrastructure for— (i) any development and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (ii) any expansion and related operation activity or activities listed in this Notice, Listing Notice 2 of 2014 or Listing Notice 3 of 2014; (iv) any phased activity or activities for development and related operation activity or expansion or related operation activities listed in this Notice or Listing Notice 3 of 2014; or (a) is similarly listed to an activity in (i)[,or (ii)[, or (iii)] above; and (b) is still in operation or development is still in progress; excluding where— (aa) activity 22 of this notice applies; or (bb) the decommissioning is covered by part 8 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.	Before the quay walls and ferry landing can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4.
GN. R327 Activity 48(i)(a)	The expansion of— (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion [or expansion and related operation] occurs— (a) within a watercourse; excluding— (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;	The proposed repair/replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 100 square meters and will be developed within the Buffalo Estuary. The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2. Therefore, the footprint of the existing port will be increased towards the estuary.

	(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such expansion occurs within an urban area; or (ee) where such expansion occurs within existing roads, road reserves or railway line reserves.	
GNR 327 Activity 54 (ii) (iii) (v) (a) (b) (c) (d) (e)	The expansion of facilities— (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater; in respect of— (a) fixed or floating jetties and slipways; (b) tidal pools; (c) embankments; (d) rock revetments or stabilising structures including stabilising walls; or (e) [buildings where the building is expanded by 50 square metres or more; or] (f) infrastructure or structures where the development footprint is expanded by 50 square metres or more. but excluding— (aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; or (bb) where such expansion occurs within an urban area.	The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2. Therefore, the footprint of the existing port will be increased towards the estuary.
GNR No. 327 Activity 52	The expansion of structures in the coastal public property where the development footprint will be increased by more than 50 square metres, excluding such expansions within existing ports or harbours where there will be no increase in the development footprint of the port or harbour and excluding activities listed in activity 23 in Listing Notice 3 of 2014, in which case that activity applies.	The proposed replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 50 square meters and will be developed within the Buffalo Estuary. The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo

		Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2. Therefore, the footprint of the existing port will be increased towards the estuary.
GNR 327 Activity 55 (ii) (iii) (v)(a)(d)(e)(f)	Expansion— (ii) in an estuary; (iii) within the littoral active zone; (iv) in front of a development setback; or (v) if no development setback exists, within a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever is the greater in respect of — (a) facilities associated with the arrival and departure of vessels and the handling of cargo; (d); breakwater structures; (e) coastal marinas (f) coastal harbours or ports. but excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 100 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2.
GNR 327 Activity 65 **(i)(ii)**	The expansion and related operation of (i) an anchored platform; or (ii) any other [permanent] structure or infrastructure; on or along the sea bed, where the expansion will constitute an increased development footprint, excluding expansion of facilities, infrastructure or structures for aquaculture purposes.	The proposed repair/replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 100 square meters and will be developed within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing port and will stretch by approximately 684.34 m, thus, has a footprint of ~ 2 592 square meters. Therefore, the footprint of the existing port will be increased towards the estuary.
Activity No(s):	Provide the relevant **Basic Assessment Activity(ies)** as set out in **Listing Notice 3** of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GNR R324 Activity 14 (xii) (ii) (a) (b) (c) ai (aa) (bb) (ff) (hh) (jj)	The development of— (xii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;] (ii) infrastructure or structures with a physical footprint of 10 square metres or more;	The proposed quays have a development footprint that exceeds 10m² and occurs within a watercourse, the Buffalo River, estuary. It's also located within 5km of the Amathole Marine Protected Area and is located within a Critical Biodiversity Area.

	where such development occurs— (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. a. Eastern Cape i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; (jj) In an estuarine functional zone, excluding areas falling behind the development setback line.	The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 10 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2. Therefore, the footprint of the existing port will be increased towards the estuary.
GNR R324 Activity 23 (xi) (ii) (a) (b) (c) a.i.(bb)(ee)(gg)(hh)(ii)	The expansion of— (xii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more;] (ii) or structures where the physical footprint is expanded by 10 square metres or more; where such [development] expansion occurs— (a) within a watercourse; (b) in front of a development setback adopted in the prescribed manner; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse.	The proposed repair/replacement of Quay wall 3, Quay wall 4 and Ferry Landing exceeds 10 square meters and will be developed within the Buffalo Estuary which is a watercourse and are located within a critical biodiversity area (Eastern Cape Biodiversity Conservation PLAN, 2018) and is within 5km of the Amathole Marine Protected Area. The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) exceeds 10 m^2 in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2.

	excluding the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. a. Eastern Cape i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; (hh) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or (ii) An estuarine functional zone, excluding areas falling behind the development setback line.	Therefore, the footprint of the existing port will be increased towards the estuary.
Activity No(s):	Provide the relevant **Scoping and EIA Activity(ies)** as set out in **Listing Notice 2** of the EIA Regulations, 2014 as amended.	Describe the portion of the proposed project to which the applicable listed activity relates.
GNR 325 Activity 14 **(ii)(iii)**	The development and related operation of— (ii) an anchored platform; or (iii) any other structure or infrastructure — on, below or along the sea bed. excluding — (a) development of facilities, infrastructure or structures for aquaculture purposes; or (b) the development of temporary structures or infrastructure where such structures will be removed within 6 weeks of the commencement of development and where coral or indigenous vegetation will not be cleared.	The proposed replacement of the quay wall 3 and 4 and the ferry landing will require the installation of concrete-filled tubular piles, with AZ infill sheets between them and structural stability of the combi-wall will be ensured through the installation of ground anchors to tie back the pile head. Part of the structures will be underwater on the seabed.
GNR 325 Activity 26 (ii)(iii) (iv) (v)(a)(b)(c)d)(f)	Development— (ii) in an estuary;	The proposed development of Quay 3. Quay 4 and Ferry Landing replacement will occur in the Buffalo estuary,

	(iii) within the littoral active zone; (iv) in front of a development setback; (v) if no development setback exists, within a distance of 100 metres inland of the highwater mark of the sea or an estuary, whichever is the greater; in respect of — (a) facilities associated with the arrival and departure of vessels and the handling of cargo; (b) piers; (c) inter- and sub-tidal structures for entrapment of sand; (d) breakwater structures; (f) coastal harbours or ports; but excluding the development of structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	within the littoral active zone and within 100 meters of the highwater mark of the estuary. The proposed repair of Quay wall 3, Quay wall 4 and Ferry Landing (combined length of approximately 684m) in development within the Buffalo Estuary. The structure will encroach the estuary by 4 m from the existing cope line, therefore the expected increase in footprint will be approximately 2 592 m^2.

6. NEED AND DESIRABILITY OF THE PROJECT

6.1 NEED AND DESIRABILITY

Quay 3 is a mass gravity structure that was constructed in the 1920s, whilst the landing is a sheet pile wall constructed in the 1900s. Both quays have served well beyond their respective design lives. A condition assessment report for the (replacement) of quay 3 by Transnet (2020) details the need and desirability of the project as detailed in the discussion below.

Cavities were first discovered in 1993 within the section of Quay 3 below sea level. Repairs were made thereafter, however, in 2012 the CSIR conducted a multibeam survey to ascertain the condition of the concrete structure. The CSIR report showed that the damage to Quay Wall 3 was extensive. Cavities as deep as 1.4 m were identified from the waterline to just below the toe, and the concrete had reached an advanced stage of deterioration.

On October 9, 2018, a structural failure occurred which resulted in the collapse of the Ferry Landing Transition Wall. The root cause of the failure could not be ascertained due to the age of the infrastructure and unavailability of as-built drawings. However, it is alleged that a rotational failure occurred, which may have been caused by loss of founding material and additional loading imposed by the mass concrete capping beam. Significant settlement was noted by TNPA during the first 2 months following the collapse. The movement indicated that the cope beam was still settling, even though at a slower rate, and there was possible scouring at the toe of the structure. This therefore increased the likelihood of eventual total collapse of the structure, which will result in erosion of the road platform, back-up space at Quay 3 and the undermining of Quay 3. Additionally, further erosion of the exposed cliff is occurring due to the rise and fall of tides, indicating that the condition of the quay has further deteriorated. The Ferry Landing site in its current state is unsafe since the embankment is supported by a collapsed and eroded steel sheet pile wall and a collapsed coping beam. Should both the cope beam and steel sheet pile fail, the entire embankment will slip and cause further damage to surrounding infrastructure.

TNPA Marine was appointed by the Port of East London to conduct a visual condition and structural assessment of the Ferry Landing and Quay 3. The catalyst for the undertaking of this investigation was because the back of the quay has displayed signs of decay as water is penetrating onto the surface at Quay 3 and leaches out small sand particles from the back of the quay. Additionally, a diving inspection of the Port's quay walls was conducted in September 2020 and the findings indicated that the deterioration of Quay 3 was of concern. Defects were found within the low high-water area and the concrete has eroded in numerous places. The collapsed portion of Ferry Landing is reported to have caused some damage to the Quay. Furthermore, some cavities that were previously repaired have since reopened. The diving inspection report further indicated that there is evident of delamination and undermining between Bollard 46 and 61, which is on the ferry landing side of the Quay. A gradual decline in the condition of Quay 3 has been noted, hence the need for the need for the replacement.

Risks identified during the condition assessment are detailed below:

- Should the ferry landing collapse completely, it would be difficult to recover bollards from underwater due to its robust anchor system. The recovery would likely involve the tedious process of breaking down concrete and lifting the bollards to the surface.
- Interruption of the transportation of goods and personnel on the landside due to damaged road and Rail infrastructure.
- Resultant impact on Quay3 will lead to further deterioration or undermining, which could result in the global failure of the mass gravity quay wall.

- Reduction in operational length of Quay 3.
- Should Quay 3 fail, there will be a significant impact on Port operations as the quay is used for the berthing and handling of general cargo vessels, as well as cattle and cruise vessels.
- Failure of Quay 3 will also affect the design of ongoing FEL 3 refurbishment project for the quay because backfill behind the existing mass gravity structure will continue to support backfill material, even when it is buried behind the new quay. If quay 3 collapses, the design might change.
- Rubble material in water due to the potential collapse of either Quay 3 or the entire ferry landing sheet pile wall will result in a reduction in navigable waters.

In order to mitigate these risks, there is an urgent need for the proposed project to be undertaken. Table 9 includes a list of questions to determine the need and desirability of the proposed project.

Table 9: Determination of the Need and Desirability of the development

No.	Question	Response
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the IDP).	Yes, the proposed project will be in line with the identified programmes within the IDP.
2.	Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?	Yes. Should it not occur at this current time, the structures will fail to provide the services they were designed for.
3.	Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate)	Yes, the proposed development is a societal priority as it will ensure that the port functions at full capacity and create and sustain employment opportunities.
4.	Are the necessary services with appropriate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?	Yes, the necessary services with appropriate capacity are currently available. No additional capacity will be needed.
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services)	The proposed replacement of the quay walls and ferry landing does not specifically have to be provided for in the infrastructure planning of the municipality. The applicant, Transnet is responsible for improving, managing and maintaining the national ports which act as

No.	Question	Response
		the "economic arteries" of South Africa. Thus, the applicant will be responsible for ensuring all required services for the construction phase,
6.	Is this project part of a national programme to address an issue of national concern or importance?	No. Although the Transnet ports and harbors play a significant role in the general economy of the district.
7.	Is the development the best practicable environmental option (BPEO) for this land/site?	The project is a project to reconstruct collapsed or deteriorating infrastructure in the Port to sustain and improve operational efficiency of the Port. BPEO will relate to the type of design that has been selected and the design life of the structure including specific environmental and sustainability design criteria in the design.
8.	Would the approval of this application compromise the integrity of the existing approved municipal IDP and SDF as agreed to by the relevant authorities?	No, the proposed development is in line with the municipal IDP and SDF as well as the Port Development Framework Plan.
9.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	No. The approval of the project would not compromise the integrity of the existing approved Municipal IDP and SDF as agreed to by the relevant authorities. The project is also in line with the Port Development Framework Plan.
10.	Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).	Yes. The project relates to reconstruction/replacement of existing infrastructure within an existing operational Port.
11.	How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)	The project will be undertaken within an existing operational Port. The existing quay is older than 60 years and therefore a heritage structure. The cultural / heritage significance of the quay is relevant for the proposed project. A heritage impact assessment will be undertaken, and the specialist will advise on

No.	Question	Response
		potential other heritage aspects of importance based on available information of the area.
12.	How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?	The area where the activity will be undertaken is an already existing Port that is exposed daily to various Port operational activities. Therefore, there are no new impacts on people's health and well-being that are envisaged.
13.	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	The project is a maintenance project to reconstruct collapsed and/or deteriorating infrastructure in the Port to sustain and improve operational efficiency of the Port. The area where the activity will be undertaken is an already existing Port and there will not be any change in the operational activities of the Port. Therefore no unacceptable opportunity costs are envisaged.
14.	Will the proposed land use result in unacceptable cumulative impacts?	No, the project is a maintenance project to reconstruct collapsed and/or deteriorating infrastructure in the Port to sustain and improve operational efficiency of the Port. The area where the activity will be undertaken is an already existing Port and there will not be any change in the operational activities of the Port. Therefore, no unacceptable opportunity costs are envisaged.

6.2 Compatibility with adjoining land uses and character/function of the area

The proposed replacement of the quay walls and ferry landing will occur within the existing Transnet EL Port. As such, there will be no new land use or additional infrastructure added.

5.3 SOCIO-ECONOMIC CONSIDERATION

The proposed project includes the following key drivers:

- To address the advanced state deterioration of the structures to ensure the ability of the structures to fulfil its functional requirements;
- To improve service delivery by ensuring the continued use of the quay walls and ferry landing by vessels;
- To prevent future collapse of the infrastructure;

The intended upgrade will foster commerce and socio-economic development within the metropolitan municipality and beyond.

7. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT

The following baseline studies have been conducted so far for the Port of East London Quay wall 3 and 4 and the Ferry Landing that provide a clear picture on the selection of the preferred development footprint:

Cavities in concrete of Quay Wall 3: Geotechnical Investigation report (2013)

A phase 1 geotechnical investigation was commissioned by Transnet Capital Projects (TCP) in 2013 (Appendix D7). The report showed that Quay Wall 3 had extensive damage. The damage was described as being mostly whole concave sections or cavities from the waterline to just above the toe. Cavities as deep as 1,4m were identified. The report concluded that the concrete has reached an advanced state of deterioration resulting in the cavities forming on the surface of the quay wall. It was recommended that the concrete be repaired and/or replaced.

East London Quay Wall: Final Geotechnical Report (2014)

Aurecon South Africa (Pty) Ltd was appointed by Transnet National Ports Authority (TNPA) in 2014 to carry out further investigative work in the area of the existing old tug wharf in the Port of East London (Appendix D6). The investigative work included marine geological investigation (offshore and onshore) which would guide the rehabilitation design of the proposed new quay structure. The investigation found that the existing sheet piled wall is at the end of its life and it will be necessary to replace the wall with a new sheet pile system.

Detailed condition assessment of the Quay no. 3 and adjoining Ferry Landing at the Port of East London (2017)

PRDW was appointed by TNPA as the marine structural engineer to evaluate the structural integrity of the quay wall and investigate the repair and/or replacement options (Appendix D5). Conclusions from the study were that:

- the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse;
- given the advanced state of deterioration the ability of the structure to fulfil its functional requirement is uncertain and the modelling indicates that further section losses will negatively impact the overall stability of the wall;
- although there are no obvious signs of stress evident along the structure's capping or back of quay areas, the progressive weakening of the retaining structure could result in a sudden failure in the high load areas of the concrete should the cavities be allowed to grow unchecked;
- the results of the stability assessments show that the structure has sufficient structural stability considering the geometry and mass of the structure, but the continual deterioration of the mass concrete will lead to stability issues;
- doing nothing would eventually result in the abandoning or condemning of the quay due to safety concerns;
- the options for rehabilitation are complicated by the risk of further concrete deterioration even if the existing structure is clad and protected against direct sea water contact;
- to clad or locally repair the structure would be impractical to do effectively and would at best slightly delay the continuous deterioration of the surrounding concrete and make any predictions regarding the increased lifespan very difficult; a replacement option was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Quay and possible future alignment with Quay 4.

Port of East London Biodiversity Management Plan (2018)

EOH Coastal and Environmental Services developed a Biodiversity Management Plan in 2018. The report set out to establish the baseline for terrestrial (botanical and avifaunal) and estuarine (invertebrate, fish and macrophytic algae) biodiversity and to give an account of the relative condition of different terrestrial ecosystems, habitats and vegetation types within the jurisdiction of the Port. The management plan indicated that the Buffalo River estuary is home to numerous fish species. The estuary is probably also an important spawning and haven for juvenile species.

Assessment of sediment quality in the Port of East London (2019)

CSIR conducted a sediment quality assessment for the Port of East London. The report presents and discusses findings of the physical and chemical analysis of sediment sampled in the Port of East London in August 2019. Findings of this survey indicated that the disposal of sediment dredged in the Port of East London is unlikely to pose a significant ecological risk when it is disposed at the open water dredged material disposal site, even though sediment off the Dry Dock, and to a lesser degree the Victoria Slipway is significantly contaminated. The disposal site is situated in a highly dispersive environment and contaminants that do reach the seabed are likely to be rapidly winnowed and diluted by the prevailing currents. This conclusion is based on the fact that there is virtually no mud in sediment at the dredged material disposal site, and metal concentrations in the sediment are very low.

Port of East London: Repairs (replacement) to quay 3 condition assessment for quay 3 (2020)

The document presents a condition assessment which was done for the Ferry Landing and Quay 3 which are located within the Port of East London. The study indicated that the structures require remedial works to address all the problematic issues found, especially the issues related to water damages.

The preferred development footprint will be kept to what is required for safe and efficient construction and operation of the structures. All repair or replacement solutions shall be designed considering the safety measures, ease of access and environmental considerations particular to the structure type. All repair or replacement quay structures shall be designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance.

The mitigation measures proposed in the specialist reports will be implemented in order to avoid or minimize negative social and environmental impacts. Compliance with the Environmental Authorisation, EMPr and any other permits obtained will be monitored by the appointed ECO on a regular basis.

8. PROJECT ALTERNATIVES

Appendix 2 Sections 2 (1) (h) (i) and (x) Appendix 3 Sections 3 (1) (h) (i) and (ix) of the EIA Regulations, 2014 require that S&EIR processes must identify and describe alternatives to the proposed activity that were considered, or motivation for not considering alternatives. Different types or categories of alternatives can be identified, e.g., location alternatives, type of activity, design or layout alternatives and technology alternatives. Not all categories of alternatives are applicable to all projects. However, the consideration of alternatives is inherent in the detailed design and the identification of mitigation measures, and therefore, alternatives have been and will be taken into account in the design and S&EIR processes.

The identification of alternatives is a key aspect of the success of the environmental scoping phase. All reasonable and feasible alternatives must be identified and screened to determine the most suitable alternatives to consider and assess in the EIA phase. There are, however, some significant constraints that have to be considered when identifying alternatives for a project with this scope. Such constraints include social, financial and environmental issues, which will be discussed as part of the evaluation of the alternatives for this project.

"Alternatives", in relation to a proposed activity, is defined as different means of meeting the general purpose and requirements of the activity, which may include alternatives to; -

a) the property on which or location where it is proposed to undertake the activity;
b) the type of activity to be undertaken;
c) the design or layout of the activity;
d) the technology to be used in the activity;
e) the operational aspects of the activity;

A detailed assessment of alternatives was undertaken during the feasibility study conducted by PRDW (2017) on behalf of Transnet. A copy of this report is included as Appendix D5. It is the EAP's request that this report be accepted by the Department as a written proof of an investigation undertaken and motivation since no reasonable or feasible alternatives exist in terms of Appendix 2.

8.1 Full description of the process followed to reach the proposed preferred alternative within the site

The process followed to reach the preferred alternative may be described as follows:

- Developer provides description of project and proposed site area;
- The preliminary sensitivity of the site area is determined using the National Web Based Screening Tool;
- Verification of site sensitivity is done through visual site assessment;
- Options of how the desired project can be implemented with least disturbance of sensitive areas are considered (i.e. alternatives);
- The feasibility of the options/alternatives presented is assessed, only feasible and reasonable alternatives are considered for impact assessment;
- The potential Impacts that may be caused by the feasible alternatives are identified, inputs from specialist reports and I&APs are taken into consideration in this process;
- The technical justification for the alternatives are also considered;
- An assessment of the significance of the impacts is done using the methodology described in Section **Error! Reference source not found.**;

- The alternative with the lowest (negative) overall combined impact significance score is selected as the preferred alternative.

8.2 Details of Alternatives Considered

8.2.1 Site/Location Alternatives

Location alternatives relate to the main project components as well as the location of ancillary activities and structures (e.g., construction camps, laydown areas, staff accommodation, etc.). The project entails replacement of existing Port infrastructure to deliver the same function as previously. Site alternatives are therefore not applicable. The project is proposed within an existing operational Port in the same location in the Port.

The proposed project will take place at the existing TNPA Port of East London. The proposed site is the only site where replacement can take place because the infrastructure that requires replacement is located there. Therefore, no site alternatives were considered as this is the only site where the proposed project can take place.

The structures will encroach the estuary by 4 m from the existing port and will stretch by approximately 684.34 m, hence, the development footprint of the port or harbour will be increased or expanded by approximately 2500 square metres in total. Although the replacement will increase the development footprint of the port, all the works will occur within the East Bank Multi-Purpose Terminal (MPT). The project site is located within the Port boundary.

Thus, no other property or location alternatives are feasible except for the proposed Site Alternative 1.

8.2.2 Activity alternatives

These are sometimes referred to as project alternatives, although the term activity can be used in a broad sense to embrace policies, plans and programmes as well as projects. Consideration of such alternatives requires a change in the nature of the proposed activity.

The mass concrete gravity Quay Wall 3 was constructed in the 1920's and has since reached an advanced stage of deterioration. The quay has historically been used for berthing and offloading general cargo vessels. The landing collapsed in 2019 and is to be upgraded as part of the Quay 3 Project. The project scope also includes the adjacent Quay 4 to alleviate alignment issues. A FEL 2 prefeasibility study conducted in 2017 (Appendix D5) indicated that the current deterioration of the mass concrete wall was ongoing and likely to get progressively worse. Given the advanced state of deterioration, the ability of the structure to fulfil its functional requirement is uncertain.

The options for rehabilitation of the deteriorating structure were complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. Several options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

The Ferry Landing and interface up to Quay 3 are in poor condition and are a safety concern. These areas must remain fenced off and unloaded and should be made structurally sound as soon as possible. It is recognised that this is only likely to occur as part of a larger project looking at the entire Quay 3 wall.

The results of investigations (PRDW, 2017) undertaken on the Quay 3 concrete structure indicate:

- Large sections of the quay face show evidence of material loss.
- X-ray diffraction analysis and scanning electron microscopy show that the cement had suffered attack by sea water.
- The concrete is in an advanced state of deterioration.
- In addition to the cavities identified in the surface of the quay wall, visual signs of deterioration and inconsistencies were observed in the core samples such as:
    - Softening of the concrete.
    - Decomposition of the cement paste.
    - Formation of voids under the coarse aggregate.
    - Splintering of the coarse aggregate above the cavities.
    - Formations of soft, white gel.
- The concrete deterioration occurs over the full height of the submerged height of the wall, from about 4m below the cap surface to the bottom of the wall.
- The rate of loss of concrete will increase as the structure deteriorates further and the area exposed to seawater increases.
- The investigations have focused on the front face of the wall, but it is probable that similar deterioration has occurred on the buried back face which is also exposed to seawater.

It is not certain how deep into the wall cross section the concrete deterioration has occurred, from the front and back faces, but is highly likely that it is significant given the low concrete strengths (and consequent high permeability), the variability of the concrete matrix, and the length of time that the wall has been in service. It would only be possible to verify the lateral extent of the deterioration by undertaking extensive cores across the width of the structure.

Given the advanced state and probable lateral extent of the deterioration the future time for which the structure is able to fulfil its functional requirement is uncertain. The report is of the view that states concrete of such advanced stage of deterioration has to be considered unsuitable for future use, especially if long term service life extension of the quay wall is required.

A stability analysis has been undertaken (Annexure C) and this shows that the structure has sufficient structural stability for the original geometry and mass of the structure. However, section losses negatively impact the overall stability of the wall and the continual deterioration of the mass concrete will eventually lead to stability issues. The wall was most likely constructed in a series of casts coincident with the steps in the structure width. There should therefore be joints in the structure at the location of the steps which would be rough with a high coefficient of friction due to the in-situ casting method. However, there is the risk that the presence of gel could reduce the coefficient of friction across a joint and this could lead to an unacceptable factor of safety or instability in some cases.

Although there are no obvious signs of stress evident along the structure's capping or back of quay areas, the progressive weakening of the retaining structure could result in a sudden failure of the concrete should cavities be allowed to grow unchecked.

The options for rehabilitation are complicated by the risk of further concrete deterioration, even if the existing structure is clad and protected against direct sea water contact. Even if clad the structure will remain submerged in seawater and deterioration of the concrete will continue.

Figure 6: Example of material loss due to concrete deterioration

Based on the available test and investigation evidence it is PRDW's opinion that one can expect to see evidence of overstressing in the form of localised cracking and significant material losses in the medium term and it is anticipated that the structure will need to be condemned at some stage. The high load areas around the bollard locations are of concern.

8.2.3 Technology alternatives

Technology alternatives imply the investigation of alternative processes or technologies that can be used to achieve the same goal. This includes using environmentally friendly designs or materials and re-using scarce resources like water and non-renewable energy sources. Seven quay wall rehabilitation options have been considered.

In order to focus the engineering effort a Multi Criteria Assessment (MCA) was used to select two options for more engineering development in the FEL 2 study (Appendix D5). The MCA process and results are presented in the next Section.

The options development effort has focused on finding a solution that best meets the following key principles:

- Minimising the capital cost of the rehabilitation construction.
- Future operational conditions and uses of the berth.
- Ease of integration with the existing infrastructure – beneficial use of the existing gravity quay

- Reduction of the overall construction programme.
- Maximising durability of the completed works.
- Effectively increasing the overall functional quay wall length – by including the Ferry Landing
- Allowing execution to be undertaken at appropriate levels of risk.

The options development effort has focused on are listed below:

Option 1 - Do Nothing: Leave the structure as is. TNPA would have to accept that although the structure is currently stable, they may soon be operating a facility that has safety factors below recommended practice and will continue to deteriorate;

Option 2 – Cladding Repair: Install a surface protection cladding to the tidal and submerged wall surfaces similar to the previous repairs carried out on the wall. Cladding of the wall would fill the existing cavities and would therefore assist in restoring the original section geometry and mass. However, the analysis work to date has indicated that the overall stability of the wall is not the major concern but rather the potential for further concrete deterioration resulting in the formation of shear failures through the wall. Cladding may not correct this and may only slightly delay the continuous deterioration of the core concrete;

Option 3 – Caisson: Bury the existing wall behind a new caisson quay structure. To decommission the existing structure and construct a new quay in front of it is the only certain way of guaranteeing the long term functionality of Quay 3. Constructing a new caisson quay wall utilising the East London dry dock to construct and float the caissons is a feasible option. However, the impact of the significant step out of the cope line on the channel width and the effect on the surrounding quay geometries need to be considered carefully. This wall option can be extended past the Ferry Landing and thereby resolve the concerns with that structure;

Option 4 – Counterfort: Bury the existing wall behind a new counterfort quay structure. A counterfort wall is a material efficient gravity structure option, which could also be constructed in the local dry dock and then transported by barge to the placing location. This option has the same step out issues as the other gravity wall types. This wall option can be extended past the Ferry Landing;

Option 5 – Deck-on-Pile: Bury the existing wall behind a new revetment. This option buries the existing wall in a revetment and uses a concrete deck on piles to achieve the required offset for the berth depth to be maintained. Pile options could consider socketing into the rock founding material to achieve the required founding resistance. This quay option can be extended past the Ferry Landing;

Option 6 – Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.

Option 7 – Concrete Sheet Pile: Bury the existing wall behind a new concrete sheet retaining wall. This option is similar to Option 6 but tries to minimise the use of imported materials by developing a concrete retaining wall element, which can be fabricated locally. However, this option may require a modification for areas with sand foundation material. Founding this option on sand requires further design and refinement.

According to the FEL 2 Prefeasibility study, a steel tubular combi-wall is the preferred design solution (option 6) (Technology alternative 1) as it requires only a 4m step-out from the existing cope line; thereby limiting the narrowing of the navigation channel. The proposed solution will also address the collapsed Ferry Landing. Concrete-filled tubular piles are the preferred king piles, with AZ infill sheets between them. Structural stability of the combi-wall will be ensured through the installation of ground anchors to tie back the pile head. The main concern with the concrete sheet pile option is that the high bending moments will require a large section. In the areas with shallow rock the section can be pinned for easy installation. However, when the layer of sediments overlaying the rock is deep then installation of heavy sections will be challenging if not impossible.

8.2.4 Layout and design alternatives

Design and layout alternatives ensure the consideration of different design and spatial configurations of the proposed development on a specific area, to enhance the positive impacts and to reduce the negative impacts. As such applicants are usually asked to give due consideration to the placement, location, and orientation of required infrastructure and activities in relation to site environmental aspects/sensitivities.

The concrete sheet pile option (option 7) attempts to mimic the combi wall concept but using a locally fabricated precast concrete element instead of the imported steel combi sections. The precast concrete element has a 700 mm section and is cast with a central void to facilitate pinning into the rock. The elements will need to include a joint detail to facilitate the installation of a grout or stone sock between elements. This is required to prevent the loss of any retained material and restrict movement between elements.

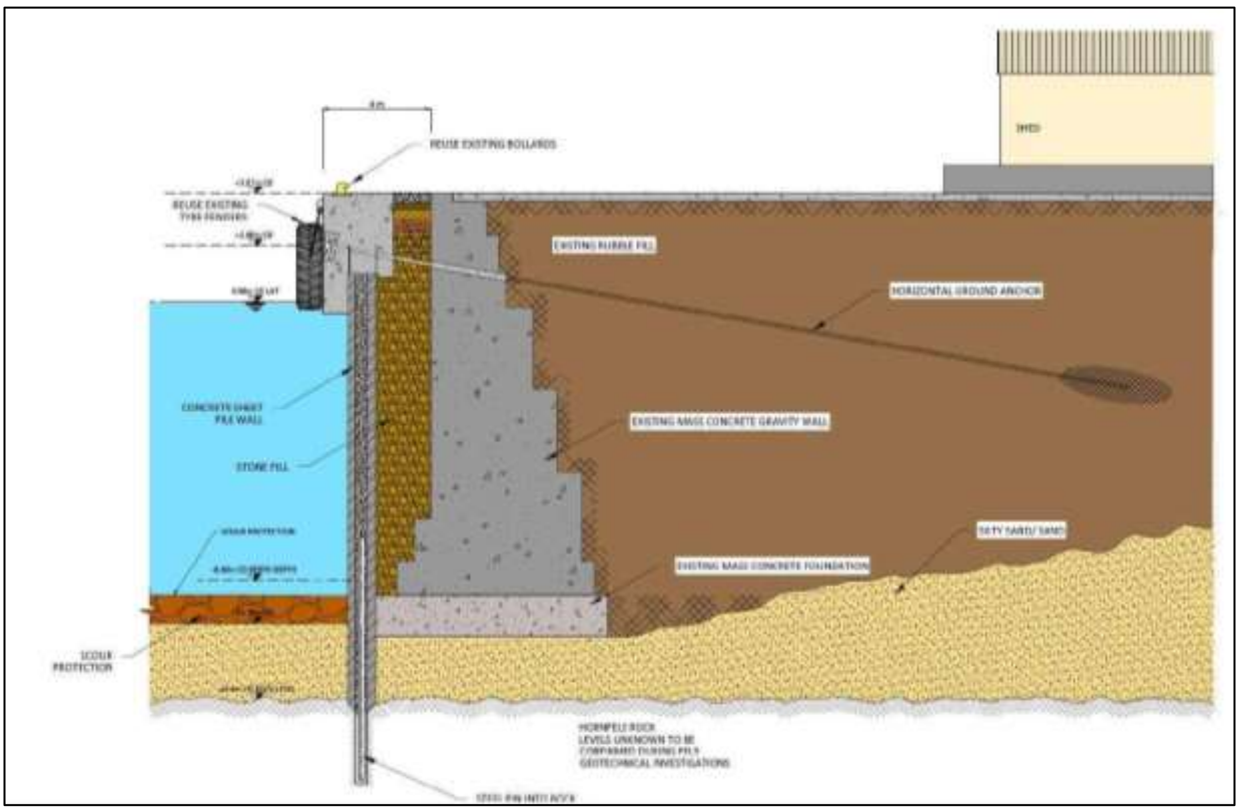


Figure 8: Option 7 -Concrete sheet pile

The Steel Combi Wall structure (preferred design option 6, (Layout alternative 1) has been designed according to EN 1997, Design Approach 1 Combinations 1 and 2, using recommendations from BS6349-2:2010. The piles, and tie rod sections have been verified against structural failure according to the provisions in EN 1993. The selection of a tubular combi-wall section was governed by the installation requirements. The anticipated presence of shallow hard Hornfels layers in the soil profile requires a section that can withstand the high installation stresses resulting from heavy driving and allow for socketing into the hard layers to achieve the required embedment. The combi-wall has been designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance over its design working life.

The focus of the design effort has been to limit the extent of any temporary works, limit the requirement for any dredging and limit the new cope line offset ahead of the existing wall and hence limit the loss of water area in the river.

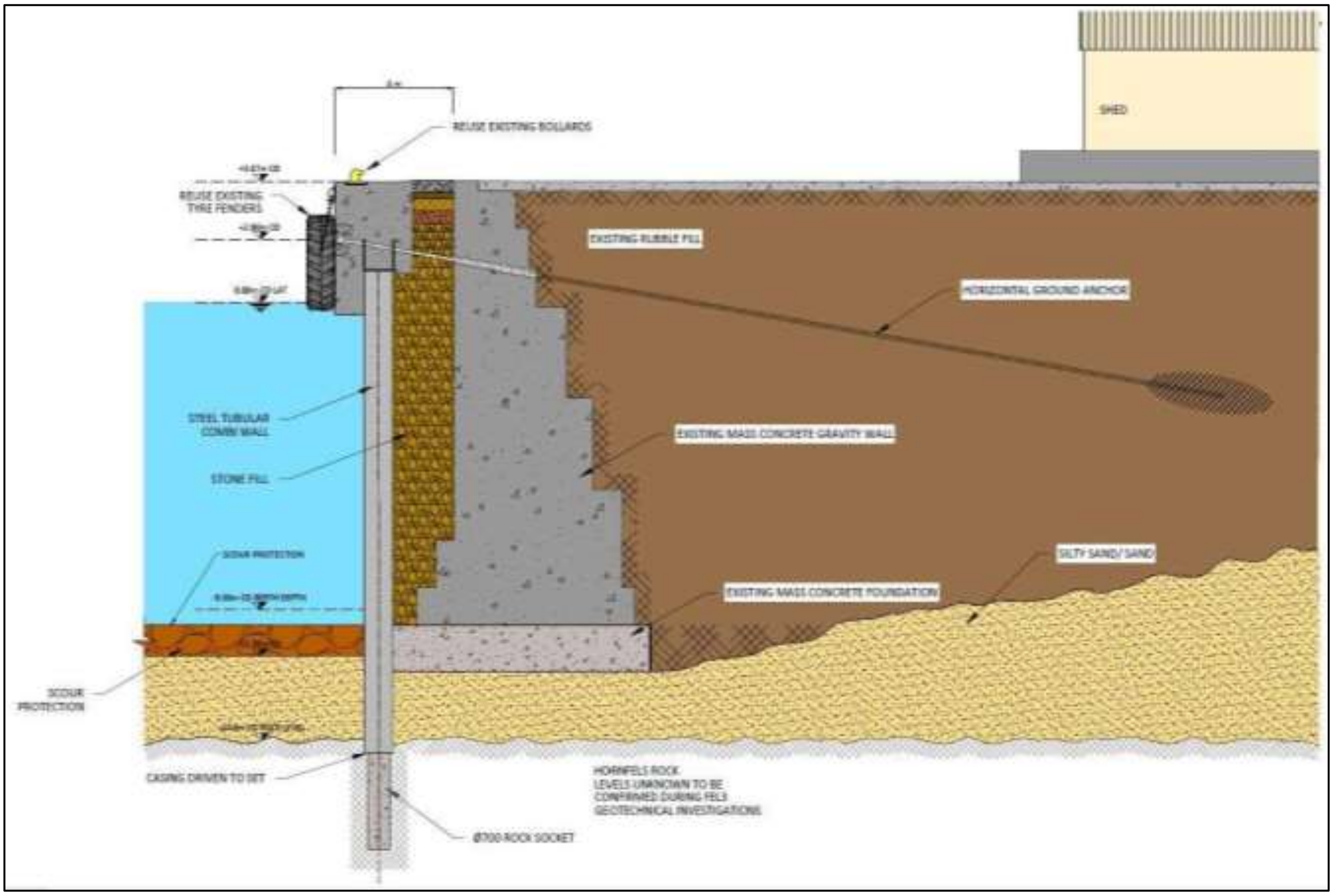


Figure 9: Option 6- Steel Tubular Combi Wall

A high-level options comparison was undertaken to select the most feasible Replacement option.

Table 10: High Level Options Comparison Table (PRDW, 2017)

Rehabilitation Option		Design Life	Option for Ferry Landing	Step out	Geotechnical Concerns	Constructability	Estimated % of materials imported	High Level construction duration	High level construction cost *
01	Do Nothing	< 5 yrs	• Ferry Landing not addressed will require another solution	0 m	None		0 %	0 mo	R 0 mil
02	Cladding Repair	< 10 yrs	• Ferry Landing not addressed will require another solution	< 1 m	None	Extensive diver work, temporary works for cladding application maybe challenging and expensive	0 %	6 - 12 mo	R < 90 mil
03	Caisson	> 50 yrs	• Suitable for entire length	14 m	Based on the performance of the existing gravity structure founding should not be a problem	Construct caissons in dry dock and tow down river to placing location. Standard construction methods	5 %	16 - 20 mo	R 375 mil
04	Counterfort	> 50 yrs	• Suitable for entire length	13 m	Based on the performance of the existing gravity structure founding should not be a problem	Construct counterfort units in dry dock and transport down river to placing location. Standard construction methods	5 %	16 - 20 mo	R 350 mil
05	Deck on Pile	> 50 yrs	• Suitable for entire length	21 m	The piles will need to be socketed or pinned into the bedrock	Install piles off existing quay wall standard construction methods	5 % - provided pile section can be sourced locally	16 - 20 mo	R 375 mil
06	Steel Combi Wall	> 50 yrs	• Suitable for entire length	4 m	The king piles will need to be socketed or pinned into the bedrock. Infill sheets can be driven to top of the rock.	Install piles off existing quay wall. Standard construction methods	55 % - Steel sections not produced locally	18 - 24 mo	R 330 mil
07	Concrete Sheet Pile	> 50 yrs	• May require a modification for areas with sand foundation material	4 m	Founding this option on sand requires further design and refinement	Install precast concrete units off existing quay wall	25 %	18 - 24 mo	R 375 mil

To comprehensively assess the different options individuals in each of the design and TNPA teams undertook separate Multi-Criteria Analysis (MCAs). This allows individuals to subjectively apply weightings and scores. The results for the various\ MCAs were collected and the pattern of preferred options assessed. This method of undertaking an MCA is slightly unusual but provides a result which tests a large range of sensitivities. A summarised version of the MCA results and relative ranking is presented below.

The result summary clearly shows the preference for the Steel Combi Wall solution over all the other options. The concrete sheet pile was consistently the second highest scoring option.

	1. Do Nothing	2. Clad and Patch Repair	3. Caisson	4. Counterfort	5. Deck on Pile	6. Steel Combi Wall	7. Concrete Sheet Pile
MCA #01	660 83%	609 77%	683 86%	682 86%	662 84%	791 100%	717 91%
MCA #02	411 76%	398 74%	479 89%	490 91%	477 89%	539 100%	529 98%
MCA #03	287 77%	235 63%	339 92%	348 94%	328 89%	371 100%	355 96%
MCA #04	372 86%	366 84%	359 83%	376 87%	375 86%	434 100%	398 92%
MCA #05	242 77%	241 77%	284 91%	296 94%	282 90%	314 100%	299 95%
MCA #06	242 84%	249 87%	219 76%	223 77%	257 89%	288 100%	266 92%
MCA #07	312 97%	308 96%	229 71%	234 73%	278 87%	320 100%	291 91%

Figure 10: MCA Results (PRDW, 2017)

The benefits of the steel combi system are summarised below:

- Constructability – suitable for both rock and sand founding material
- Similar design currently under construction in the port
- Simple solution to deal with collapsing Ferry Landing
- Can address the alignment issues with Quay 4
- Limited loss of water area
- Could benefit from utilising the existing wall to reduce earth pressures and thereby reduce section sizes

- Option to raise cope level if required
- Less material intensive that the gravity options
- Shorter construction durations
- Lower construction costs

The benefits of the concrete sheet pile system are summarised below:

- Limited loss of water area
- Could benefit from utilising the existing wall to reduce earth pressures and thereby reduce section sizes
- Option to raise cope level if required
- Less material intensive that the gravity options
- Shorter construction durations
- Lower construction costs

8.2.5 Operational Alternatives

No operational alternatives have been considered in this assessment.

8.2.6 No-go alternative

The no-go option was also considered. This entails leaving the site (infrastructure) in its present state. If the no-go alternative is chosen, this means no replacement of the quay walls and ferry landing will be undertaken. As explained in section 6 of this report, there is a need for this replacement because the infrastructure has served well beyond their respective design lives. The Ferry Landing site in its current state is unsafe since the embankment is supported by a collapsed and eroded steel sheet pile wall and a collapsed coping beam. Should both the cope beam and steel sheet pile fail, the entire embankment will slip and cause further damage to surrounding infrastructure. Therefore, the no-go alternative cannot be considered.

8.3 SUMMARY OF ALTERNATIVES

Table 11: Assessment of alternatives

Alternative level	Alternatives	Advantages	Disadvantages	Reasonable and feasible	Further assessment	Comment
Property or Location	Site Alternative 1	Proposed replacement is within the existing Port of EL. Property is owned by applicant and is already disturbed.	Minimum space for laydown areas during construction	YES	YES	
Type of Activity	Alternative 1- Only activity alternative.	To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future.	Construction phase of the project will lead to temporary disturbance of the current land uses, deterioration of water quality due to sedimentation and negative impact on aquatic animal and plant species.	YES	YES	
Layout	Layout Alternative 1	The Steel Combi Wall structure (preferred design option 6) has been designed according to EN 1997, Design Approach 1 Combinations 1 and 2, using recommendations from BS6349-2:2010. The piles, and tie rod sections have been verified against structural failure according to the provisions in EN 1993. The selection of a tubular combi-wall section was governed by the installation requirements. The anticipated presence of shallow hard Hornfels layers in the soil profile requires a section that can withstand	55 % - Steel sections not produced locally	YES	YES	

Alternative level	Alternatives	Advantages	Disadvantages	Reasonable and feasible	Further assessment	Comment
		the high installation stresses resulting from heavy driving and allow for socketing into the hard layers to achieve the required embedment. The combi-wall has been designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance over its design working life.				
Technology	Technology Alternative 1	Option 6 – Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.	55 % - Steel sections not produced locally	YES	YES	
Operational	N/A	N/A	N/A	NO	NO	
No-Go Alternative Mandatory to consider the option of not implementing the project	No replacement of quay wall 3 and 4 and ferry landing.	No disturbance of the environment	-Safety risk to current activities -Loss of income when Quay is decommissioned -No job creation	YES	YES	

8.4 ALTERNATIVES TO BE ASSESSED

The removal of the non-feasible alternatives listed above leaves FOUR (4) alternatives applicable to the proposed project:

- Site Alternative 1;
- Layout Alternative 1;
- Technology Alternative 1;
- No-Go Option (land and sea to remain unaltered).

The Environmental Impact Assessment will therefore only consider these alternatives.

9. PUBLIC PARTICIPATION

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 were undertaken, 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 competent authority and Transnet Port of East London in making decisions regarding implementation of the proposed project. The environmental assessment was undertaken in compliance with the NEMA, specifically EIA Regulations GNR No. 324, 325 of 2014 as amended. Cognisance was also taken of related guideline documents and other relevant legislation.

Public participation is an integral part of the environmental assessment process and affords potentially interested and affected parties (I&APs) an opportunity to participate in the EIA process, or to comment on any aspect of the development proposals. The public participation process to be undertaken for this project complies with the requirements of the EIA Regulations. The description of the public participation process as included below itemizes the steps and actions undertaken to date and as appropriate at this stage of the project. The objectives of the PPP are also outlined below.

The primary objectives of the public participation process are to:

- Inform and notify potentially I&APs of the proposed application (explain steps that were taken to achieve this);
- Initiate or promote meaningful and timeous participation of I&APs by providing proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed, or given;
- Maintain a list of all persons, organization and organs of state that were registered as interested and affected parties in relation to the application;
- Identify issues and concerns of key stakeholders and I&APs with regards to the application for the proposed project;
- Provide a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues; and
- Provide responses to I &AP's queries.

The overall aim of the PPP is to ensure that all Interested and Affected Parties (IAPs) have adequate opportunities to provide input into the process. More specifically, the objectives of the PPP are as follows:

- Identify IAPs and notify them of the proposed project and of the EIA process;
- Provide an opportunity for IAPs to raise issues and concerns; and
- Provide an opportunity for IAPs to review all reports generated in the EIA process.

9.1 IDENTIFICATION AND REGISTRATION OF KEY DEPARTMENTS AND OTHER I&APs

An initial I&AP list was compiled using records from previous studies undertaken to determine the contact details of government officials and traditional authorities. Landowners were identified using windeed searches and through consultation with known landowners. The I&AP database was compiled containing the following categories of stakeholders:

- The competent authority
- Directly impacted landowners/occupiers
- Adjacent landowners/occupiers
- Relevant organs of state departments
- Municipalities
- Ward councilors and other key stakeholders.

Registered I&APS have been kept abreast of the application and Scoping process and received notification when there is opportunity to provide comment.

Table 12: Key stakeholders

I&AP Category	Name	Organisation	Email
Competent Authority	Ms Juliet Mahlangu	Department of Forestry, Fisheries and the Environment	JMMahlangu@environment.gov.za
	Ms Judy Beaumont	Department of Forestry, Fisheries and the Environment	jbeaumont@environment.gov.za
	Ms Makhosi Yeni	Department of Forestry, Fisheries and the Environment	Myeni@dffe.gov.za
	Ms Olivia Letlalo	Department of Forestry, Fisheries and the Environment	OLetlalo@dffe.gov.za
	Mr Mahlatse Shubane	Department of Forestry, Fisheries and the Environment	MSHUBANE@dffe.gov.za
	Mr Kevin Mathebula	Department Of Forestry, Fisheries & the Environment Regulatory, Compliance And Sector Performance Integrated Environmental Authorisations: Priority Infrastructure Authorisation	kmathebula@dffe.gov.za
	Mr Khorommbi Matibe	Department of Environmental Affairs: Biodiversity and Conservation	kmatibe@dffe.gov.za
	Mr Peter Lukey	Department of Environmental Affairs: Climate Change and Air Quality	plukey@environment.gov.za
	Mr Luvuyo Mlilo	Department of Environmental Affairs: Environmental Programmes	lmlilo@dffe.gov.za
	Ms Mashudu Mudau	Department of Forestry, Fisheries and the Environment: Biodiversity Conservation	mamudau@dffe.gov.za
	Mr Seoka Lekota	Department of Forestry, Fisheries and the Environment: Biodiversity Conservation	BCAdmin@dffe.gov.za
	Ms Portia Makitla	Department of Forestry, Fisheries and the Environment: Biodiversity Conservation	pmakitla@dffe.gov.za
	Ms Thandeka Mbambo	Department of Forestry, Fisheries and the Environment: Oceans & Coasts: Coastal Development & Protection	TMbambo@dffe.gov.za
	Mr Simphiwe Dlamini	South African National Defence Force	siphiwe.dlamini@dod.mil.za

I&AP Category	Name	Organisation	Email
	Ms Tabisile Mahlana	Department of Forestry, Fisheries and the Environment: Oceans & Coasts: Coastal Development & Protection	tmhlana@dffe.gov.za
	Ms Siphesihle Tasana	Department of Forestry, Fisheries and the Environment: Oceans & Coasts: Coastal Development & Protection	STasana@dffe.gov.za
	Ms Yvonne Mokadi	Dept of Forestry, Fisheries and the Environment: Estuaries Management	ymokadi@dffe.gov.za
	Mr Bonke Bangani	Dept of Forestry, Fisheries and the Environment: Estuaries Management	bbangani@dffe.gov.za
	Ms Jessica Mans	Dept of Forestry, Fisheries and the Environment: Estuaries Management	jmans@dffe.gov.za
Provincial Government	Mr Div de Villiers	Department of Economic Development Environmental Affairs and Tourism	Div.DeVilliers@dedea.gov.za
	Ms Natasha Higgit	SAHRA	nhiggitt@sahra.org.za
	Mr Siyabonga	Gqalangile	Siyabonga.Gqalangile@dedea.gov.za
	Mrs Hlomela Hanise	Department of Economic Development Environmental Affairs and Tourism	Hlomela.Hanise@dedea.gov.za
	Ms Lungiswa Mzazi	ECPHRA	lmzazi@ecphra.org.za
	Ms Africa Maxongo	ECPHRA	africam@ecphra.org.za
	Mr Selo Mokhanya	ECPHRA	smokhanya@ecphra.org.za
	Mr Olwethu Vongwe	Department of Water and Sanitation	vongweo@dws.gov.za
	Ms Rachel Rambani	Department of Water and Sanitation	rambanir@dws.gov.za
	Mr Lonwabo Mini	Department of Water and Sanitation	MiniL@dws.gov.za
	Ms Nqabisa Ngwentshe	Department of Water and Sanitation	gwentshen@ds.gov.za

I&AP Category	Name	Organisation	Email
	Dr Siviwe Shwababa	Department of Agriculture, Land Reform and Rural Development	Siviwe.Shwababa@dalrrd.gov.za
	Ms Dorothy Jagers	Department of Forestry, Fisheries and the Environment	DJagers@dffe.gov.za
	Mr Thobani Vetsheza	Department of Forestry, Fisheries and the Environment	tvetsheza@dffe.gov.za
	Ms Phumza Mathumba	Department of Agriculture, Land Reform and Rural Development	phumza.mathumba@drdlr.gov.za
	Mr Zibule Bolana	Department of Agriculture, Land Reform and Rural Development	Zibule.Bolana@dalrrd.gov.za
	Mr Andile Mbarane	Department of Human Settlements	andilembarane@yahoo.com
Local Government	Ms Jane Gallo	Buffalo City Metropolitan Municipality	janeg@buffalocity.gov.za
	Mr Raymond Foster	Buffalo City Metropolitan Municipality	raymondf@buffalocity.gov.za
	Ms Funeka Wolose	BCMM Ward 47	funekaW@buffalocity.gov.za
Directly impacted landowners/occupiers	Ms Renee DeKlerk	Transnet SOC Ltd	Renee.DeKlerk@transnet.net
	Mr Nelson Mbatha	Transnet SOC Ltd	nelson.mbatha@transnet.net
	Mr Willie Zietsman	Transnet Property	Willie.zietsman@transnet.Net
	Ms Zukiswa Duze	Transnet SOC Ltd	Zukiswa.duze@transnet.net
	Ms Nontobeko Funde	Transnet SOC Ltd	Nontobeko.funde@transnet.net
Conservation	East London Office	South African Maritime Safety Authority	elreception@samsa.org.za
	Mr Mzwandile Mjadu	South African National Parks	Mzwandile.Mjadu@sanparks.org.za
	Mr R. Adams	WWF SA	Radams@wwf.org.za
	Ms Kirsten Day	Bird Life	kirsten.day@birdlife.org.za
	Dr Tommy Bornman	SAEON	tommy@saeon.ac.za
LOCAL BUSINESS AND INDUSRTY		East London Industrial Development Zone (ELIDZ)	info@elidz.co.za
		The Association of Ships' Agents and Brokers of Southern Africa (ASABOSA)	www.asabosa-asl.co.za

I&AP Category	Name	Organisation	Email
		South African Association of Ship Operators and Agents (SAAOA)	secretary@saasoa.com
		Border Kei Chamber of Business	communications@bkcob.co.za
		Mercedes Benz South Africa	webmails.southafrica@cac.mercedes-benz.com
Recreational Users	Yachting	East London Yacht Club	info@elyc.co.za
	Ms Kate Godlyn	Buffalo Rowing Club	kate@godlyn.co.za
I&APs	Ms Sharnae Hopewell	GIBB	shopewell@gibb.co.za
	Ms Mellina Koopman	Law Explorer	Mellina@lawexplorer.co.za

9.2 Notification of I&APs

The principles of NEMA govern many aspects of the Scoping and EIA process, including consultation with Interested and Affected Parties (I&APs). These principles include the provision of sufficient and transparent information flow to I&APs on an ongoing basis, to allow them to comment; and ensuring the participation of historically disadvantaged individuals, including women, the disabled and the youth throughout the process.

The I&AP database will be updated throughout the Scoping and EIA process and new participants register on the project. All I&APs who register will be included within this database and included in project related correspondence going forward.

All potential I&APs are afforded the opportunity to register for the project. All registered I&APs will be informed of further activities regarding the project.

9.3 Public Announcement of the Project

The following means of public engagement were made:

- Electronic notification of stakeholders via email
- Publication of media advertisement
- On-site notices were placed, detailing the proposed development, the Scoping and EIA process, and an invitation to register and comment.
- Notices were placed at strategic places on site and in the vicinity of the site (along the road, at intersections, etc.) as well as at high frequented places within the area; and
- Distribution of letters by email and post to I&APs and telephonic calls.

During the Scoping phase of this project, the key objective of public participation is to provide I&APs with an opportunity to provide comment and input in the planning phase of the project. Issues of concern and suggestions raised by I&APs have been addressed and responded to as required in the Scoping Report, and I&APs will also be given the opportunity to comment on the findings of both the Scoping and EIA Reports and findings of the Specialist studies during the specified comment periods. I&APs were provided with a 14-day comment period in which to raise issues and / or concerns in response to the Background Information Document.

A draft Scoping Report (dSR) was compiled and made available for public comment for a period of 30 days, where after the Final Scoping Report (FSR) including Comments and Responses from the public was submitted to the Competent Authority, DFFE during April 2023. On 06 June 2023, the DFFE accepted the FSR and confirmed that the project may proceed to the Impact Assessment Phase.

This Draft Environmental Impact Report (DEIR) will be made available for a 30 day comment period during July 2023. Thereafter the Final Environmental Impact Report (FEIR), together with all comments and responses from the public will be submitted to DFFE for decision. I&APs will be notified in writing of any decisions made by DFFE after submission of the FEIR. Please note that communications regarding the process and the availability of reports will only be sent to registered I&APs.

9.4 Public meetings

Two public meetings were held during the scoping phase, one face-to-face with some of the key stakeholders if possible as well as a virtual meeting. The meetings were held in line with COVID-19 protocols and safety precautions. To limit exposure to COVID-19, all relevant documentation regarding the proposed application was made available on the public venues with a register for comments and responses, Abantu Environmental Consultants website (www.abantuenvironmental.co.za) as well as electronically on request.

The EIA phase public meetings will be communicated to all registered I&APs, it is anticipated that these will take place during July-August 2023.

9.5 Summary of Comments Received

Please refer to the Comments and Responses Report in Appendix B-5 for a full account of comments and responses as well as copies of all correspondences between the EAP and I&APs. They key issues that were raised during the public review period of the Draft Scoping Report can be summarized as follows:

- Registration of IAPs
- Acknowledgement of receipt of EA application
- Request for Site Inspection
- Support of the proposed project
- Request for clarification regarding project description, application form and listed activities, alternatives and layout maps
- Recommendation to include additional key stakeholders in public participation process
- Content of Specialist Assessment Reports
- Specialist studies required by the Screening Tool
- General
- Request For Extension of Timeframes
- Comments from Oceans & Coasts branch
- Environmental and social impacts
- Comments from Biodiversity Conservation Directorate
- Significance of impacts in sensitive areas after mitigation
- Contact details for distribution of Public Participation Process documents

9.6 Availability of the EIA report

As per the requirements of Regulation 43 of GN R982 of 2014 as amended, the Draft EIA Report will be made available for a 30-day commenting period. Printed copies of this report will be available for viewing at:

- The Ward Committee Chairman's office;
- The report can also be accessed as an electronic copy on Abantu Environmental Consultants website (https://abantuenvironmental.co.za/company-projects/) under the Projects Tab.

Comments will be submitted in writing by post, or email to:

Abantu Environmental Consultants

10 Liddiard Street, Saxilby

Amalinda

5247

Email: EL-EIA@abantuenvironmental.co.za

Attention: Zona Quvile

The commenting period on the Draft EIAR will be specified.

9.7 DECISION AND APPEAL PERIOD

Once DEDEAT has reviewed the final EIA/EMPr report and is satisfied that it contains sufficient information to make an informed decision, they will use the information contained within the final EIA/EMPr report to determine the environmental acceptability of the applicant's preferred options. A decision on the applications and associated reports will be made by the DFFE based on the findings of the EIR.

Following the issuing of the decision, I&APS will be notified via email, or post. All I&APs will be provided with the opportunity to appeal the decision to the Minister in terms of the NEMA. Registered I&APs will be informed of the appeals process and the associated timeframes.

10. DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the biophysical and socio-economic environment that may influence or be affected by the development while establishing the baseline conditions of the site. This includes information obtained from literature sources and specialist studies (where applicable) and is described at a level deemed appropriate for an EIA study. A summary of the affected environment is provided. The three components to the environment are recognised as:

- Physical Environment;
- Biological Environment; and
- Socio-Economic Environment.

Only those elements of the environment considered to have a bearing on the project are discussed.

10.1 PHYSICAL ENVIRONMENT

10.1.1 Climate

East London has a borderline humid subtropical climate, with the warm temperatures and moderation typical of the South African coastline. Although it has no true dry season, there is a drying trend in the winter, with the wettest times of year being "spring" and "autumn". There is also a shorter and lesser dry period in December and January. The all-time record low is 3 °C (37.4 °F), and the all-time record high is 42 °C (107.6 °F). Although temperatures have never dropped below freezing since records began, East London has recorded snowfall in 1985 and 1989 (Eastern Cape Department of Health, 2021).

Temperatures are high in summer and relatively mild during the winter months (Figure 11). Evaporation is extremely high due to the strong coastal winds and high humidity index and the evaporation rate exceeds the mean annual rainfall. The warmest month is March with an average maximum temperature of 25°C. The coldest month is August with an average maximum temperature of 20°C. November is the most wet month. June is the driest month. December is the sunniest month. The mean annual rainfall is in the region of 900 mm pa (Figure 12). On average, the most wind is seen in September and the least wind is seen in January (Figure 13).

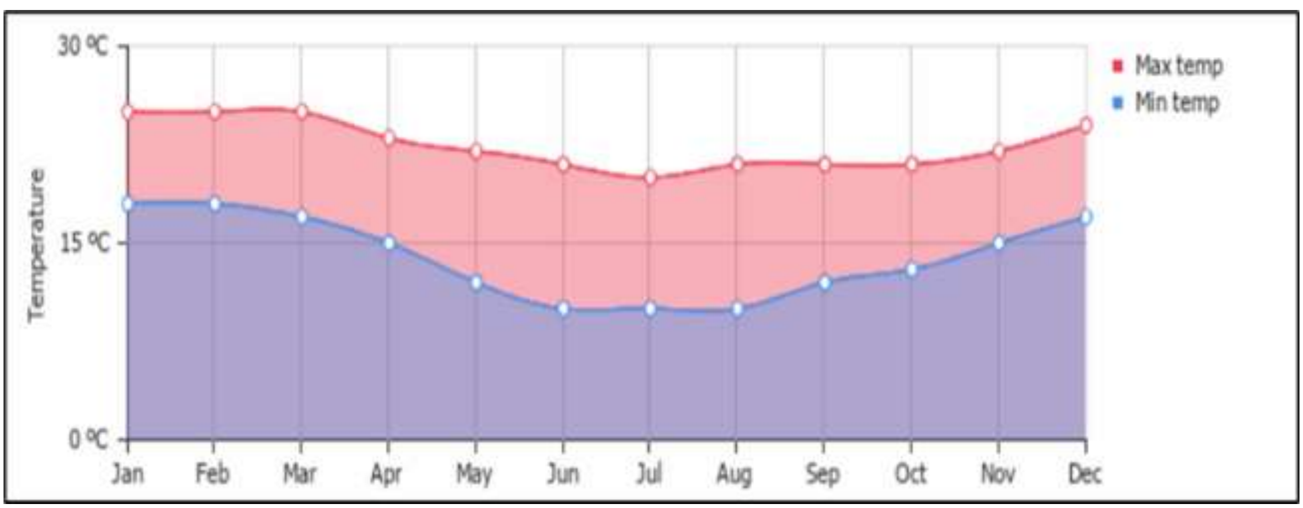


Figure 11: Average temperatures

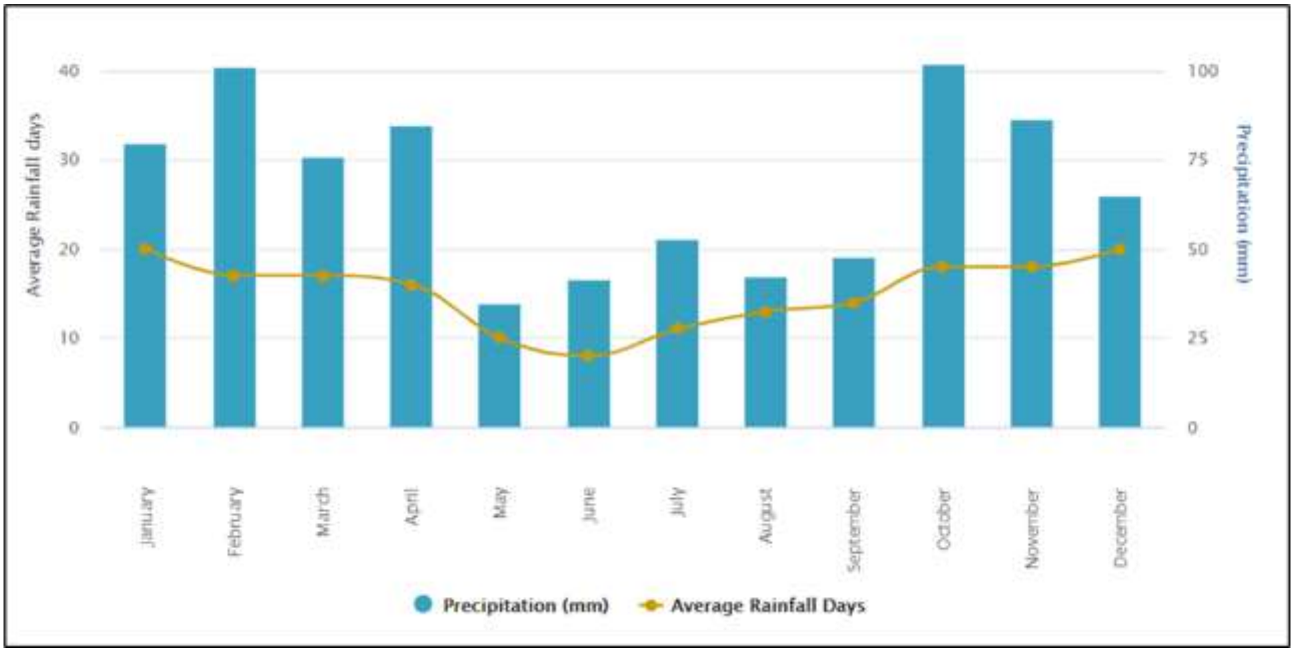


Figure 12: Average rainfall

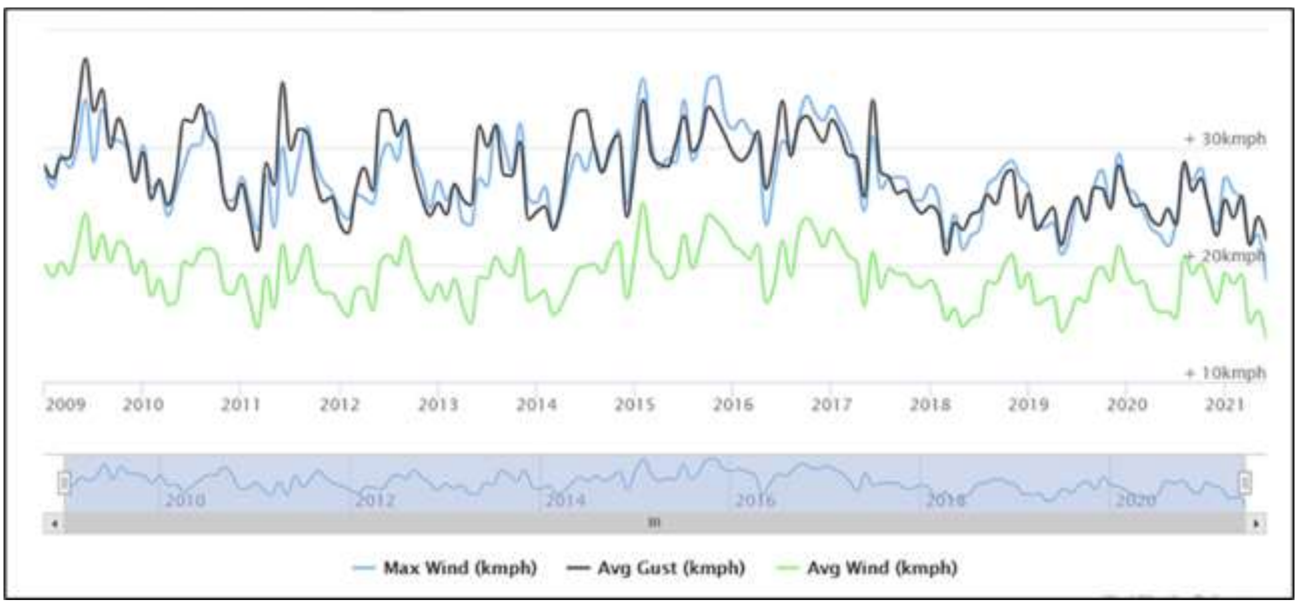


Figure 13: Maximum and average wind speed and wind gust

10.1.2 Tides and Currents

According to CSIR (2023) Estuarine Ecology Specialist Study (Appendix D1), tides in the East London area are semi-diurnal microtidal with a dominant M_2 tide, that is, there are two high tides and two low tides within an approximately 25 hr period. The tidal period is 12 hrs and 25 min, with a slight diurnal inequality (Schumann *et al*., 1996). The Mean High Water Spring tide is +1.82 m relative to Chart Datum, Mean Low Water Spring tide is +0.23 relative to Chart Datum, and the Highest Astronomical Tide is +2.08 relative to Chart Datum. The time of the low and high tide in the estuary will lag that in the sea.

The CSIR (CSIR, 1996) measured currents at a point in the entrance to the Buffalo River estuary over an approximately three-month period. The water column at the measurement area was 13 m, with the current meter about 2 m off the bottom. The current velocity was relatively low, ranging from about 1-19 $cm.s^{-1}$ and with an average velocity of only 5 $cm.s^{-1}$. The tide, as expected, exerted a strong influence on the current velocity.

10.1.3 Bathymetry and substrate

The bathymetry of the port area of the Buffalo River estuary is kept fairly constant through maintenance dredging to ensure safe navigation conditions for vessels. The depth alongside berths ranges between ~8.1 - 10.4 m and is ~9.1 - 9.5 m alongside Quay 3 and ~8.1 m alongside Quay 4. The area upstream of the port shallows quickly and in areas surveyed above the Steve Biko Bridge by the CSIR the water column is only a few meters deep (tidally dependent). As also discussed above the lower part of the estuary, extending from the mouth to ~2 km upstream, comprises the Port of East London (Figure 1). There are no estuarine banks *per se* in this part of the estuary as the banks are given over to port infrastructure, such as quay walls, slipways, armoured shorelines, and breakwaters. The intertidal in the port area is thus dominated by hard infrastructure. The bottom substrate in the port area, and indeed in the greater estuary area that has been surveyed to date is largely 'soft' in type, that is, it is comprised of unconsolidated sediment. In some parts of the port area, most notably near T Berth near the estuary mouth the substrate is a mix of sediment and stone, and there may possibly even be low relief reef in this area based on some organisms recently (August 2022) retrieved in grabs by CSIR scientists. The intertidal banks of the estuary upstream of the port area are generally rocky, and as stated previously unlike many South African estuaries there are no extensive intertidal sand and mudflats, or saltmarshes in the estuary (CSIR (2023) Estuarine Ecology Specialist Study).

10.1.4 Water quality

Transnet National Ports Authority has commissioned a Long-Term Ecological Monitoring Programme for the Port of East London. The water quality component of the monitoring programme has generated sufficient data to allow a good description of the main physical, chemical, and biological properties of the water column in the estuary. The discussion below is based on water quality measurements made for the monitoring programme between 2015-2019 (CSIR 2016, 2017, 2018, 2019, 2020). Water quality surveys were made in summer and winter each year. The temperature, salinity, pH, dissolved oxygen concentration, turbidity, and chlorophyll-a concentration was measured in situ using an automated water quality monitoring instrument. Other water quality indicators were measured in surface water samples returned to the laboratory for analysis, including faecal indicator bacteria, salinity, pH, and total suspended solids, nutrient and metal concentrations. The Long-Term Ecological Monitoring Programme has generated a large amount of data.

The findings for numerous of the water quality indicators analysed for the Long-Term Ecological Monitoring Programme for the Port of East London were included in an index to classify water quality in the port/estuary for the period 2015-2019. Water quality according to the index was variable in summer and winter across years, but was usually classified fair, marginal, or poor. The classifications were usually driven by high nutrient and/or faecal indicator bacteria counts, but periodically high values/concentrations for other indicators also contributed to the classification.

10.1.5 Sediment quality

The total organic content is a measure of the amount of particulate organic matter present in sediment. The organic matter may come from natural sources, such as the decomposing remains of plants and animals, or from anthropogenic sources, such as wastewater. Particulate organic matter is an important food source for many animals, such as benthic invertebrates that live in and on sediment (the infauna and epifauna respectively). If the mass-loading of particulate organic matter in sediment exceeds the rate at which it can be consumed by benthic invertebrate infauna and epifauna or degraded by bacteria, this can lead to the development of very low dissolved oxygen concentrations (hypoxia) or in extreme cases the lack of oxygen (anoxia) in sediment porewater (*i.e.* water between grains of sediment) and at the sediment-water interface. The depletion of dissolved oxygen usually comes about by bacteria that decompose particulate organic matter proliferating to such a degree they consume oxygen in the water at a rate faster than it can be replenished. As the dissolved oxygen concentration falls certain bacteria begin to reduce sulphate from the water column to fuel their metabolism, producing hydrogen sulphide as a by-product. Hydrogen sulphide is toxic to most forms of aquatic life at moderate to high concentrations. However, some bottom-dwelling invertebrates (*e.g.* capitellid polychaetes) thrive under, and their increased abundance is commonly used as an indicator of these conditions (*e.g.* Tomassetti *et al*., 2016). As the input of particulate organic matter increases from natural to moderate levels the presence of these species demonstrates the transition from an oxic to hypoxic state. As the degree of particulate organic matter accumulation increases further, even sulphide-tolerant invertebrates are unable to survive and the sediment becomes progressively lifeless, until only single celled organisms such as protozoa, ciliates, and flagellates that can live in sulphide-rich sediment remain (Fenchel and Riedl, 1970). This results in the severe disruption of sediment-dwelling communities, with ripple-like impacts through an aquatic ecosystem (Pearson and Rosenberg, 1978; Diaz and Rosenberg, 1995; Gray *et al*., 2002). The total organic content of sediment thus provides important information towards understanding factors that might influence the structure and composition of benthic biological communities.

Many types of anthropogenic chemicals tend to accumulate in sediment rather than remain in solution in the water column. As a result, the concentrations of contaminants in sediment are usually several orders of magnitude higher in sediment than in the water column. If there is continued input, the concentrations of chemicals in sediment may eventually reach a state where they become toxic to sediment-dwelling organisms. Numerous studies on metal concentrations in sediment in the Buffalo River estuary have been performed in the last 20 years. The findings of some studies on metals were not considered as they were performed so long ago the findings no longer reflect the contemporary situation (*e.g.* Watling *et al*., 1983; Talbot *et al*., 1985) or the findings support those of the studies discussed below and do not thus warrant further consideration (*e.g*. Fatoki and Mathabatha, 2000). The most recent survey was performed by the CSIR in August 2022 (CSIR, unpublished data). Sediment was sampled at 14 stations in the estuary, including alongside the Ferry Landing, Quay 3, and Quay 4. The sediment was analysed for its grain size, total organic content, and the concentrations of 15 metals. The toxicity of the sediment was also tested using the sea urchin embryo-larvae test under a sediment-water interface testing regime.

The number of metals that were enriched in sediment at each of 14 stations sampled in the Buffalo River estuary in August 2022 are provided in Figure 28. The Enrichment Factors for individual metals in the sediment. The sediment sampled at six of the 14 stations was found to be metal enriched. The highest number of metals at an enriched concentration was found in sediment sampled at Station 3 near the Dry Dock, followed by sediment sampled at Station 7 off the Victoria Slipway. No metals were enriched in sediment alongside the Ferry Landing, Quay 3, and Quay 4. These findings can be compared to the findings of studies on metal concentrations in sediment sampled nearly annually between 2012-2021 in the Buffalo River estuary for maintenance dredging permit applications. As is evident, the sediment at many stations was metal enriched at some point during the period 2012-2021. Sediment near the yacht mole, near the Dry Dock, and near Victoria Slipway was often enriched by metals, but only in the case of sediment near the Dry Dock and Victoria Slipway was the enrichment of a significant magnitude. There are clearly anthropogenic sources of metals in these areas. The source in the case of the Dry Dock is obvious. In most surveys the sediment across most of the estuary was either not enriched by metals, or when it was the enrichment was of a low magnitude. The sediment near the Ferry Landing, Quay 3, and Quay 4, was periodically enriched by metals, but almost always to a very low magnitude.

The Department of Forestry, Fisheries and the Environment has defined sediment quality guidelines that it uses to decide if sediment identified for dredging in South African ports is suitable for open water disposal. However, there are only guidelines for metals. There are three guidelines, known as the Warning Level, Level I and Level II. The Warning Level provides a warning of incipient metal contamination but is not used for decision-making. Sediment with metals at a concentration below the Level I is considered suitable for open water disposal. Sediment with metals at a concentration between the Level I and Level II is considered cause for concern, with the degree of concern increasing as the concentrations approach the Level II. Further testing may be requested to determine if metals in the sediment pose a toxic risk to sediment-dwelling organisms, but in practice this has not been implemented. Sediment with metals at a concentration exceeding the Level II is considered unsuitable for open water disposal unless other evidence (*e.g.* toxicity testing) shows the metals are not toxic to sediment-dwelling organisms due, for example, to the metals being present in metal flecks or metal-impregnated paint flakes and the entire concentration thus not being in a bioavailable form.

The copper, chromium, lead, and zinc concentrations in sediment sampled at Station 3 near the Dry Dock in the Buffalo River estuary in July 2022 exceeded the Warning Level. The copper concentration in the sediment at this station also exceeded the Level I. No metal concentrations exceeded the Level II. The implication is there was a low probability metals in sediment in the Buffalo River estuary at the time were adversely affecting sediment-dwelling organisms through direct toxic effects. Sediment dredged in the estuary is thus suitable for open water disposal. Metal concentrations in sediment sampled in the estuary for annual maintenance dredged permit applications between 2012-2021 provide a point for comparison. Metal concentrations in sediment at five stations exceeded the Warning Level of the sediment quality guidelines used by the Department of Forestry, Fisheries and the Environment. However, only at Station E1 near the Dry Dock did metal concentrations exceed the Level I or Level II, and only in two instances in the latter case. The sediment is thus considered suitable for open water disposal apart occasionally for Station 1 near the Dry Dock. However, in the latter case the metal contamination probably reflects the inclusion of metal enriched antifouling coating flakes lost from vessels when they are repaired in the dock.

The South African sediment quality guidelines do not provide guidelines for chemicals other than metals. The concentrations of organic chemicals must thus be compared to guidelines used elsewhere in the world. The sediment quality guidelines are like the South African guidelines in that they also define two guidelines, which have a similar narrative intent as the South African Level I and Level II in the context of estimating the likelihood of toxic effects to sediment-dwelling organisms. The polycyclic aromatic hydrocarbon, pesticide, and polychlorinated biphenyl concentrations in some surveys exceeded the lower of two sediment quality guidelines commonly used to assess the potential toxicological significance of these chemicals in sediment in North American coastal waters but were well below the upper guideline. The tributyltin concentration in sediment sampled near the Dry Dock exceeded the lower, and occasionally the upper of two sediment quality guidelines used to assess the potential toxicological significance of these chemicals in sediment in parts of Europe. The comparison of organic chemical concentrations to sediment quality guidelines thus suggests a possibility for toxic effects to sediment-dwelling organisms.

The concentrations of chemicals in sediment are not a good predictor of toxic effects to sediment-dwelling organisms because contaminants can be complexed to various phases in sediment to a degree that this essentially renders them non-bioavailable and thus unable to exert a toxic effect. It is for this reason that the sediment sampled in the Buffalo River estuary in August 2022 was tested for toxicity to sea urchin embryo-larvae, using a sediment-water interface testing regime. The sediment sampled at Stations 1 and 2 upstream of the Steve Biko Bridge was highly toxic, while that sampled at Station 3 near the Dry Dock was marginally toxic. The sediment sampled at seven other stations, including alongside the Ferry Landing, Quay 3, and Quay 4, was non-toxic. The sediment sampled at Stations 1 and 2 was periodically contaminated by metals and organic chemicals, but never severely. Although contaminants in the sediment might have contributed to the toxicity, a more likely explanation is that hydrogen sulphide in the sediment was responsible for the toxicity. A stated previously, the sediment at these stations is anoxic and this has led to sulphate reducing bacteria in the sediment using anaerobic respiration to meet their energy requirements. In the process they produce hydrogen sulphide, which is toxic at moderate concentrations to most aquatic organisms.

10.1.6 Geology and Soils

The published 1:250 000 Geological Map of Grahamstown shows that the proposed site area is underlain by grey and red Mudstone, Sandstone of the Beaufort Group, Karoo Sequence. Post-Karoo dolerite dykes and sills intrusive into the mudrock and the sandstone layers are common to the general area. The mudstones alternate with sandstone units and vary in thickness from less than a metre to tens of metres The sandstone units consist of grey, fine grained quartz feldspathic sandstone. The sandstones commonly display flat-bedding, cross bedding and micro cross-lamination while the mudstone is usually poorly stratified of massive. On site the contact metamorphism resulting from dolerite intrusions has affected both the sandstone as well as the mudstone imparting a fine-grained glassy nature to the rock. The area is classified as having a climatic N-value of 1.6, which indicates that chemical weathering (decomposition) is predominant. As a general rule this further implies that residual soils with deep profiles might be expected (Aurecon, 2014).

According to *The Geological Map of the Republic of South Africa and the Kingdoms of Lesotho and Swaziland*, the materials that occur in the area are classified as follows (refer to Figure 14 below).

- Pa: Mudrock, sandstone (Dominant); and
- J-d: Dolerite (Traces).

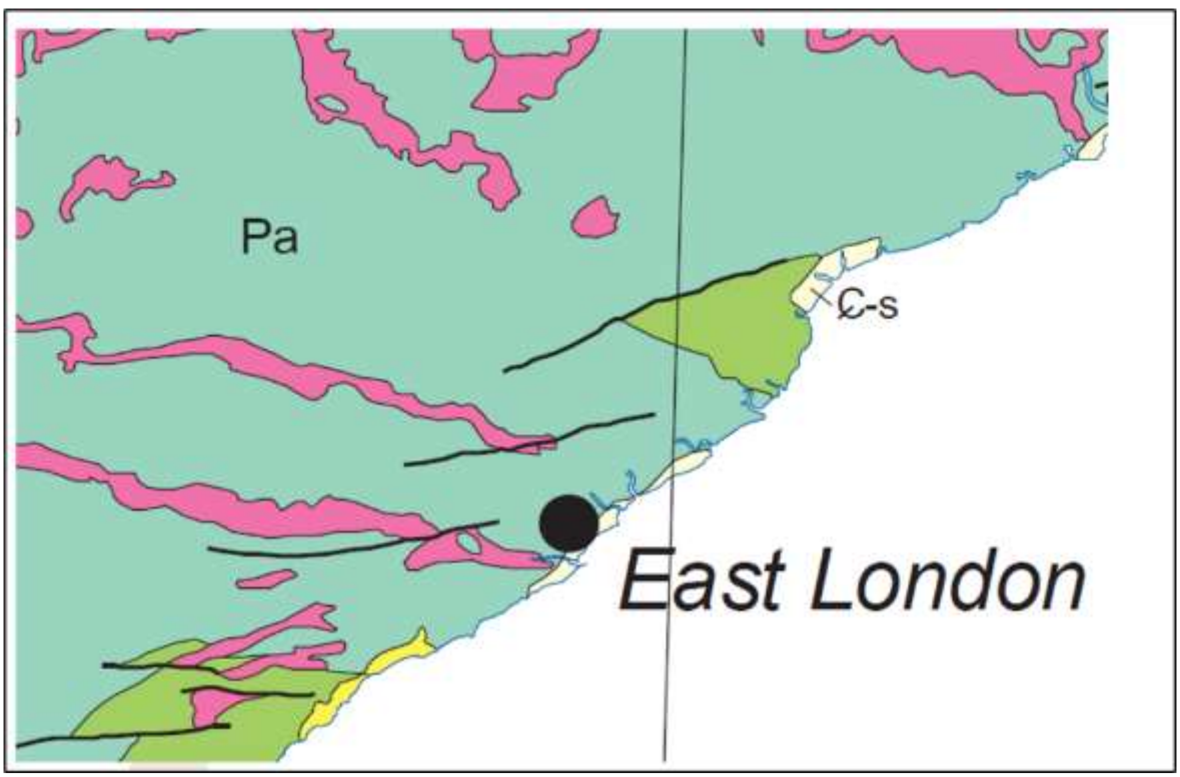


Figure 14: Geology map

10.1.7 Heritage

Information in this section was obtained from the Heritage Impact specialist study (which is attached as Appendix D4).

East London Harbour, which is situated at the mouth of the Buffalo River, is the only river port that still exists in South Africa. "East London's port terminal began in 1848 when the British military decided to build a port in order to supply the troops in King William's Town. As a result, it is possible to trace the port's origins to the supply of military personnel, materials, and tools during the Frontier Wars. Work on the main harbour began in 1872, while the breakwater project began in 1873 ".

The harbour was first designed by Mr. Woodford Pilkington and his team after his appointment as the Civil Engineer of British Kaffraria in 1856. Upon his appointment, sought to reduce the river's mouth first and then train the current so that it flowed in the same direction as the current along the shore at low tide. To complete the plan, a breakwater needed to be constructed from the river's west bank to stop the ebbtide from weakening as it encountered waves breaking along the coast. Unfortunately, his plans did not surface due to the financial constrains and lack of skilled labours. Mr. Pilkington was the first appointed municipal engineer in South Africa from 1831 to 1913.

His successor was Mr (Sir) John Code, a consulting engineer was hired in 1866 after the British Kaffraria was annexed to Cape of Good Hope. Mr. Coode examined the plans for East London Harbour in depth and agreed with them in theory, but he had different ideas about the design and direction of the construction activities. The plan proposed by Mr. Coode in 1870 called for the building of:

- a curved South Breakwater, 1 230 feet (± 375 metres) long
- a Training Wall from the south-western corner of the entrance of the river, to join up with the unfinished Kaffraria Western Bank - this new wall was to run in front of the existing wharves, which would disappear when the area behind them was reclaimed.
- a Revetment Wall along the sea front between the root of the Breakwaters and the seaward end of the West Training Wall
- a 300 foot (± 91 metres) long extension to the Eastern Breakwater, but in a direction quite different from that laid down by the Kaffrarian Engineers
- an Eastern Training Wall between ' the upstream end of the Eastern Breakwater and the unfinished (Kaffrarian) Training Bank.

Most of the harbour's designed work that is presently being renovated was Mr. Coode's suggestion. He had suggested two steam cranes, a 300-foot (91-metre) long timber wharf on the East Bank, and 400-foot (122-meter) long timber wharfs on the West Bank. He also suggested extending the South Breakwater to 1,500 feet. While the pontoon was being carried further river, two additional warehouses were being built.

The East Bank of the river's dock had been extended to a length of 480 feet (146 meters) by 1878, and all cargo landing and shipping were moved to this side of the river.

10.1.8 Topography

The Buffalo City Metropolitan Municipality (BCMM) area extends from sea level along the coastal belt increasing in north-westerly direction to a plateau of elevation between 450m and 850m above sea level. This plateau extends from Maclean Town and Berlin, through to Dimbaza. The elevation in the most north-westerly portion of the BCMM occurs in the Amatole Mountains and reaches 2100m above sea level.

The topography of the region is characterized by a number of incised river valleys, which run nearly parallel to each other in a south easterly direction through the municipality and which dissect the municipality at regular intervals. This terrain, which lacks large tracts of flat land, impacts significantly on settlement patterns and the cost of provision of services within the region (Integrated Development Plan Review of Buffalo City Metropolitan Municipality 2022/21). The slope of the area ranges between 6 – 18% as per Figure 15 extracted from the Council for Geoscience report for "*Groundwater vulnerability map for South Africa*".

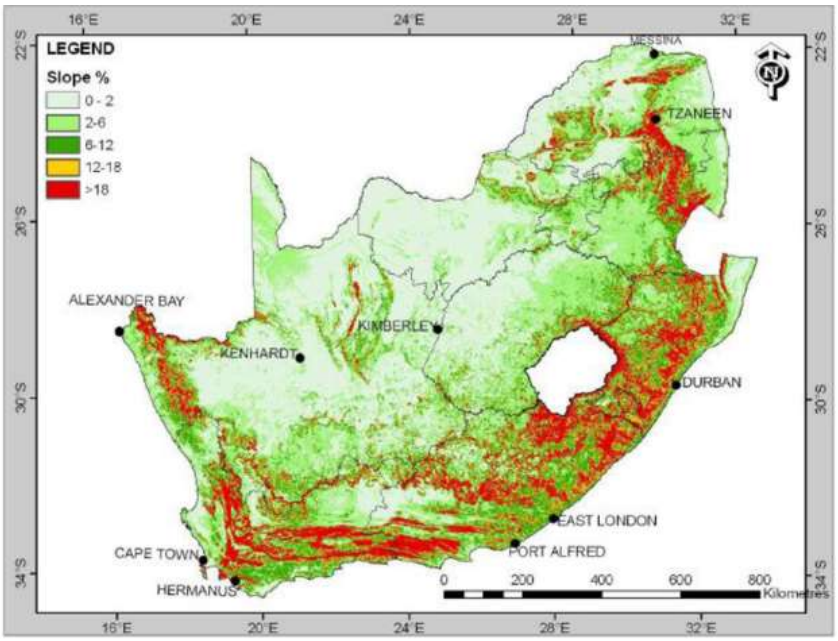


Figure 15: Slope classes map (DWA Groundwater Resources Assessment Study of 2004)

10.2 Biological Environment

10.2.1 Phytoplankton

No information on phytoplankton in the Buffalo River estuary could be found in the scientific or other literature. However, it is probable the phytoplankton species composition is broadly comparable to that in neighbouring estuaries. Van Niekerk et al. (2014) assigned a Present Ecological State of D: Largely modified to the microalgal (phytoplankton) health of the Buffalo River estuary. The key pressures identified that led to this rating are flow modification, compromised water quality, and changes in the macrophyte community. The assessment was, however, not based on empirical data but expert opinion. The CSIR measured chlorophyll-a concentrations in the estuary for the Long-Term Ecological Monitoring Programme for the Port of East London, as discussed above (CSIR 2016, 2017, 2018, 2019, 2020). Chlorophyll-a is a surrogate for microalgal biomass. The chlorophyll-a concentration in the estuary is periodically high, showing that on occasion phytoplankton in the estuary reach bloom status.

10.2.2 Macroalgae

EOH (2018) provide a list of 11 species/taxa of macroalgae that were encountered in a survey at ten stations in the intertidal part of hard structures in the Port of East London. The macroalgae encountered are common to the intertidal zone of rocky shores in the Eastern Cape. The distribution of macroalgae tended to show a richer diversity toward the estuary mouth, which EOH (EOH, 2018) concluded was a consequence of the improvement in water quality and water movement nearer the mouth (EOH, 2018). However, considering the macroalgae are marine invaders of the estuary they are unlikely to be tolerant of a persistently low salinity, and the salinity increase toward the estuary mouth probably thus has a stronger influence on macroalgal distribution than water quality. A visual survey made in July 2022 for the purposes of this Environmental Impact Assessment confirmed that macroalgae are sparse on hard structures in the estuary, particularly vertical quay walls. The reason is not entirely certain but is potentially varied, including grazing pressure, water quality, and an inability to grow on concrete structures. The ports primary production is thus almost exclusively driven by phytoplankton in the water column.

10.2.3 Zooplankton and nektonic invertebrates

No information on zooplankton or nektonic invertebrates in the Buffalo River estuary could be found in the scientific or other literature. However, it is probable the zooplankton species composition is broadly comparable to that in neighbouring estuaries, but possibly somewhat depauperate in terms of species due to poorer water quality.

10.2.4 Ichthyoplankton

No surveys on ichthyoplankton in the Buffalo River estuary could be found in the scientific or other literature. It is probable the estuary serves as a nursery for the juveniles of fish that are resident as adults in the marine environment, but its importance in this context is uncertain and is likely to be somewhat diminished by habitat loss and transformation and impacts on water and sediment quality. If so, many of these fish will enter the estuary in the planktonic phase.

10.2.5 Sediment benthic invertebrate communities

Benthic macrofaunal communities were analysed in sediment sampled at six stations in the Buffalo River estuary for the Long-Term Ecological Monitoring Programme for the Port of East London between 2015-2019 (CSIR 2016, 2017, 2018, 2019, 2020). The stations where the sediment was sampled are identical to the stations where sediment was sampled for physical and chemical analysis. The fauna was identified to the family level. The communities at all stations were dominated by annelid worms and/or ostracods. There is a gradient in the number of taxa recorded and the species diversity from upstream of the port area to the near estuary mouth. The gradient probably reflects the gradient in salinity and sediment properties in the estuary, but it must also be borne in mind that the sediment at Stations 1 and 2 was sometimes anoxic. The abundance of benthic macrofauna at some stations varied widely between surveys. The abundance was least variable at Station 3 off the Dry Dock and at Station 5 near Quay 3.

10.2.6 Biological communities on hard substrates

EOH (2018) provide a list of 18 invertebrate species encountered in a survey at ten stations in the intertidal part of quay walls and other hard structures in the Port of East London. The fauna recorded by EOH (EOH, 2018) is by no means an exhaustive species list of fauna that can be expected to be found on quay walls or other hard structures in the port area since the survey was only made in the intertidal and was based largely on a photographic assessment rather than through the destructive removal of fauna from quay walls to aid the identification of species sheltering amongst, for example, mussels. Indeed, a rapid non-quantitative survey of fauna on the quay walls at a few stations in the port area for the purposes of this Environmental Impact Assessment identified numerous additional taxa not recorded by EOH (2018), including several nereid worms, amphipods, crabs, and gastropods, and species of sponges and ascidians. The quay walls in some parts of the port area are heavily colonised (fouled, or encrusted) by invertebrates. These communities undoubtedly contribute to the ecological productivity of the estuary and adjacent marine environment (e.g. by the export of larvae to the marine environment).

Peters *et al*. (2017) identified 12 introduced invertebrate species in the Port of East London, most of which are ascidians.

10.2.7 Fish

Marais (1988) caught 18 species of fish (list not provided) in the Buffalo River estuary using gill nets set at the mouth and head of the estuary. James and Harrison (2016) provide a list of 24 fish species caught in the estuary in a survey made in 1996 (apparently the last scientific fish survey in the estuary). EOH (2018) added to this list by including fish reported for the estuary in the South African Institute for Aquatic Biodiversity database and based on discussions with an experienced local fisher. This increased the list to 48 species. It is unlikely this represents the full fish species list as the catches in scientific surveys are dictated by the fishing gear used and it is unlikely all habitats in the estuary were sampled previously (e.g. deep parts of channels in port area). EOH (2018) provides a list of a further 54 species they considered likely to occur in the estuary based on their occurrence in nearby estuaries and based on available knowledge of their biology, but which have not been confirmed to occur in the estuary through scientific surveys. The latter may overestimate the species that could be found in the estuary since several types of habitat prevalent in nearby estuaries are largely or completely absent in the Buffalo River estuary, such as eelgrass (Zostera species) beds.

The estuary does not support a commercial fishery, but a limited amount of recreational and subsistence fishing is practiced upstream of the port area. The proposed project will thus not impact on commercial fisheries directly.

10.2.8 Marine reptiles

No scientific studies on marine reptiles (e.g. turtles) in the Buffalo River estuary could be found in the literature.

10.2.9 Birds

No scientific studies on birds in the Buffalo River estuary could be found in the literature. As there are no intertidal sand and mudflats in the estuary, many species of birds common in Eastern Cape estuaries that make use of these habitats (e.g. waders) are largely excluded from the estuary. The banks of the estuary do nevertheless provide habitat for birds, as does the open water. During a field visit in July 2022 a large number (>100) of cormorants, and moderate numbers of gannets and terns were observed in the port/estuary. Various other bird species were observed in lower numbers, including seagulls, heron, several species of kingfishers, and oyster catchers. Most of the bird species were observed to be actively feeding in the estuary, in the port area, and near the estuary mouth. EOH (2018) state that the African fish eagle (Haliaeetus vocifer) and goliath heron (Ardea goliath) have also been recorded in the estuary.

10.2.10 Marine mammals

No scientific studies on marine mammals in the Buffalo River estuary could be found in the literature. Dolphins are reported to enter the port/estuary to feed, but this is sporadic and they may not be observed for extended periods between sightings. The dolphin species that enter the port are uncertain but probably include bottlenose (Tursiops aduncus) and humpback (Sousa chinensis) dolphins. Dolphins also regularly pass the estuary mouth – a pod of humpback dolphins was observed doing so during a field survey in July 2022. Various whales are known to occur further offshore of East London, including humpback and southern right whales that migrate to calving grounds further north.

10.2.11 National Biodiversity Assessment: Estuarine Realm

The recent National Biodiversity Assessment 2018: Estuarine Realm, evaluated the health of South African estuaries. Various abiotic and biotic components were used to compute an Estuarine Health Index, also known as Present Ecological State. Each estuary was assigned a score based on the similarity to an assumed natural condition for the abiotic and biotic components. For each component the change was estimated as a percentage (0-100%) of the natural state. Scores were weighted (25% for each abiotic and 20% for each biotic component) and aggregated (50:50) to provide an overall score that reflects the present health of the estuary as a percentage of that under natural conditions. The degree of similarity reflects six broad categories of estuarine condition (A-F scale), ranging from natural to extremely degraded. These categories in turn relate to decreasing levels of ecosystem function. The loss of function occurs on a continuum, with estuaries retaining more than 90% of their natural function rated as “Natural” and estuaries degraded to less than 40% of natural function as “Severely or Critically Modified”. It must be emphasised that the A-F scale represents a continuum and the boundaries between categories are conceptual points along the continuum.

There may, therefore, be cases where there is uncertainty as to which category a particular estuary belongs, potentially having components that have membership in two categories (Van Niekerk et al., 2019b). It is also important to note the assessment is based on expert knowledge and opinion rather than empirical measurements of abiotic and biotic components of an estuary.

The Present Ecological State for the Buffalo River estuary is rated 'D' (41-60% condition of pristine), meaning the estuary is regarded as heavily modified due to a large loss of natural habitat, biota, and basic ecosystem services. The estuary is thus considered as having a low to average biodiversity importance (Van Niekerk et al., 2019b). The rating reflects the fact that the lower part of the estuary is given over to port infrastructure and operations but also because water quality in the Buffalo River estuary is known to often be poor, principally due to sewage discharge into the river that then impacts on the estuary. The estuary has recommended ecological category of 'C', meaning that rehabilitation and improvements, where possible, are unlikely to increase the health to a higher level because of permanent changes to the system (e.g. port area).

10.2.12 Eastern Cape Biodiversity Conservation Plan

The Eastern Cape Biodiversity Conservation Plan (ECBCP, 2019) attempts to map priorities areas for conservation in the province, as well as assign land use categories depending on current conditions of unit areas and conservation targets that need to be achieved (*Berliner et al.,* 2007). ECBCP, although mapped at a finer scale than the National Spatial Biodiversity Assessment is still, for the large part, inaccurate and "course" (Driver et al., 2005). Therefore, it is vital that the status of the environment, for any proposed development must first be verified before the management recommendations associated with the ECBCP are considered (Berliner and Desmet, 2007).

The main outputs of the ECBCP are "critical biodiversity areas" (CBAs), "ecological support areas" (ESAs) and land-use management categories. CBAs are areas required to meet biodiversity targets for ecosystems, species and ecological processes, as identified in a systematic biodiversity plan. Whilst ESAs are not essential for meeting biodiversity targets, they do play a role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services. CBAs and ESAs may be terrestrial or aquatic.

They are classified according to the following categories:

- CBA 1 = maintain natural state
- CBA 2 = maintain in a near-natural state
- ESA 1 = natural habitat
- ESA 2 = no natural habitat

According to the ECBCP (2019), the project site is located within Terrestrial CBA 2 (Figure 16). According to the ECBCP 2019 Handbook, the following management objectives apply to CBA 2: Maintain in a near- natural state that secures the retention of biodiversity pattern and ecological processes.

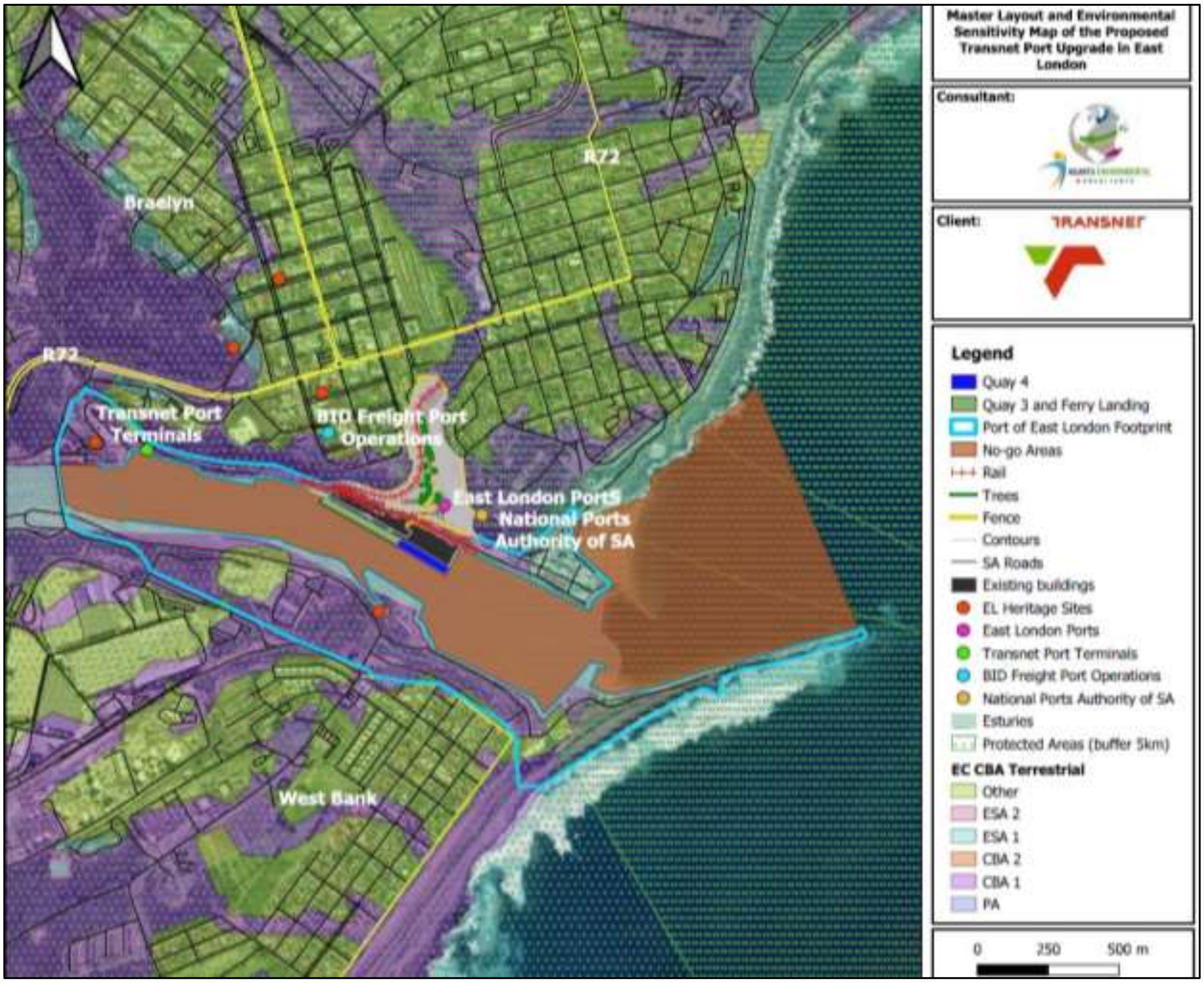


Figure 16: ECBCP (2019) terrestrial critical biodiversity areas

10.3 SOCIAL ENVIRONMENT

10.3.1 Demographic Profile

With 884 000 people, the Buffalo City Metropolitan Municipality housed 1.5% of South Africa's total population in 2018. Between 2008 and 2018 the population growth averaged 1.11% per annum which is close to half than the growth rate of South Africa as a whole (1.61%). Compared to Eastern Cape's average annual growth rate (0.94%), the growth rate in Buffalo City's population at 1.11% was very similar than that of the province.

Based on the present age-gender structure and the present fertility, mortality and migration rates, Buffalo City's population is projected to grow at an average annual rate of 1.0% from 884 000 in 2018 to 929 000 in 2023. The population projection of Buffalo City Metropolitan Municipality shows an estimated average annual growth rate of 1.0% between 2018 and 2023.

Buffalo City Metropolitan Municipality's male/female split in population was 92.4 males per 100 females in 2018. The Buffalo City Metropolitan Municipality appears to be a fairly stable population with the share of female population (51.99%) being very similar to the national average of (51.05%). In total there were 460 000 (51.99%) females and 424

000 (48.01%) males. In 2018, the Buffalo City Metropolitan Municipality's population consisted of 86.68% African (766 000), 6.68% White (59 100), 5.80% Coloured (51 300) and 0.84% Asian (7 400) people.

The largest share of population is within the young working age (25-44 years) age category with a total number of 319 000 or 36.1% of the total population. The age category with the second largest number of people is the babies and kids (0-14 years) age category with a total share of 24.9%, followed by the older working age (45-64 years) age category with 163 000 people. The age category with the least number of people is the retired / old age (65 years and older) age category (Figure 17) with only 55 800 people (BCMM IDP, 2020/2021).

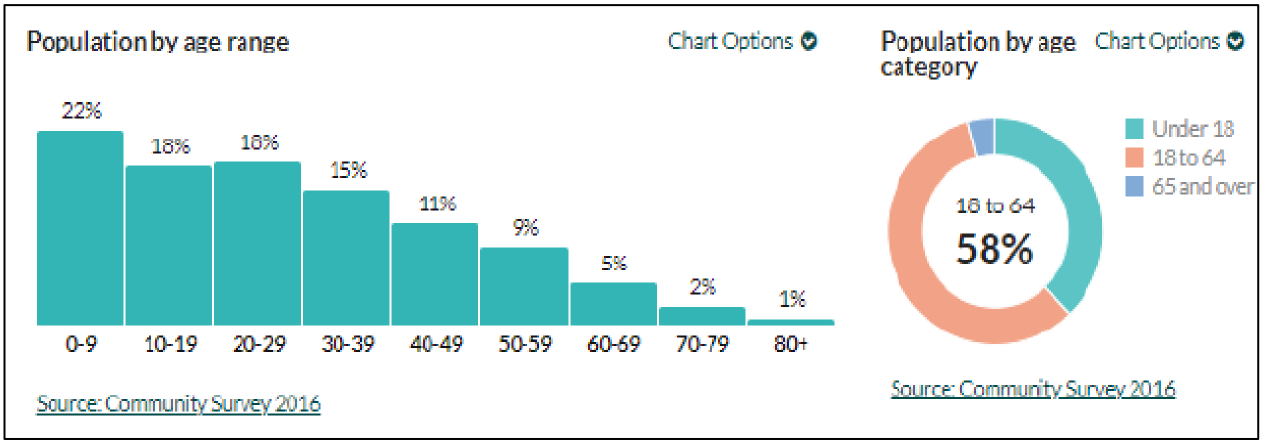


Figure 17: Age structure

10.3.2 Education and Health

Educating is important to the economic growth in a country and the development of its industries, providing a trained workforce and skilled professionals required. Within Buffalo City Metropolitan Municipality, the number of people without any schooling decreased from 2008 to 2018 with an average annual rate of -3.92%, while the number of people within the 'matric only' category, increased from 128,000 to 166,000. The number of people with 'matric and a certificate/diploma' increased with an average annual rate of 3.60%, with the number of people with a 'matric and a Bachelor's' degree increasing with an average annual rate of 5.74%. Overall improvement in the level of education is visible with an increase in the number of people with 'matric' or higher education. The number of people without any schooling in Buffalo City Metropolitan Municipality accounts for 7.08% of the number of people without schooling in the province and a total share of 0.98% of the national. In 2018, the number of people in Buffalo City Metropolitan Municipality with a matric only was 166,000 which is a share of 17.62% of the province's total number of people that has obtained a matric.

Buffalo City Metro has a young population with an under 5’s and a 15-39 years of age bulge. The majority of the population is at the East London Sub-district and this where the majority of the public health facilities are (BCMM IDP, 2020/2021).

10.3.3 Economic Profile

The upper poverty line is defined by StatsSA as the level of consumption at which individuals are able to purchase both sufficient food and non-food items without sacrificing one for the other. This variable measures the number of individuals living below that particular level of consumption for the given area, and is balanced directly to the official upper poverty rate as measured by StatsSA. In 2018, there were 500 000 people living in poverty, using the upper poverty line definition, across Buffalo City Metropolitan Municipality - this is 2.09% lower than the 510 000 in 2008. The percentage of people living in poverty has decreased from 66.24% in 2008 to 58.18% in 2018, which indicates a decrease of 8.05 percentage points.

The average annual household income within the City is R29 400 (Figure 18). This is much higher than the provincial average annual income of R14 600.

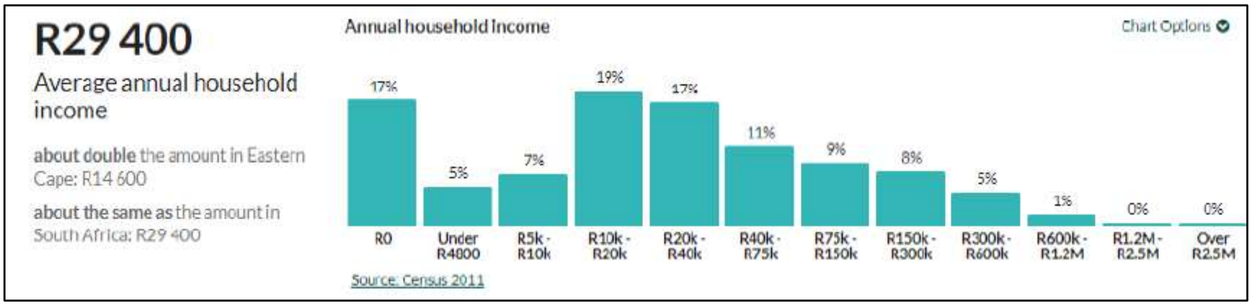


Figure 18: Annual household income

In Buffalo City Metropolitan Municipality the economic sectors that recorded the largest number of employment in 2018 were the community services sector with a total of 64 600 employed people or 25.5% of total employment in the metropolitan municipality. The trade sector with a total of 60 000 (23.6%) employs the second highest number of people relative to the rest of the sectors. The mining sector with 188 (0.1%) is the sector that employs the least number of people in Buffalo City Metropolitan Municipality, followed by the electricity sector with 2 230 (0.9%) people employed. In 2018, there were a total number of 123 000 people unemployed in Buffalo City, which is an increase of 45 300 from 77 800 in 2008. The total number of unemployed people within Buffalo City constitutes 15.66% of the total number of unemployed people in Eastern Cape Province. The Buffalo City Metropolitan Municipality experienced an average annual increase of 4.70% in the number of unemployed people, which is worse than that of the Eastern Cape Province which had an average annual increase in unemployment of 4.66% (BCMM IDP, 2020/2021).

10.3.4 Land Use

Information provided in this section is taken from the Transnet National Port Authority website accessed, 29 July 2022. Like other ports of South Africa, East London is a common user port, meaning that it usually operates on a first-come-first-served basis. The port consists of a Multi-Purpose Terminal (including the container terminal) on the East Bank, and a Bulk Terminal (Grain Elevator) and Car Terminal both on the West Bank. East London Port has 11 commercial berths ranging up to 250 metres in length. Fresh water is available at all berths on request. Bunkering is available (fuel and gas oil) by road tankers.

The Grain Elevator, with a storage capacity of 76,000 tonnes is the largest in South Africa. In the 1970s the elevator handled 3.8 million tonnes of exports and in 1994 a total of 2.1mt, during a time when the Durban facility was out of commission. In recent years the elevator has been converted to handle discharged cargo (imports) and has handled World Food Aid imports on behalf of the United Nations.

Nowadays the Multi-Purpose Terminal handles mainly containers - 66,293 TEUs during 2015 using ships own gear as the port now possess a mobile crane and straddle carriers. The Car Terminal on the West Bank has been responsible for a turnabout in the port's fortunes and is geared to handle 50,000 units annually, which it has already exceeded, and has space for expansion when required.

Bunkering with fuel oil and marine gas oil is available at the port from pipelines at S and T berths on the West Bank of the harbour. Cruise ships use any available berth, usually on the East Bank. Ship repair facilities are extensive with a well-equipped dry dock able to handle ships up to 200m length with a 106-metre ship repair quay alongside.

The outer anchorage one n.mile east of the south breakwater offers anchorage for vessels outside the port, but lies in an exposed position. This has an approximate depth of 35m with sandy bottom

A full range of ships chandling and stevedoring is available. The port houses a yachting marina within the harbour at Latimer's Landing where there was a small waterfront but which is due for refurbishment. The NSRI maintains a rescue vessel named ACSA Rescuer One plus an inflatable named Spirit of Madiba.

A car terminal on the West Bank, which includes a four-storey parking facility connected by dedicated road to the adjacent Daimler (Mercedes Benz) factory, has transformed the port. The terminal has a theoretical design throughput of 50,000 units a year with 2,800 parking bays. The parkade has been designed to be increased in size to 8 storeys to raise the throughput to 180,000 vehicles a year. Provision of a third berth is also a possibility.

The multi-purpose terminal on the East Bank handles an increasing volume of containers and is geared for 90,000 TEUs a year - many for the motor industry. Ships own gear is required as the port lacks gantry cranes.

East London has a dry dock capable of handling ships of up to 200m and a maximum beam of 24.8m. The dock is equipped with four electric and one mobile crane.

There are a total of 12 commercial berths plus a repair quay of 110m, a pilot jetty and fishing jetty next to the small Latimer's Landing Waterfront. Six of the berths lie on the West Bank. The port has a total of 2,410m of quayside.

The port entrance is dredged up to 12m, the draught at the berths vary from -8.5m to -10.4m alongside. Passenger ships are accommodated at whichever berth is most suitable and available.

11. ENVIRONMENTAL IMPACT ASSESSMENT

11.1 IMPACT ASSESSMENT METHODOLOGY

This section provides the methodology for assessing the significance of impacts associated with the activity. The criterion for determining impact significance has been defined in accordance with the criteria drawn from Appendix 3 of the Environmental Impact Assessment Regulations, 2014. The levels of detail described in the EIA regulations were fine-tuned by assigning specific values to each impact identified. The impact ratings will be informed by the findings of specialist assessments conducted, fieldwork, and desk-top analysis. The significance of potential impacts that may result from the proposed development will be determined to assist the competent authority in making a decision.

To establish a coherent framework within which all impacts could be objectively assessed, it is necessary to establish a rating system, to be applied consistently to all the criteria. For such purposes each aspect is assigned a value ranging from one (1) to four (4) depending on its definition. Table 13 provides a summary of the criteria and the rating scales, which will be used in the assessment the impacts.

Table 13: Impact rating method

Nature: classification of whether the impact is positive or negative, direct or indirect.
Scale: spatial scale of impact and classified as: • Site: the impacted area is the whole or significant portion of the site; • Local: Within a radius of 2 km of the construction site; • Regional: the impacted area extends to the immediate, surrounding and neighbouring properties; and • National: the impact can be considered to be of national significance.
Duration: Indicates what the lifetime of the impact will be and is classified as: • Short term: The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase; • Medium term: The impact will last for the period of the construction phase, where after it will be entirely negated; • Long term: The impact will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory; and • Permanent: 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.
Magnitude: Describes whether an impact is destructive or benign. • Low: Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected; • Moderate: Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way;

• High: Natural, cultural and social functions and processes are altered to extent that they temporarily cease; and • Very High: Natural, cultural and social functions and processes are altered to extent that they permanently cease.
Probability: Describes the likelihood of an impact actually occurring: • Improbable: Likelihood of the impact materialising is very low; • Possible: The impact may occur; • Highly Probable: Most likely that the impact will occur; and • Definite: Impact will certainly occur.
Significance: Based on the above criteria the significance of issues was determined. The total number of points scored for each impact indicates the level of significance of the impact, and is rated as: • Low: the impacts are less important. • Medium: the impacts are important and require attention; mitigation is required to reduce the negative impacts. • High: the impacts are of great importance. Mitigation is therefore crucial.
Mitigation: Where negative impacts are identified, mitigation measures (ways of reducing impacts) are required. An indication of the degree of success of the potential mitigation measures is given per impact.

11.1.1 Criteria for rating impacts

Table 14 describes the criteria to be used and the significance rating of the impacts.

Table 14: Impact rating criteria

DURATION (D)	MAGNITUDE (M)
5 - Permanent 4 - Long term (ceases with operational life) 3 - Medium term (5-15 years) 2 - Short term (0-5 years) 1 – Immediate	10 - Very high/do not know 8 - High 6 - Moderate 4 - Low 2 - Minor
SCALE (S)	**PROBABILITY (P)**
5 - International 4 - National 3 - Regional 2 - Local 1 - Site 0 – None	5 - Definite/do not know 4 - Highly probable 3 - Medium probability 2 - low probability 1- Improbable 0 - None
SIGNIFICANCE POINTS (SP) = (D+M+S) X P	
HIGH (H) = >60 POINTS	
MODERATE (M) = 30-60 POINTS	

LOW (L) = <30 POINTS	
NO SIGNIFICANCE = 0	
POSITIVE IMPACT	

The maximum value of significance points is 100. Environmental effects could therefore be rated as either high (H), moderate (M), or low (L) significance, as seen above.

Practicable mitigation measures were recommended, and impacts were rated in the prescribed way both with and without the assumed effective implementation of mitigation measures.

11.1.2 IMPACT PRIORITIZATION

Further to the assessment criteria presented above, it is necessary to assess each potentially significant impact in terms of:

- Reversibility;
- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

Table 15: Impact prioritization

REVERSIBILITY (R)	CUMULATIVE IMPACTS (CI)
3 - High 2 - Medium 1 – Low	3 - High 2 - Medium 1 – Low
LOSS OF RESOURCES (LR)	
3 - High 2 - Medium 1 – Low	

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact significance score (post-mitigation). The aim of the prioritisation factor is not to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the significance score based on the assumption that relevant suggested management/mitigation impacts are implemented. PF=(R+CI+LR)/3

The degree of confidence in predictions based on available information, the EAP's judgment and/or specialist knowledge.

Table 16: Description Significance Ratings

SIGNIFICANCE RATING	DESCRIPTION
Very Low (Negligible)	The impacts on this issue are acceptable and mitigation, whilst desirable, is not essential. The impacts on the issue by themselves are insufficient, even in combination with other low impacts, to prevent the development being approved. Impacts on this particular issue will result in either positive or negative medium to short term effects on the social and/or natural environment.
Low (Minor)	The impacts on this issue are important and require mitigation. The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project, but could in conjunction with other issues with moderate impacts, cause restrictive approval of the proposed project. Impacts on this issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
Medium (Moderate)	The impacts on this issue are important and require mitigation. The impacts on this issue are, by themselves, insufficient to prevent the implementation of the project, but could in conjunction with other issues with moderate impacts, prevent its implementation. Impacts on this particular issue will usually result in either a positive or negative medium to long-term effect on the social and/or natural environment.
High (Major)	The impacts on this issue are serious, and if not mitigated, they may prevent the implementation of the project (if it is a negative impact). Impacts on this particular issue would be considered by society as constituting a major and usually a long-term change to the (natural and/or social) environment, and will result in severe effects or if positive, substantial beneficial effects.

11.2 IMPACT IDENTIFICATION

The impact assessment methodology utilised for the project consists of two phases namely impact identification and impact significance rating. Impacts and risks have been identified based on a description of the activities to be undertaken and consideration of each phase of the development.

It is expected that the proposed replacement of quay wall 3 and 4 and ferry landing will have environmental and social impacts during the planning, construction, rehabilitation and operational phases. There is no intended decommissioning phase for the project as the rehabilitated quay will be designed for a 50-year service life subject to regular and effective maintenance (PRDW, 2017). It is impossible to anticipate what the port and its surroundings may resemble at that time, making it difficult to assess the significance of decommissioning impacts. The following list of impacts have been identified through EIA process:

Table 17: Impact identification

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	-ve	5	5	5	4	low	low	medium	high	high
2.Environmental deterioration due to spillages from portable toilets	Construction	-ve	3	1	2	2	medium	low	medium	very low	high
3.Impacts to soil, sediment, and geology	Construction	-ve	1	1	5	1	low	low	high	very low	high
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	-ve	4	2	4	4	medium	low	high	high	high
5. Ecological impacts due to the spillage of construction material	Construction	-ve	1	1	1	4	high	low	medium	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
and demolition debris into the estuary											
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Construction	-ve	1	1	1	2	medium	low	high	very low	high
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Construction	-ve	2	1	1	2	medium	low	high	very low	high
8.Deterioration in water quality due to the release of oxygen depleting substances	Construction	-ve	1	1	1	1	high	low	high	very low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
from sediment by construction activities											
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	-ve	1	1	1	1	medium	low	high	very low	high
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	-ve	2	1	1	2	medium	low	high	very low	high
11.Ecological impacts due to the temporary loss of quay wall biological communities	Construction	-ve	3	2	1	5	medium	low	high	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
12. Ecological impacts due to underwater noise	Construction	-ve	4	3	2	4	medium	low	medium	medium	high
13. Ecological impacts due to above water noise disturbance	Construction	-ve	2	1	2	4	medium	low	medium	low	high
14. Impact of altered quay wall geometry on hydrodynamics	Operation	-ve	1	1	5	1	low	low	low	Very low	high
15. Ecological impact due to permanent habitat loss	Operation	-ve	3	2	5	2	low	medium	low	low	high
16.The damage and disruption of paleontological resources as preserved in its host	Construction	-ve	3	2	4	3	low	medium	low	low	high

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	Phase	Nature	Magnitude	Spatial Extent	Duration	Probability	Reversibility	Loss of Resources	Avoidance, management or mitigation	Significance	Confidence Level
rocks within the development footprint											
17.Employment creation	Construction	+ve	4	2	2	5	medium	low	high	medium	high
18.Skills development and transfer	Construction	+ve	4	2	2	5	medium	low	high	medium	high
19.Scheduling of Construction	Planning	-ve	1	2	3	4	high	low	high	low	high
20.Employment creation	Planning	+ve	1	2	2	3	high	low	high	low	high
21.Policy and Legislative Context	Planning	-ve	5	2	3	3	medium	low	high	low	high
22.Air Quality	Construction	-ve	2	2	2	3	medium	low	high	low	high
23.Disturbance of existing land uses and visual impact	Construction	-ve	2	2	2	4	high	low	medium	low	high
24.Climate Change	Operation	-ve	3	2	5	3	medium	low	medium	medium	medium

IMPACT IDENTIFICATION							DEGREE OF IMPACT-			PREMITIGATION	
Impact	**Phase**	**Nature**	**Magnitude**	**Spatial Extent**	**Duration**	**Probability**	**Reversibility**	**Loss of Resources**	**Avoidance, management or mitigation**	**Significance**	**Confidence Level**
25.Safety-Injuries and fatalities during construction	Construction	-ve	5	3	2	3	medium	low	medium	medium	
26.Improved Jetty stability and safety	Operation	+ve	4	3	5	5	medium	low	medium	medium	medium
27.Economic stimulation of BCMM	Operation	+ve	2	2	3	3	medium	low	medium	low	medium

11.3 POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

A description of the positive and negative impacts of the proposed activity are described below. These impacts are applicable to both alternatives considered, however the significance of the impact may vary per alternative.

11.3.1 Impacts due to the ingress of non-hazardous solid waste into the estuary

Construction for the proposed project will generate non-hazardous solid waste that, if not properly managed, will enter the Buffalo River estuary and pose an environmental risk. Plastic and other solid waste that washes up on estuary and marine shorelines and floats in water is also unsightly and affects tourism and recreation. Especially problematic from an environmental perspective is the ingress of non-biodegradable waste into aquatic ecosystems, such as plastic bottles, plastic bags, plastic food wrappers, polystyrene food containers, plastic strapping tape, and synthetic rope and cord. Plastic and small items of solid waste are often light enough to be blown by wind or washed by surface (rain) runoff into aquatic ecosystems. Plastic and other low density solid waste does not immediately sink to the bottom and can be transported over extremely large distances by ocean currents. The spatial extent of the impacts caused by solid waste are thus potentially international. Floating plastic waste, including small plastic particles, can be mistaken for food and be ingested by marine mammals, seabirds, sea turtles, fish, and invertebrates. The ingestion of solid waste can have a variety of adverse effects on fauna, including but not limited to ulceration or laceration in the digestive tract leading to infection or internal bleeding, blockage of the digestive tract resulting in reduced nutrient uptake, and retention of ingested waste and reduction of the urge to feed (NOAA Marine Debris Program, 2014a; 2016). Marine fauna can also become entangled in solid waste, which can reduce the swimming and feeding abilities of the fauna and may result in injury or mortality (NOAA Marine Debris Program, 2014b). Solid waste also provides a site for the attachment of encrusting (fouling) fauna (*e.g.* barnacles) that can potentially be transported in this way to and colonise areas well outside their natural range, where they may become invasive (Lewis *et al*., 2005; Allsopp *et al*., 2006; Gregory, 2009; NOAA Marine Debris Program, 2017). Plastic also leaches constituent chemicals as it breaks down, such as plasticisers, which can present a toxic risk to fauna and flora (Thompson *et al*., 2009). Plastic waste that sinks to the bottom can smother benthic habitat, causing the death of or displacing invertebrate fauna and flora.

Responsible construction companies generally implement measures to limit the release of solid waste from their construction sites into the surrounding environment. It is nevertheless **probable** that non-hazardous solid waste will enter the Buffalo River estuary without effective waste management at the proposed construction site. The amount would probably be quite small, but the implications (intensity) of non-hazardous waste in estuaries and the marine environment is potentially **high** because it can pose a risk to threatened, vulnerable and endangered species. The potential for non-hazardous solid waste to enter the estuary will persist for the duration of construction (*i.e.* medium term), but many forms of non-hazardous solid waste (such as plastic items) are essentially non-biodegradable (or at least take a very long time to degrade) and may be transported over very large distances by ocean currents. The extent of this impact is thus potentially **international** and the duration **permanent** (or at least long-term). This impact is thus largely **irreversible**. The significance rating for this impact without mitigation is thus **HIGH**.

11.3.2 Deterioration in Water and Sediment Quality due to spillages from portable toilets

Sanitation facilities will obviously be required for use by construction personnel. It is assumed the contractor will provide portable sanitation facilities, but if reasonable access to existing facilities in the area is possible this would be preferred. If portable sanitation facilities are provided onsite there is the possibility these might leak or overflow and faecal material and chemicals used in the toilets might find their way into the estuary, either directly or via surface (stormwater) runoff. The chemicals used in these toilets are toxic to aquatic biological communities.

It is **possible** waste from portable toilets could reach the estuary with no mitigation. The possibility will persist for the duration of construction, but a spill or leak from a toilet at any time would have a **temporary** impact as the toxic chemicals and other waste would be diluted and dispersed quite rapidly and adverse impacts would thus be limited to a small area. The spatial extent is thus **site-specific** and the intensity **low**. This impact is fully **reversible** as any waste that might reach the estuary would degrade over time. The significance rating for this impact without mitigation is thus **VERY LOW**.

11.3.3 Impacts to soil, sediment and geology

The sub-surface geology in the construction footprint is unknown, but a geotechnical survey for the rehabilitation of the quay at Latimer's Landing showed that site is underlain by grey and red mudstone and sandstone of the Beaufort Group of the Karoo Sequence. Post-Karoo dolerite dykes and sills intruding into the mudstone and the sandstone layers are common to the general area. The mudstone alternates with sandstone units and vary in thickness from less than a metre to tens of metres. The sandstone units consist of grey, fine-grained quartz feldspathic sandstone. The sandstones commonly display flat-bedding, cross bedding, and micro cross-lamination while the mudstone is usually poorly stratified of massive. On site the contact metamorphism resulting from dolerite intrusions has affected both the sandstone and mudstone, imparting a fine-grained glassy nature to the rock. The bedrock below alluvium in the estuary is moderately weathered to highly weathered, closely to medium jointed, hard rock hornfels (Aurecon, 2014).

The proposed project will lead to the permanent loss or disturbance of sediment and rock in the construction footprint. The disturbance and loss will occur through piling and the projection of the new quay wall ~4 m further into the estuary than the current quay wall. Other geological resources may be disturbed and removed from site during the dismantling of the Ferry Landing, but this material was previously brought onto site for the Ferry Landing construction. Geological material will be brought onsite for the quay rehabilitation and may alter the existing soil and sediment composition. The surface sediment on the estuary bottom in the construction footprint is not of a high ecological value because of its rarity since similar material is present elsewhere in the estuary, and it has no apparent commercial value. The area of geological material that will be lost is very small in the context of similar material in the wider estuarine area. The proposed construction works are unlikely to lead to geological instability in the area, nor to seismic activity, based on similar works at Latimer's Landing not causing such effects. It must, however, be reiterated that nothing is known about the sub-surface geology in the construction footprint and this impact might need to be re-assessed when the findings of geotechnical surveys are available.

Geological material in the construction footprint will thus be impacted by construction. However, the intensity will be **minor** as little material will be disturbed or lost and the material has no commercial value. The impact will be **site-specific**. Although the impact to some geological resources will be **permanent** as they will be covered the significance rating for this impact without mitigation is **VERY LOW**.

11.3.4 Deterioration in water and sediment quality due to hazardous material spills and leaks

The proposed rehabilitation of the Ferry Landing, Quay 3, and Quay 4 will require the operation and use of construction machinery, equipment, and vehicles, and the delivery of construction materials to the site by vehicle (road). Some of the construction machinery and equipment will be operated in and over water in the Buffalo River estuary. There is a risk the machinery, equipment, and vehicles may leak oil, hydraulic fluids, and fuel amongst other potential hazardous materials, for the accidental spillage of these same materials during the refuelling or emergency repairs to machinery, equipment, and vehicles, and for a spill through a loss of onsite containment. The hazardous materials could enter the estuary directly if there is a leak on machinery and equipment that is operated in or over water or near the water's edge, or indirectly if hazardous materials are spilled or leaked onto hard surfaces such as the quay apron and then drain directly into the estuary or are washed from hard surfaces by surface (rainfall) runoff. If construction support vessels are used, hazardous materials such as fuel will leak from the vessel engines into the estuary, although this will probably comprise only a small volume of material. If there is a fire onsite and the fire is doused using firefighting equipment the resultant waste will represent hazardous material that could enter the estuary if not properly contained and cleaned up.

Hazardous materials are so denoted because they are toxic to aquatic biological communities and thus pose an environmental risk if they enter aquatic ecosystems (in addition to presenting human health risks). The magnitude of impacts arising from hazardous material spills and leaks will depend on the nature and amount of the material released. These impacts can be acute if a 'large' amount of a hazardous material, or a particularly hazardous material enters a waterbody, resulting in the mortality of organisms and in so doing disrupting ecological processes (Hutchinson et al., 2013; Main et al., 2015; Wenger et al., 2017). Alternately, or in addition, the impact may be chronic, wherein a hazardous material affects the physiology of organisms over an extended period while accumulating in their tissue, in this way allowing contaminants to also pass through the wider ecosystem (Oleksiak, 2008; Hamilton et al., 2017). The larval and juvenile stages of aquatic fauna and reproductive propagules of aquatic flora are especially sensitive to contaminants and usually require a lower dosage for adverse effects to occur than adults (Costa et al., 2011; Limburg and Waldman, 2009; Wenger et al., 2017). Contamination can also affect primary production by aquatic flora, the availability of oxygen since the breakdown of chemicals is usually an oxygen demanding process, and the health of microbial communities (Lee and Lin, 2013).

It is thus probable hazardous materials will be spilled or leaked at the construction site for the proposed project since hydraulic lines on machinery fails from time to time and multiple refuelling events or other maintenance of vehicles and equipment, for example, increases the probability of human error. However, these are in the main likely to be small volume leaks and spills that can be adequately contained and cleaned up if they occur on land and are unlikely to have a major impact on water and sediment quality and associated biological communities in the Buffalo River estuary. Oil and fuel leaks during the normal operation of construction support vessels, if they are required, are also probable but these too are likely to release a small volume of hazardous materials into the estuary. Here, however, it will be impossible, or at least very difficult to retrieve and clean-up the leaked material, although these spills are also unlikely to have a major impact on water and sediment quality and associated biological communities in the estuary. A major spill of hazardous material is possible and would have a more significant and widespread impact on water and sediment quality in the estuary and potentially beyond without adequate management, and hence to affect biological communities at a local scale with a high intensity. The impact on the water column will occur over the short-term as the spilled or leaked hazardous material will dissipate due to dispersion, dilution, and degradation. However, if the hazardous material accumulates in sediment the effect may be longer lasting (years) since various biogeochemical processes can delay the degradation of hazardous chemical compounds in sediment, with the result the duration could be long-term. Indeed it is because of these differences in degradation that certain contaminants may be found in sediment but not in the overlying water. The impact is fully reversible as the hazardous materials will degrade with time, even if this may occur of a considerable period. The significance rating for this impact without mitigation is thus HIGH.

11.3.5 **Ecological impacts due to the spillage of construction material and demolition debris** into the estuary

There is the potential for various types of construction material and debris to be spilled into the estuary during the demolition and reconstruction of the Ferry Landing and the rehabilitation of Quays 3 and 4, including concrete debris generated during the removal of quay furniture, the demolition of concrete structures at the Ferry Landing, the breaking of the concrete quay apron behind the Ferry Landing and Quays 3 and 4, solid granular material used for backfilling the area between the new sheet pile wall and existing quay walls, debris removed from tubular piles if they need to be drilled for anchoring into the bedrock, and so on. Pre-cast concrete beams will be used for the various parts of the quay rehabilitation. However, liquid concrete will be poured over the top to bind the concrete elements together before grouting. There is thus the potential for wet cement and grout to be spilled into the estuary.

The spilled solid material will alter the physical properties of the benthic habitat, changing it from a sediment dominated one to a mixed sediment and gravel/stone type habitat. The change may impact on fauna that preferentially live in and on sediment, to the extent they may be excluded. For example, if the benthic habitat is transformed from a sediment to a gravel type habitat, burrowing animals will not be able to burrow through the material. Stones, gravel, and other hard objects spilled into the port could also crush or injure delicate benthic invertebrate epifauna when they impact the bottom. Small stones, gravel, and other solid objects will also be buffeted along the bottom by vessel propeller wash and in this way may physically damage invertebrate epifauna, although this is more likely to occur only after construction ceases since no vessels will be allowed to use Quays 3 and 4 during the construction period. Small stones, gravel, and other solid objects that can be buffeted in this way will probably be gradually removed over time by maintenance dredging.

Fresh concrete, cement, and grout are highly alkaline and corrosive. The excessive spillage of cementitious material and grout into the estuary could adversely affect biological communities by impairing water quality, most notably by altering (increasing) the pH well above that of the baseline (Fitch, 2003). The cement will harden over time and will alter the physical properties of sediment in the same way as spilled stones and solid construction debris.

Construction activities will thus probably introduce construction material, demolition waste, and cementitious material into the estuary without mitigation. The material will affect the immediate area of construction activities and is thus site specific. It is improbable the spilled material will be retrieved and the impact is thus irreversible, noting that some of the material will be removed by future maintenance dredging depending on its size. However, because the material will remain in the bottom for some time the duration is medium-term. It is unlikely such a large amount of material would be spilled as to cause a major change in the physical properties of the bottom substrate over a large area, nor to result in a significant loss of benthic ecology, and the intensity is thus considered low. The significance rating for this impact without mitigation is thus LOW.

11.3.6 Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities

Several construction activities required for the rehabilitation and reconstruction of the Ferry Landing, Quay 3, and Quay 4 have the potential to or will disturb sediment and in this way increase in the suspended sediment concentration and associated turbidity in the water column in the Buffalo River estuary. This will directly impact on water quality and indirectly impact biological communities. The construction activities include, but are not limited to:

- Site establishment.
- The dismantling, removal, and replacement of the existing structure at the Ferry Landing.
- Removal of existing concrete superstructure in the quay area.
- The installation of tubular and sheet piles at Quays 3 and 4.
- The removal of so-called quay furniture.
- The loss of material from temporary construction material stockpiles onsite, including the temporary storage of demolition waste from the Ferry Landing.

- The release of dust from material used to backfill the area between the new and the existing quay wall at Quays 3 and 4.

As discussed above, the Ferry Landing is in such a poor condition there is a danger of it catastrophically collapsing (see Figure 3). The existing structure will thus need to be dismantled and removed before it can be reconstructed. At present there is no detailed plan for the dismantling, removal, and reconstruction of the Ferry Landing structure, but it is inevitable this will require the use of concrete breaking, cutting, crushing, and drilling machinery. It is inevitable the dismantling of the existing Ferry Landing structure will lead to the generation and loss of dust, small pieces of concrete and stone, and sediment to the surrounding environment, including the estuary. If not properly managed the dismantling of the Ferry Landing structure could lead to the substantial loss by erosion of soil/material infill for the quay. Should this occur, it will increase the suspended sediment concentration and turbidity in the estuary water column. If not properly managed the dismantling of Ferry Landing structure could in an extreme scenario result in large heavy items, such as rocks and concrete, falling into the estuary. These items will mobilise sediment into the water column when they impact on the bottom.

The existing Quay 3 and 4 apron concrete superstructures will be removed. Quay furniture, including bollards, fenders, and ladders, will also need to be removed to allow construction to proceed. This will also require the breaking, cutting, crushing, and drilling of concrete and will result in the generation of highly alkaline fine-grained cementitious dust. If not properly managed the dust will enter the estuary and increase the suspended sediment concentration. Removal of the concrete superstructure will expose the caisson fill material below that might be blown by wind or carried by surface (rain) runoff into the estuary.

Piling creates shockwaves that disturb and mobilise fine-grained sediment into the water column.

Construction materials that might be blown by wind or eroded by rain/surface runoff will be stored onsite, such as backfill material, soil, cementitious material, and so on. The quay apron behind Quays 3 and 4 is impermeable, which will heighten the potential for the wash off of these materials by rainfall/surface runoff. There is a high probability some of this material will be blown by wind into the estuary from storage areas and during handling near the estuary edge.

The face of the new quay wall will project □4 m further into the estuary than the existing quay wall. The area between the new quay wall and existing quay wall will be backfilled with solid granular material or mass concrete that can transmit loads from the existing structure without deformation. It is inevitable that during the process of backfilling with granular fill, dust and particles of soil adhering to the fill material will be released as it is dropped into the area between the new and existing quay walls and will enter the estuary and contribute to the suspended solids concentration.

An increase in the suspended sediment concentration and turbidity in the water column in an aquatic ecosystem above the baseline can have numerous adverse effects on biological communities. In general, the higher the concentration of suspended sediment and the longer the period of exposure above the baseline the greater the risk of adverse effects (Berry et al., 2003; Wenger et al., 2018). Many aquatic biological communities, including those in ports and estuaries, can tolerate relatively short intense increases in the suspended solids concentration such as might occur during a high river discharge event associated with rainfall, but will be adversely affected if the increase is prolonged. Fish and invertebrates that live in, on, or near sediment are generally more tolerant of suspended sediment exposure than their pelagic counterparts given their natural association with sediment and the sediment-water interface, where the suspended concentration is naturally higher on average than in the water column (Sherk et al., 1974; Noggle, 1978; Wilber and Clarke, 2001; Berry et al., 2003). Fish and other mobile fauna can escape areas of high suspended sediment concentrations, but slow moving or sessile invertebrates cannot. An increase in the suspended sediment concentration and turbidity in the water column can affect the ability of fish that hunt by sight to capture their prey, affecting their foraging success or leading to a shift in their foraging strategy (Breitburg, 1988; Hecht and van der Lingen, 1992; de Jonge et al., 1993; Wilber and Clarke, 2001; Utne-Palm, 2002; De Robertis et al., 2003; Hedrick et al., 2006; Johansen and Jones, 2013; Wenger et al., 2017). The avoidance of areas of high suspended sediment concentration restricts access to normal foraging areas (Collin and Hart, 2015; Wenger et al., 2017). Excessive suspended sediment concentrations can clog or physically damage the feeding and respiratory organs (e.g. gills) of invertebrates and fish (Servizi and Martens, 1987; Kerr, 1995; Bash et al., 2001; Wilber and Clarke, 2001; Hess et al., 2015) with implications for respiratory ability, nitrogenous excretion, and ion exchange (Appleby and Scarratt, 1989; Wong, et al., 2013). The size of fish gills is proportional to their size, meaning the spaces between gill lamellae are smaller in larvae and juveniles. It is, therefore, likely that suspended sediment will more easily clog the gills and reduce their efficiency in smaller fish and larvae than in adult fish (Appleby and Scarratt, 1989). The eggs and larvae, and juvenile stages of fish are indeed generally more susceptible to suspended sediment than adult stages (Engell-Sørensen and Skyt, 2001; Wenger et al., 2017). Excessive suspended sediment concentrations can reduce the fitness and in extreme cases the survival of filter feeding invertebrates (e.g. mussels) that must process large amounts of sediment that is poor in organic material, causing them to use more energy than can be replaced by food intake (Widdows et al., 1979; Essink and Bos, 1985). Suspended sediment can also cause 'shading' that affects photosynthesis in micro- and macroalgae (Fredette and French, 2004; Wenger et al., 2017).

Certain construction activities for the proposed project, as discussed above, will disturb sediment, or will introduce soil and dust into the estuary and in this way will increase the suspended solids concentration and turbidity in the water column above the baseline. The sediment alongside the Ferry Landing and Quays 3 and 4 is comprised of a moderate to large amount of fine-grained material (mud) that is easily mobilised into the water column. Coarse heavy particles of sand will fall (back) to the bottom quickly (within seconds) near the point of disturbance or introduction. Fine-grained particles, such as silt and clay, have a low fall velocity and will in contrast remain in suspension for longer (hours to possibly days for very fine-grained material) and will be dispersed over a wider area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason. Nevertheless, it is unlikely a significant amount of suspended sediment will be dispersed over a wide area and the increase in suspended sediment concentrations and turbidity is anticipated to be site specific. As discussed above, the suspended sediment concentration and turbidity in the Buffalo River estuary water column is naturally often high and may be very high during periods of high river flow. Vessel propeller wash and periodically maintenance dredging in the port area, including the project area, also result in elevated suspended solids concentrations and turbidity. The biological communities in the Ferry Landing and Quay 3 and 4 area, including those that have colonised quay walls, are undoubtedly habituated to periodically elevated suspended sediment concentrations and turbidity. There are no known fauna and flora in the project area that are of special ecological, commercial, or social significance. Pelagic species and life stages will continue to use unaffected parts of the water column during construction. Construction will only occur during daylight hours. The increase in suspended sediment concentrations and turbidity will thus be intermittent, providing a measure of relief as the suspended sediment will disperse and settle from the water column between construction days. The intensity of this impact is thus assessed as minor and the duration temporary. The impact is fully reversible since the mobilisation of sediment will cease when construction ceases. The significance rating for this impact is thus VERY LOW.

11.3.7 Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities

The same construction activities that have the potential to directly impact on water quality and indirectly on biological communities by causing an increase in the suspended sediment concentration and turbidity in the water column (see Impact 6) will result in the deposition of suspended sediment beyond the area of disturbance or introduction. Areas of the estuary bottom that are directly and indirectly affected by construction activities will thus be impacted by the deposition of suspended sediment. Coarse heavy particles of sand will fall (back) to the bottom quickly (within seconds) near the point of disturbance or introduction. Fine-grained particles, such as silt and clay, have a low fall velocity and will remain in suspension for longer (hours to possibly days for very fine-grained material) and will be dispersed over a wider area depending on prevailing currents. The fine-grained sediment will eventually deposit in areas where and when the current is weakest (e.g. slack tide). Some of the fine-grained material could be re-mobilised by currents and be dispersed further on subsequent tides or when the current increases in strength for some other reason.

The excessive deposition of sediment can bury, smother, and crush biological communities, including benthic invertebrate infauna and poorly mobile, sessile, or sedentary epifauna, the eggs of invertebrates and fish that develop on the bottom, and in extreme cases can lead to the complete loss of benthic ecology (Miller et al., 2002). Most benthic invertebrate infauna live in the top 10 cm of sediment and rely on a connection (e.g. burrows) to the sediment-water interface for ventilation (respiration) and feeding. The 'excessive' deposition of fine-grained sediment (mud) on sandy sediment can lead to the clogging of the spaces between sand grains, displacing the fauna that live between the sand grains or retarding the exchange of oxygen with the overlying water, leading to the suffocation of benthic invertebrate fauna. Frequent repositioning to maintain a relative distance to the sediment-water interface, or the need by burrowing organisms to increase maintenance to prevent the infilling of burrows, requires that organisms shift their energy allotment from other functions, such as growth or reproduction. If the deposited sediment has a different grain size to the sediment existing before deposition it may alter the physical properties of the sediment, which can impact on bottom-dwelling fauna that prefer to live in or on sediment of a fairly specific grain size because of their need to maintain an open burrow or because of their mode of feeding, for example (Holland et al., 2005; Smit et al., 2006; Smit et al., 2008; Boon and Dalfsen, 2022). The deposition of muddy sediment on sandy sediment is generally more problematic than the reverse (Diaz and Boesch, 1977; Boon and Dalfsen, 2022). Many benthic invertebrate infauna and epifauna can migrate upwards through deposited sediment and may be relatively unimpacted by sediment deposition within reasonable limits (Maurer et al. 1979, 1981a, 1981b, 1982, 1986; Fredette and French, 2004; Wilber et al., 2007). Maurer et al. (1979) found that some benthic invertebrates can migrate through as much as 30 cm of deposited sediment, but other invertebrates are less tolerant of burial and smothering and may be significantly affected by even a thin layer of deposited sediment (Schaffner, 1993; Wilber and Clarke, 2007; Hendrick et al., 2016). The consequence of these impacts is usually an altered species diversity, abundance, and biomass of benthic invertebrate infauna and epifauna (Bolam and Rees, 2003; Bolam et al., 2011; Ware et al., 2010; Bolam et al., 2021), with attendant impacts to other ecosystem processes (e.g. fish that rely on invertebrates in the affected area as a food resource will be deprived of this resource). Biota will colonise areas where sediment has been deposited, and will recover to a species composition, abundance, and biomass comparable to that which existed before deposition provided the physical properties of the sediment are not immeasurably different as a consequence of the deposition. Depending on the intensity of sediment deposition, recolonisation may start immediately, but the recovery of benthic invertebrate communities to a comparable species composition, abundance, and biomass to that which existed before sediment deposition will take longer.

Benthic biological communities in the port area of the Buffalo River estuary are undoubtedly habituated to, and thus tolerant of a certain amount of sediment deposition since sediment (particularly the fine-grained fraction) in this area is regularly mobilised into suspension by vessel propeller wash and periodically by maintenance dredging (see Figure 21). Most of the sediment mobilised by these activities can reasonably be expected to settle on the estuary bottom, although an insignificant amount might be exported to the adjacent marine environment depending on the tidal state. The Buffalo River also introduces (largely fine-grained) suspended sediment into the estuary during periods of high rainfall (see Figure 21) and this also settles on the estuary bottom. Estuaries are known sediment depositional environments due to the usually weak currents that characterise these waters. Indeed, it is the introduced sediment and calm conditions that accounts for the need to periodically maintenance dredge the port area in the Buffalo River estuary. As discussed above, many benthic invertebrate infauna and epifauna are able to migrate through an appreciable depth of deposited sediment, although the smothering of less mobile forms and newly settled juveniles may be too much for them to tolerate and will lead their mortality. The volume of sediment that is mobilised into the water column by vessel propeller wash and maintenance dredging, or that is introduced by riverine flow in the Buffalo River estuary will undoubtedly far exceed the volume that will be mobilised into the water column in any day by construction activities. This is because construction of the new quay is likely to proceed sequentially from one end of the quay to the other. Furthermore, only a limited number of piles can be sunk in each day and piling will only take place in the daytime. This will allow benthic invertebrate infauna and epifauna time to migrate through or otherwise deal with sediment deposited on the bottom between deposition events (which may only last a few days as construction progresses). The sediment mobilised into the water column and then dispersed to settle elsewhere is unlikely to differ substantially in terms of its grain size from bottom sediment in the greater area near the project area. As discussed elsewhere, the sediment in the Buffalo River estuary is dominated by mud.

Construction activities will thus definitely mobilise or introduce sediment and dust into the water column. The sediment and dust will settle on the bottom and bury or smother benthic biological communities, with the possible attendant impacts as outlined above. Although fine-grained sediment and dust will probably be dispersed by currents over a fairly wide area, most of the sediment and dust will probably settle on the bottom near the point of disturbance or introduction. The impact is thus site-specific. Sediment and dust may be mobilised or introduced into the water column throughout the construction period if not properly controlled, but this will be intermittent and the effects of the deposition on biological communities are for the most part likely to be temporary in duration. However, the mobilisation or introduction of a large amount of sediment and dust, such as could possibly occur during the Ferry Landing rehabilitation, or frequent incidence of mobilisation and introduction, into the estuary may have longer-lasting effects and the duration is thus short-term. There appear to be no benthic invertebrate infauna or epifauna in that part of the port most likely to be impacted that are of special ecological, commercial, or social significance, and impacts on other components of the biological community in the estuary that may be indirectly affected, such as through a loss of food resources due to the direct impact, are likely to be insignificant. Benthic biological communities in the area where this impact is most likely are also already disturbed by vessel propeller wash and maintenance dredging and are thus probably habituated to the impact of sediment deposition. The intensity is thus considered low. However, there is uncertainty on how the Ferry Landing will be dismantled, which if not properly managed has the potential to introduce a considerable amount of sediment into the estuary. The assessment of this impact might need to be revisited when the procedure that will be followed for the dismantling of the Ferry Landing is finalised. The impact is reversible as its potential to occur will cease when construction ceases, and fauna will colonise and migrate through, or otherwise deal with the deposited sediment over time. The significance rating for this impact is thus LOW.

11.3.8 Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities

Piling and other construction activities for the proposed rehabilitation of the Ferry Landing, Quay 3, and Quay 4 will disturb the estuary bottom (e.g. through shock waves for percussive piling) and will mobilise sediment into the water column. The mobilisation of sediment can lead to the release of oxygen depleting substances into the water column. Oxygen depletion can occur when reduced iron, manganese, ammonia, nitrite, and hydrogen sulphide in the mobilised sediment is oxidised and by the mineralisation of exposed organic matter. The oxygen depleting substances will disperse in the water column depending on prevailing currents and the amount of sediment mobilised. A depletion in the dissolved oxygen concentration in the water column directly impacts on water quality and may indirectly affect components of biological communities that rely on an adequate supply of dissolved oxygen for their survival, depending on the magnitude of oxygen depletion and individual organism requirements and tolerances. Sessile and poorly mobile fauna that live in and on sediment in deeper water are often at the most risk because the oxygen concentration in the water column usually natural decreases from the surface to the bottom. Mobile fauna can in contrast can avoid areas of low oxygen concentration provided this does not occur through the water column over a large area.

The amount of particulate organic matter in the sediment sampled alongside Quays 3 and 4 in July 2022 was within the baseline (Table 1) and there was no evidence the sediment was anoxic (Figure 9). There is no information on nutrient concentrations in sediment porewater in the estuary but these are anticipated to be low based on the low particulate organic matter content (see Impact 9). The sediment alongside most of Quays 3 and 4 is already often mobilised into the water column to a far greater degree by vessel propeller wash than is likely to occur by construction activities, but this has not resulted in any apparent widespread or sustained depletion of the dissolved oxygen concentration in the water column in the estuary as established by periodic measurements made for the Long-Term Ecological Monitoring Programme for the Port of East London. Indeed, vessel propeller wash disturbance of the sediment probably contributes to limiting the excessive accumulation of particulate organic matter and nutrients and development of anoxia in sediment near the Ferry Landing and Quays 3 and 4.

A potential additional source of oxygen depletion associated with the proposed project is the decomposing remains of fauna and flora that currently colonise the quay wall at Quays 3 and 4, which will die when construction proceeds. The most substantial risk will occur if the remains of these fauna and flora sink to the bottom in relatively large amounts, which could lead to oxygen depletion and the development of anoxia in the sediment when they are degraded by oxygen consuming microorganisms. It is difficult to estimate the possible consumption of oxygen that might occur in this way since this will depend on the amount of organism remains that reach the bottom and whether these might be scavenged by other organisms (e.g. crabs). It is, however, unlikely the sheet pile fauna remains will sink to the bottom in a single pulse, but rather gradually since construction of the quay wall will proceed progressively. This will minimise the risk of significant oxygen depression.

Construction activities will thus mobilise sediment into the water column, and this will in turn probably release oxygen depleting substances into the water column. However, the area of sediment and associated porewater that will be disturbed by construction activities at any time will be so small in the context of the estuary water volume, and sediment will already have been disturbed by dredging before construction proceeds, that it is highly unlikely the oxygen depleting substances that might be released will reduce the oxygen concentration in the water column to any significant degree. Any reduction in the dissolved oxygen concentration that does occur will be temporary as the concentration will return to the baseline when construction activities cease disturbing the sediment at the end of each day, or even within a day. The dissolved oxygen concentration in the water column in the Buffalo River estuary is usually high. Biological communities in the estuary are nevertheless probably habituated to and tolerant of fluctuations in the dissolved oxygen concentration in the water column and motile fauna will be able to avoid areas where the dissolved oxygen concentration is temporarily depressed. However, as stated above it is highly unlikely the oxygen concentration will be depressed to any significant degree below the baseline. The intensity is thus anticipated to be minor, and the spatial extent of oxygen depletion to be site specific. This impact is fully reversible as the dissolved oxygen will quickly return to the baseline once the mobilisation of sediment ceases. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.9 Deterioration in water quality due to the release of nutrients from sediment by construction activities

Piling and other construction activities for the proposed rehabilitation of the Ferry Landing, Quay 3, and Quay 4 will disturb the estuary bottom (e.g. through shock waves for percussive piling) and will mobilise sediment into the water column. The mobilisation of sediment can lead to the release of nutrients dissolved in sediment porewater into the water column (Wainright and Hopkinson, 1997; Gibson et al., 2015). The mobilisation of particulate organic matter from the sediment may also result in an increase in nutrient concentrations when the matter is remineralised. A potential additional source of nutrient release with the proposed project is the decomposing remains of fauna that currently colonise the Quay 3 and Quay 4 walls, which will die when construction proceeds. The most substantial risk will occur if the remains of these fauna sink to the bottom in relatively large amounts, which could lead to a nutrient pulse when they are degraded by oxygen consuming microorganisms or are scavenged by other fauna. It is difficult to estimate the possible nutrient release that might occur in this way since this will depend on the amount of organisms affected at any time. It is, however, unlikely fauna on the entire quay wall will die in a single pulse but rather gradually as construction of the counterfort wall will proceed progressively. This will minimise the risk of nutrient release in a pulse.

An increase in nutrient concentrations can have a direct impact on water quality and in that way an indirect impact on biological communities. The release of small amounts of nutrients can positively impact on primary productivity by increasing nutrient availability to micro- and macroalgae (Lohrenz et al., 2004). A marked increase in nutrient concentrations, in contrast, can stimulate the excessive growth of micro- and macroalgae, leading to eutrophication that in turn can lead to a host of ecological problems (including depleting the dissolved oxygen concentration in the water column and sediment). There is no information on the concentrations of nutrients in sediment porewater in the Buffalo River estuary, but nutrient concentrations in the water column are often high and are a cause of the often poor water quality rating for parts of the estuary. The microalgal biomass in the estuary is also often high, presumably reflecting the high nutrient concentrations in the water column. The occurrence of microalgal blooms indicate that, under certain circumstances, the estuarine environment is susceptible to eutrophication. However, sediment in the project area is often mobilised by vessel propeller wash and periodically by maintenance dredging. These disturbances will release nutrients from the sediment porewater and probably result in the porewater concentration remaining low. The disturbance of sediment in the project area by vessel propeller wash will decrease significantly during the construction period as vessels will not berth at Quays 3 and 4 while construction proceeds, and this could result in an increase in nutrient concentrations in sediment porewater. The recently rehabilitated part of Latimer's Landing, which also involved the installation of a combination tubular steel and sheet pile wall like that for the proposed project, had no apparent marked effect on nutrient concentrations in the water column in the estuary as deduced from measurements made for the Long-Term Ecological Monitoring Programme for the Port of East London (the winter 2017 survey coincided with construction for the Latimer Landing project).

Construction activities for the proposed project will thus disturb sediment, and this will release nutrients into the water column. Any increase in nutrient concentrations that does occur will be temporary as the concentration will return to the baseline when construction activities cease at the end of each day, but may occur intermittently throughout the construction period. Any nutrients that are released will probably be rapidly diluted in the surrounding water column and any increase is thus likely to be site specific. Although the nutrients might add to the high nutrient concentrations in the water column in the estuary, the area of sediment and associated porewater that will be disturbed by construction activities at any time will be so small in the context of the estuary water volume that it is highly unlikely the released nutrients will excessively stimulate the growth of microalgae over and above the growth attributed to existing nutrient concentrations. The intensity will thus be minor. This impact is fully reversible since nutrient concentrations will return to the baseline when the disturbance of sediment ceases. The significance rating for this impact without mitigation is thus VERY LOW.

11.3.10 Deterioration in water and sediment quality due to the release of toxic chemicals from sediment by construction activities

Piling and other construction activities for the proposed rehabilitation of the Ferry Landing, Quay 3, and Quay 4 will disturb the estuary bottom (*e.g.* through shock waves for percussive piling) and will mobilise sediment into the water column. The mobilisation of sediment can lead to the release of toxic chemicals in the sediment into the water column. Toxic chemicals dissolved in porewater in sediment can be released directly into the water column. However, most toxic chemicals in sediment are immobilised by their complexation with sulphides, hydrous metal oxides of iron and manganese, and/or or adsorption onto sediment grains and particulate organic matter. The complexes are generally stable and largely insoluble in the usually low oxygen or anoxic conditions commonly found a few centimetres beneath the sediment surface, limiting their potential to pose a toxic risk to biological communities (Goossens and Zwolsman, 1996; Eggleton and Thomas, 2004). The main mechanism by which toxic chemicals are released from sediment during mobilisation is by the oxidation of these complexes. When sediment is mobilised or otherwise disturbed, oxygen permeates the sediment and destabilises the complexes, and may result in the partitioning of the bound chemicals into the dissolved phase (Eggleton and Thomas, 2004). The rate of metal desorption from complexes during sediment mobilisation is strongly influenced by properties of the sediment, including its grain size and the presence of sulphides, particulate organic matter, and hydrous metal oxides of iron and manganese (Goossens and Zwolsman, 1996; Eggleton and Thomas, 2004; Atkinson *et al*., 2007; Cantwell *et al*., 2008). Some chemical-particle complexes (*e.g.* between high molecular weight polycyclic aromatic hydrocarbons and particulate organic matter) are quite stable even in oxygenated conditions and these chemicals may not desorb from the suspended particulate matter, or the desorption process may be slower than the time it takes for the remobilised particulate organic matter to again settle from the water column onto the bottom.

The behaviour of toxic chemicals after repartitioning or suspension with sediment is complex, governed by the properties of the chemicals and various biogeochemical modifying factors such as the salinity, pH, and dissolved oxygen concentration of the water column (Eggleton and Thomas, 2004). The toxic chemicals may be dispersed in the water column by currents in the dissolved form or bound to suspended particulate matter by currents, but most chemicals are usually rapidly scavenged from the water column and deposited on sediment by flocculation, coagulation, and settlement. Reduced iron and manganese, for example, when oxidised during suspension rapidly scavenge metals and other compounds from the water column. As the compounds settle on the bottom, they are again reduced under anoxic conditions. Thus, while mobilisation may repartition chemicals into the dissolved phase, the increase in concentration usually persists for only a short period. The scavenged chemicals, or chemical-particle complexes mobilised into the water column may settle in a different area to that where the sediment was mobilised, causing the contamination of previously uncontaminated sediment, or adding to the contaminant load in already contaminated sediment. However, as stated above chemicals repartitioned into the dissolved phase are usually rapidly scavenged from the water column, which usually limits the extent of their dispersion.

The repartitioning of chemicals into the dissolved phase makes them more bioavailable than when adsorbed onto or buried in sediment. This is important because toxic chemicals can only exert a toxic effect if they are in a bioavailable form and organisms are actually exposed to the chemicals. An increase in toxic chemical concentrations impacts on water and sediment quality and may impact in turn indirectly impact on biological communities depending on each chemical's concentration and the tolerances of organisms to the chemical. Adverse impacts might occur by fauna and flora accumulating toxic chemicals in their tissue, leading to sub-lethal impacts such as reduced growth rates or an increase in their susceptibility to other stressors, and in extreme cases mortality (*e.g.* Sved and Roberts, 1995; Gregg *et al*., 1997; Crux-Rodríguez and Chu, 2002; Geffard *et al*., 2007; Tolhurst *et al*., 2007; 2009; Lotufo *et al*., 2010). The loss of biological communities through mortality may affect other biota by depleting food resources. Toxic chemicals can enter food webs through their bioaccumulation by fauna and flora, with sub-lethal impacts (Lotufo *et al*., 2010). Some toxic chemicals increase in concentration through successive trophic levels of food webs in a process known as biomagnification and in this way can pose a toxic risk to higher level consumers (*e.g.* sharks, dolphins) and humans that consume contaminated fish and shellfish.

The sediment sampled alongside the Ferry Landing and Quays 3 and 4 in July 2022 was not contaminated by metals, but the sediment in this area has been periodically metal contaminated to a low magnitude. Metals are thus unlikely to be released into the water column at concentrations that pose a toxic risk to biological communities when the sediment is mobilised. There is no information on the concentrations of other chemicals in sediment alongside the Ferry Landing and Quays 3 and 4. However, surveys made for the Long-Term Ecological Monitoring Programme for the Port of East London between 2015-2019 showed that sediment elsewhere in the Buffalo River estuary, including at a station ~100 m from Quay 3, was contaminated by one or more of polycyclic aromatic hydrocarbons, organochlorine pesticides, polychlorinated biphenyls, and butyltins. The chemical concentrations were, however, usually low, the area near the Dry-Dock area being the exception. It is impossible to determine if these chemicals are present in sediment alongside the Ferry Landing and Quays 3 and 4 without analysing the sediment, but if so they are likely to be present at a low concentration based on the findings for sediment elsewhere in the estuary. It is difficult to quantify the amount of toxic chemicals that might be released into the water column when the sediment is mobilised by construction activities based on chemical concentrations in the sediment alone because chemicals differ in their mobility and bioavailability depending on their chemical and mineralogical form and conditions in the water column (Baeyens *et al*., 2003; Nicolau *et al*., 2006; Nouri *et al*., 2011). Chemical concentrations measured in sediment are thus a poor predictor of their potential release from sediment – the fraction that is released by the mobilisation of sediment is usually lower than concentration measured in sediment. One approach to estimating the release of chemicals is the testing of sediment elutriates, which involves mixing known volumes of water and sediment, agitating the mixture to mimic the sediment mobilisation by dredging, and then analysing chemical concentrations in the water (elutriate). However, even this information will not provide and indication if the chemicals will exert a toxic effect unless the elutriate is tested for toxicity. Elutriate testing was not performed for this study (it is rarely performed in South Africa). However, sediment sampled alongside the Ferry Landing and Quays 3 and 4 in July 2022 was tested for toxicity to sea urchin embryo-larvae under a sediment-water interface testing regime. A sediment-water interface toxicity test simulates the release of toxic chemicals from bedded sediment into the water column. The testing showed that the sediment was not toxic to sea urchin embryo-larvae.

It is thus **highly unlikely** toxic chemicals will be released from sediment disturbed by piling and other construction activities at concentrations that will cause toxic effects to biological communities. The intensity is thus **minor**. Any chemicals that are released into the water column will probably be scavenged and re-deposited on the bottom within a short period after release and the impact is thus considered **site specific** and **temporary**. The impact is fully **reversible** as the release of toxic chemicals will cease when construction ceases and the chemicals will be dispersed and diluted over time. The significance rating for this impact without mitigation is thus **VERY LOW**.

11.3.11 Ecological impacts due to the temporary loss of quay wall biological communities

If the proposed project proceeds the new quay wall will be constructed in front of the existing quay wall. The area between the new and existing quay walls will be backfilled with solid material. The biological communities that have colonised the intertidal and subtidal parts of the existing quay wall, including algae, barnacles, mussels, sponges, ascidians, and associated communities of animals that live amongst these larger fauna and flora, will be destroyed by construction of the new quay wall. The subtidal parts of fenders, access ladders, and so on, have also been colonised by encrusting fauna and flora and these will also be destroyed when this quay furniture is removed to allow construction of the quay wall.

The loss of the quay wall biological communities will impact on the ecological productivity of the estuary and possibly also the neighbouring marine environment. Impacts on the ecological productivity of the neighbouring marine environment could occur through, for example, a decrease in the export of gametes, larvae and propagules from the encrusting fauna and flora on the quay wall, which will be a food source for marine fauna. It is not easy to estimate the loss in ecological productivity in the estuary or neighbouring marine environment since the productivity of the biological communities in the estuary has not been quantified. The loss of biological communities, and hence the decrease in ecological productivity will not be immediate for the entire quay wall as the new quay wall construction will proceed progressively from one end of the existing quay to the other end. Biological communities will colonise newly constructed parts of the quay wall as construction proceeds, but these may well be impacted by other construction activities and not be very productive during the construction period.

The loss of the quay wall biological communities and associated ecological productivity will be temporary since fauna and flora will colonise the new quay wall. The colonisation will probably be quite rapid, but it will take some time (possibly years) for a 'mature' biological community to develop. A benefit of the steel tube and sheet pile combination wall is that it will increase the available surface area for colonisation by encrusting fauna and flora when compared to a straight-faced quay wall with no indentations. Although this is a positive impact, its importance will be offset by the permanent loss of open water and bottom habitat (see Impact ?).

The loss in ecological productivity might also to be temporarily offset by a probable improvement in the status of benthic biological communities near Quays 3 and 4 during the construction period as the sediment habitat will no longer be disturbed by vessel propeller wash as vessels will not berth at the quays during this period. However, this will be temporary and once the quay construction is finished these communities will again be disturbed by vessel propeller wash and maintenance dredging.

The destruction of quay wall biological communities and associated loss in ecological productivity is an unavoidable consequence of the proposed project. The loss in ecological productivity is anticipated to be medium-term in duration since although biota will colonise the new quay wall it may potentially take years for the community to reach a similar species composition, abundance, and biomass to that which presently exists on the quay wall. The impact is anticipated to be of a low intensity since although biological communities and ecological productivity will be lost and modified this will be temporary, and is thus unlikely to have a major impact on the ecology of the port. The impact will be local since the loss in ecological productivity will impact on the wider estuarine environment and possibly also the adjacent marine environment, if only temporarily and to a minor degree. The impact is fully reversible since biological communities will colonise the new quay wall and these will probably resemble those presently on the quay wall in terms of species composition, abundance, and biomass, and hence also productivity. The significance rating for this impact without mitigation is thus LOW.

11.3.12 Ecological impacts due to the underwater noise

Construction activities for the proposed project will lead to the generation of underwater noise. The noise may arise from vibration and percussive piling, the engines of construction support vessels, and heavy machinery amongst other sources. The most significant source of underwater noise will be associated with piling. As mentioned above, a total of 172 tubular steel piles of a 914 mm diameter and 171 infill sheet piles will be driven into place using vibratory and percussive piling. Vibratory piling uses a vibratory hammer to insert piles, in contrast to percussive (or hammer) piling that uses a heavy weight (hammer) to ram piles into the substrate. Percussive piling generates a much higher level of noise than vibratory piling, which can be well above the ambient and can travel over considerable distances underwater. Steel tube piles give rise to higher noise outputs depending on their diameter than sheet piles. Some of the piles may eventually require drilling to anchor the piles into the bedrock. It is expected that two piles can be placed per day, meaning the piling period will last □86 (non-continuous) days assuming no delays are encountered. An estimated five infill sheet piles can be placed per day. Percussive piling uses a heavy weight (hammer) to ram piles into the substrate. There may also be a need to drill the tubular piles.

There is little information on the effect of anthropogenic noise on estuarine and marine invertebrates, but that which is available suggests that some benthic invertebrates do respond behaviourally to anthropogenic noise (Solan et al., 2016; Wang et al., 2022). Various invertebrates use mechanoreception to locate food and prey (e.g. Klages et al., 2002) and are probably sensitive to noise. Solé et al. (2022) exposed European common cuttlefish (Sepia officinalis) adults, larvae, and eggs to playback drilling and percussive pile driving sounds in the laboratory. After exposure, damage was observed in the statocyst sensory epithelia (hair cell extrusion) in adults compared to controls, and no anti-predator reaction was observed. The exposed larvae showed a decreased survival rate with an increasing received sound level when they were exposed to maximum pile-driving and drilling sound levels, but lower sound levels were not found to elicit severe damage. A decrease in the hatching success of eggs was observed with increasing received sound levels.

The potential effects of underwater noise on fish include a range of non-auditory tissue damage to mortality, auditory tissue damage that may permanently reduce hearing ability, a temporary reduction in hearing sensitivity, and behavioural effects such as startle (diving or tighter shoaling) or avoidance responses (Popper and Hastings, 2009; Mueller-Blenkle et al., 2010). Fish near (few meters) active percussive piling operations can be killed by underwater noise, while those within about 15 m can suffer serious non-lethal injury. Behavioural effects occur over large distances of up to □150 m, but potentially further. Although many fish will avoid an area of piling due to the impact of noise, small weak swimming fish and larvae carried by currents may or will be unable to avoid the area.

The potential effects of underwater noise on birds include causing diving them to move away from the area, in which case the consequence is essentially the same as habitat loss, albeit temporary. Underwater noise may also cause diving birds to temporarily interrupt their normal activity leading to, for example, reduced feeding rates, or increased energy expenditure through movement away from sources of disturbance.

Marine mammals use acoustics for communication, navigation, and foraging, and are particularly sensitive to underwater noise (Clark et al., 2009; Leunissen et al., 2019). Underwater noise emissions can result in disruption of foraging behaviour, displacement, masking of communications, disturbance, and injury (Carstensen et al., 2006; Clark et al., 2009; Tougaard et al., 2009; Thompson et al., 2010; Brandt et al., 2011; Paiva et al., 2015; Brandt et al., 2016; Leunissen et al., 2019). Stress-related responses from increased ambient and local noise levels can include rapid swimming away from ship(s), changes in surfacing, breathing, and diving patterns, changes in group composition, changes in migration routes, and changes in vocalisations (Richardson et al., 1995; Weilgart, 2007). The noise emitted by percussive piling can have serious, permanent impacts on the hearing of cetaceans at distances of up to ~250 m from the point of origin, while their behaviour may be affected at distances of 2.5 km pr more from the point of origin.

Construction activities, particularly piling, will thus generate underwater noise that will probably impact on fauna. Dolphins are known to periodically enter the estuary, presumably to feed. Underwater noise from percussive piling associated with the proposed project may propagate from the Buffalo River estuary into the adjacent marine environment and the spatial extent of this impact is thus regional. It is uncertain if there are pods of dolphins that permanently reside in the area near the estuary mouth, but this is unlikely. Dolphins do, however, regularly pass the estuary mouth. The impact on the most sensitive of fauna may be high in intensity in the case of piling. The impact will be short-term and is reversible as the generation of underwater noise will cease when construction ceases. The significance rating for this impact is thus MEDIUM.

11.3.13 Ecological impacts due to above water noise disturbance

Construction activities for the proposed project will lead to the generation of above water noise. The noise will arise from piling operations, the operation of generators and other machinery, vehicles, and construction support vessels amongst a host of other noise generating activities usually associated with construction sites. The above water noise will principally affect aquatic birds, which may as a result avoid the area near construction activities for the period that high noise levels are generated. The consequence is essentially the same as habitat loss (albeit temporary). A variety of birds use the area near the proposed project area for feeding and roosting, including Cape cormorants, Cape gannets, terns, kelp gulls, and African oystercatchers. The birds are undoubtedly habituated to and tolerant of noise associated with ongoing port activities but are not (at least regularly) exposed to sounds as intense as those that are generated by percussive piling. Even in the case of percussive piling some degree of habituation for some bird species will probably be an outcome (Hill et al., 1997). High levels of noise will not last all day as construction will be limited to daylight hours, meaning birds will be able to roost near the proposed project area. However, the noise will go on for some time and may cause sensitive birds to leave the area until construction ceases.

Construction activities, particularly piling, will generate above water noise that will probably impact on birds in the area. Birds that feed in, roost, or otherwise frequent the proposed project area are undoubtedly habituated to the prevailing above water noise associated with port operations. The intensity of noise generated by percussive piling will, however, exceed that generated by prevailing port operations and may present a substantial disturbance for the most sensitive birds. Some birds will probably become habituated to the above water noise, but others might leave the immediate area. Numerous bird species use the area near the proposed project area for foraging or roosting, including some that are vulnerable or endangered. Noise will be generated throughout the construction period, but piling, which will generate the largest amount of noise, will be restricted to daylight hours over a relatively short period. The impact intensity of thus considered moderate, the duration as medium-term, and the extent as site specific. This impact is fully reversible as birds will use the area once construction noise recedes. The significance rating for this impact without mitigation is thus MEDIUM.

11.3.14 Impact of altered quay wall geometry on hydrodynamics

The proposed project will result in the new quay wall projecting ~4 m further into the estuary than the existing quay wall. Changes to the geometry of quay walls and other infrastructure in ports can lead to changes in the strength and direction of currents and in this way can negatively impact on ecological processes by altering sediment erosion and deposition patterns and the flushing and turnover of the water column (and in the worst case scenario lead to the development of (periodically) stagnant conditions in the water column), and can concentrate the settlement of toxic contaminants on the bottom in specific areas. An altered current strength can affect the migration of fauna, such as larval or very small fish and invertebrates that recruit to estuaries. No modelling has been performed to determine how the altered geometry of the Ferry Landing and Quays 3 and 4 will impact on hydrodynamic processes in the Buffalo River estuary. However, the change will probably be insignificant considering the small increase in the projection of the quay wall into the estuary and because the new quay wall will be aligned essentially parallel to the existing quay wall and to the predominant tidal and riverine flow directions in the estuary. The changed estuarine dynamics are unlikely to have a significant impact on ecological processes.

A change in estuarine hydrodynamics will thus occur and will be permanent and irreversible. However, it is highly unlikely the changed hydrodynamics will have a significant impact on ecological processes and the intensity is thus minor. The impact will likely only affect a small area and is thus site specific. The significance rating for this impact is thus VERY LOW.

11.3.15 Ecological impact due to permanent habitat loss

The proposed project will result in the permanent loss of open water and sediment since the new quay wall will project □4 m further into the estuary than the existing quay wall. PRDW (2017) provide a frontage of 38 m for the Ferry Landing area, 378 m for Quay 3, and 110 m for Quay 4. As stated previously there is a misalignment of Quays 3 and 4, while part of the Ferry Landing is inset from Quay 3. Ignoring these minor differences in the extent to which the different areas project into the estuary and assuming the new quay wall will extend from the Ferry Landing through to the end of Quay 4, the project will result in the permanent loss of □2 100 m2 of sediment. The same surface area, and a volume of □20 600 m3 of open water will be lost. It is not possible to express the contribution of the volume of open water that will be lost as a proportion of volume of water in the Buffalo River estuary since the bathymetry of the area above the port is unknown. Marais (1988) provides a water volume for the estuary of 2 200 000 m3. If this is a reliable estimate, then the volume of open water that will be permanently lost because of the proposed project is <1% of the estuary water volume. Transnet National Ports Authority provides a water surface area of 17 300 000 m2. If the sediment surface area is assumed to be the same as the water surface area, then water and sediment surface area that will be lost because of the proposed project will be □0.012% of the water and sediment surface area in the estuary. Regardless of the precise dimensions of open water and sediment in the estuary, it is evident the area that will be lost because of the proposed project is small.

The permanent loss of open water and sediment will diminish the available habitat for pelagic and benthic biological communities. The permanent loss of open water and benthic habitat will impact on the ecological productivity of the estuary and may have a minor impact on the ecological productivity of the adjacent marine environment as these environments are connected. It is impossible to estimate the loss in ecological productivity as there is no information on the productivity of water column and benthic habitat in the proposed project footprint. The area and volume of open water and sediment habitat that will be permanently lost is, as stated above, small in relation to the overall open water and sediment habitat in the Buffalo River estuary and comparable habitat is available elsewhere in the estuary. The open water and sediment habitat that will be lost are already disturbed and are thus not in a pristine state. The loss of habitat will not result in habitat fragmentation since the extended quay will follow the line of the existing quay wall/shoreline.

The proposed project will thus result in the permanent loss of open water and sediment habitat. The loss is essentially irreversible since the quay wall extension will be designed for a 50-year service life. The volume and area of open water and sediment that will be lost is small in relation to the overall water volume and sediment in the estuary but will affect ecological processes beyond the development footprint and the spatial extent is thus local. The loss of open water and sediment will diminish the available habitat for biological communities but is unlikely to have population level effects nor a major effect on ecological processes in the estuary. Nevertheless, habitat will be permanently lost and the intensity is thus moderate. The significance rating for this impact without mitigation is thus LOW.

11.3.16 The damage and disruption of paleontological resources as preserved in its host rocks within the development footprint

SAHRIS paleomap noted that the proposed developmental site of East London port is high in paleontological resource potential. Considering the construction phase of the proposed reconstruction of the quay wall, which will entail foundation dismantling and rebuilding, the severe impact of the construction on the surficial geology is inevitable. Should there be fossil burial, this will be destroyed due to ground disturbance and disruption of lithological profile and sealed fossils within the subsurface, rendering the environment unavailable or insignificant for future scientific research.

11.3.17 Planning Phase-Employment creation

The planning phase of the proposed project will result in appointment of a range of experts such as consulting engineers for design and project management, environmental practitioners for conducting EIAs etc. This the positive and limited to the region, the magnitude is low and duration is short term. The probability of the impact occurring id definite.

11.3.18 Construction phase-employment creation

The investment that would be required by the construction phase of the proposed Relacement of Port Structures (Quay 3 & 4, and Ferry Landing) is R399m. It can therefore be considered as a reasonably large construction project. For this reason, a noteworthy outcome of this development, throughout its construction phase, will be the creation of 660 direct employment opportunities, most presumably in the semi-skilled category.3 Given the critical unemployment challenge in the Buffalo City Metro, job creation is an important impact of the proposed development.

The creation of direct employment opportunities is not the only job related advantage of the construction phase of the proposed development. A number of indirect and induced employment opportunities would naturally follow. The number of indirect and induced employment opportunities that will be created by the proposed development's construction phase and activities is estimated at 708.

The creation of employment opportunities (direct, indirect and induced jobs) is likely to have a considerable socio-economic impact in the form of increased economic activity, poverty alleviation and favourable socio-economic implications (such as improved access to and consumption of goods and services, greater freedom of choice, better quality of life, and so on) for the affected individuals and their dependants.

11.3.19 Skills development and transfer

The commitment by developers to recruit local labour, as far as possible, in order to benefit local communities in general and the unemployed in particular, is almost standard practice in South Africa when construction projects are proposed. The proposed Replacement of Port Structures (Quay 3 & 4, and Ferry Landing) is no different and a number of employment opportunities stand to be created within the semi-skilled category. This is likely to have a considerable socio-economic impact in the form of poverty alleviation and favourable socio-economic implications (improved access to and consumption of goods and services, greater freedom of choice, better quality of life and so on) for the affected individuals and their dependents.

One well-known limiting factor that is expected to complicate the prioritisation of local labour during the construction phase of the proposed development, is the educational attainment of the prospective labour force, particularly in the case of semi-skilled and unemployed workers. The twin problems of illiteracy and low levels of post-school education and/or training are clear obstacles in this case. Thus, in order to supply the construction phase of the proposed development with the necessary local labour, the developer will most likely have to engage in a process of skills development and transfer.

In a Metro that is burdened by poverty and high unemployment rates and where many of the unemployed may actually be unemployable without some form of intervention, skills development and transfer are likely to have a substantial socio-economic impact. The benefits would essentially revolve around the improved socio-economic mobility of people and should extend well beyond the construction phase of the proposed development. Relevant individuals would for example be able to sell their newly acquired skills within and beyond the boundaries of the local economy long after the completion of the construction phase.

11.3.20 Economic stimulation of BCMM

GDP provides a measure of the total economic and sectoral activity within a particular area (municipalities, regions, etc.). Expressed as the Rand (market) value of all final goods and services that are produced and sold within a given period of time, GDP is a well-known measure of the status of a municipality's economic activity. It can therefore be used to reflect the capability of a municipality to create, sustain and develop its own economy. Contributions to the GDP of any particular place therefore carry an obvious importance, something that is particularly associated with construction projects (Lewis, 2008; Nhlapo, 2013). Although the actual contribution of the proposed development to the local GDP may appear relatively small in real terms (albeit positive), it will nevertheless happen at a time when the local economy is struggling to recover in a post-Covid era, being burdened by the problem of energy insecurity in the country and a national economic slowdown. Given this context, the contribution of the proposed development to the local economy deserves to be mentioned here.

Higher levels of local economic activity normally follow the demand for goods and services (and the supply thereof) and this in turn is likely to culminate into various socio-economic benefits, such as employment creation and poverty reduction. The extent of this impact is of course a factor of the size and health of the local economy in question and the subsequent ability of local service providers to meet such demands. It follows that the more limited this ability, the more leakage will take place from the local economy as developers would be compelled to source relevant goods and services elsewhere (DBIS, 2008). Although some leakage will inevitably occur, albeit not much given the nature of the proposed development, the impact remains relevant in the context of the positive effect that the demand for goods and services will have on the local economy.

11.3.21 Secondary operational phase impacts

The following socio-economic impacts of the proposed Replacement of Port Structures (Quay 3 & 4, and Ferry Landing) is singled out here due to its relevance and socio-economic importance:

a) Enabling the economic continuity of the Port of East London.

The site of the proposed development represents a sizeable proportion of the Port of East London's berthing capacity as far as the loading / offloading general cargo is concerned. It therefore contributes positively to the functionality and economic continuity of the port (the ability to continue to perform the socio-economic and developmental role that it does, as noted in Section 2). In this context and with specific reference to the proposed development, Department of Social Development (n.d.) states that "Efforts to upgrade East London's harbour are critical with regard to the future competitiveness of the manufacturing industry (private enterprises and co-operatives)."

b) Contribution to economic recovery and development of the Buffalo City Metro.

The proposed development forms part of the effort by the Transnet National Ports Authority to play a positive role in local economic development by transforming the Port of East London into a major manufacturing hub. With reference to the proposed development "the latest infrastructure upgrades at the port will allow for larger vessels to call, expanding business opportunities to the wider Eastern Cape region in the process" (Freight, 2019). The relevance of this for the post-Covid economic recovery of the Buffalo City Metro is obvious and the socio-economic implications of investments such as the proposed development would therefore be perfectly aligned with national and provincial plans and policies, i.e. the National Development Plan, Integrated Urban Development Framework, Metropolitan Growth and Development Strategy, and other frameworks and plans which eventually feed into the Buffalo City Metro's Integrated Development Plan.

11.3.22 Policy and legislative context

There is a risk of non-compliance with the environmental laws and policies of South Africa which could lead to pollution of the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the noncompliance, being brought against the Applicant and the appointed contractors. The magnitude of the impact is very high, spatial extent is regional, duration is short term and the probability of the impact occurring is likely. This is a negative impact, and the significance is medium.

11.3.23 Scheduling of construction

The proposed project requires careful planning and scheduling so that construction activities take place during the driest times. The appointed contractor should avoid delays in the construction program and thus also avoid prolonged environmental impacts. Some delays are caused by natural events such as heavy rains. Thus, the timing of construction as well as the rate at which progress takes place may impact the environment as well as the surrounding businesses and communities. The impact is thus negative in nature but is reversible. The magnitude of the impact is low, spatial extent is site specific, duration is short term, and the probability is likely. This is a negative impact however the significance is low.

11.3.24 Air quality

The proposed development will entail potential air pollutants during construction which may be dust emanating from site preparation and excavations. Minor exhaust gases are expected to be emitted by construction vehicles, equipment and plant. The magnitude of the impact is low and the spatial extent is local, the duration of the impact is short term as the dust and other fumes emitted will subside when construction activity ceases, The probability of the impact occurring is highly likely. This is a negative impact however the significance is very low.

11.3.25 Disturbance of existing land uses and visual impact

During construction, the presence of large construction vehicles and plant may cause visual disturbance to the surrounding landowners and occupants. The stockpiling of material and equipment on site may also disturb the existing land uses. The internal roads within the port may also be inaccessible or have slow traffic due to delivery of materials to site. The magnitude of the impact is low and the spatial extent is site, the duration of the impact is short term as the impact will subside when construction activity ceases, The probability of the impact occurring is highly likely. This is a negative impact however the significance is very low.

11.3.26 Climate change

The infrastructure must be designed to be resilient against anticipated climate change events such changes in sea levels and wind and waves. It is important to understand that the proposed sheet pile wall design wall will be sufficient to prevent any overtopping and flooding of the port infrastructure from the sea. This would be a negative impact which is reversible at a high cost. The magnitude of the impact is medium, the spatial extent is local, the duration is long term and the probability of the impact occurring is likely.

11.3.27 Safety-injuries and fatalities during construction

It may be possible that there may be fatalities and injuries during construction due to failure of equipment, untrained workers of natural disasters. This is a negative impact and is reversible with mitigation such as training of workers and providing PPE. The magnitude of the impact is low and the spatial extent is site, the duration of the impact is short term as the impact will subside when construction activity ceases, The probability of the impact occurring is highly likely especially without mitigation.

11.3.28 Improved jetty stability and safety

The proposed project will result in a safer and structurally stable jetty which will allow the current transportation and berthing activities to continue. This is a positive impact with a medium magnitude, spatial extent is local, duration is permanent, and the probability is highly likely. This is a negative impact, and the significance is medium.

11.4Impact Assessment and Significance

A summary of all the identified preliminary impact, their associated phase, as well as their impact calculations and significance are presented in Table 18 below. The preferred alternative is labelled (Alt 1) and No-Go is identified as (Alt 2).

Table 18: Impact assessment and mitigation

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 1	-1	5	5	5	4	-60	-1	4	5	5	2	-28
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 1	-1	3	1	2	2	-12	-1	1	1	1	1	-3
3.Impacts to soil, sediment, and geology	Construction	Alt 1	-1	1	1	5	1	-7	-1	1	1	5	1	-7
4.Deterioration in water and sediment quality due to hazardous material	Construction	Alt 1	-1	4	2	4	4	-40	-1	1	1	2	2	-8

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
spills and leaks														
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Construction	Alt 1	-1	1	1	1	4	-12	-1	1	1	1	4	-12
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of constructi	Construction	Alt 1	-1	1	1	1	2	-6	-1	1	1	1	2	-6

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
on activities														
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Construction	Alt 1	-1	2	1	1	2	-8	-1	2	1	1	2	-8

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	Construction	Alt 1	-1	1	1	1	1	-3	-1	1	1	1	1	-3
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	Alt 1	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	Alt 1	-1	2	1	1	3	-12	-1	2	1	1	3	-12
11. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	Alt 1	-1	2	2	3	2	-14	-1	2	2	3	2	-14
12. Ecological impacts due to	Construction	Alt 1	-1	4	3	2	4	-36	-1	3	2	2	4	-28

		PRE-MITIGATION							POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
underwater noise														
13. Ecological impacts due to above water noise disturbance	Construction	Alt 1	-1	2	1	2	4	-20	-1	2	1	2	4	-20
14. Impact of altered quay wall geometry on hydrodynamics	Operation	Alt 1	-1	1	1	5	1	-7	-1	1	1	5	1	-7
15. Ecological impact due to permanent habitat loss	Operation	Alt 1	-1	3	2	5	2	-20	-1	3	2	5	2	-20

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
16. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	Alt 1	-1	2	2	5	2	-18	-1	2	2	5	2	-18
17.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Construction	Alt 1	-1	3	2	4	3	-27	-1	1	1	1	3	-9

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
18.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 1	-1	1	1	1	4	-12	-1	1	1	1	4	-12
19.Deterioration in water quality due to the release of nutrients from sediment during disposal	Construction	Alt 1	-1	1	1	1	1	-3	-1	1	1	1	1	-3
20.Employment creation	Construction	Alt 1	1	4	2	2	5	40	1	4	2	2	5	40
21.Skills development and transfer	Construction	Alt 1	1	4	2	2	5	40	1	4	2	2	5	40

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
22.Scheduling of Construction	Planning	Alt 1	-1	1	2	3	4	-24	-1	1	2	2	3	-15
23.Employment creation	Planning	Alt 1	1	1	2	2	3	15	1	1	2	2	3	15
24.Policy and Legislative Context	Construction	Alt 1	-1	5	2	3	3	-30	-1	3	2	3	2	-16
25.Air Quality	Construction	Alt 1	-1	2	2	2	3	-18	-1	2	2	2	2	-12
26.Disturbance of existing land uses and visual impact	Construction	Alt 1	-1	2	2	2	4	-24	-1	2	2	2	4	-24
27.Climate Change	Operation	Alt 1	-1	3	2	5	3	-30	-1	3	2	5	2	-20
28.Safety-Injuries and fatalities during construction	Operation	Alt 1	-1	5	3	2	3	-30	-1	3	2	2	2	-14
29.Improved Jetty	Operation	Alt 1	1	4	3	5	5	60	1	4	3	5	5	60

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
stability and safety														
30.Economic stimulation of BCMM	Operation	Alt 1	1	2	2	3	3	21	1	2	2	3	3	21
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 2	-1	1	2	5	4	-32	-1	1	2	5	4	-32
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 2	-1	1	1	2	1	-4	-1	1	1	2	1	-4
3.Impacts to soil, sediment, and geology	Construction	Alt 2	-1	1	1	5	1	-7	-1	1	1	5	1	-7

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	Alt 2	-1	2	2	4	1	-8	-1	2	2	4	1	-8
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
6.Deterioration in water quality due to increased suspended sediment	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
concentrations and turbidity caused of construction activities														
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Construction	Alt 2	-1	2	1	1	1	-4	-1	2	1	1	1	-4
8.Deterioration in water quality due to the release of oxygen depleting substance	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

		PRE-MITIGATION							POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
s from sediment by construction activities														
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
by construction activities														
11.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
12.Deterioration in water quality due to the release of nutrients from sediment during disposal	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
13. Ecological impacts	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
due to the temporary loss of sheet pile wall biological communities														
14. Ecological impacts due to underwater noise	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
15. Ecological impacts due to above water noise disturbance	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
16. Impact of altered quay wall geometry on hydrodynamics	Operation	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

			PRE-MITIGATION						POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
17. Ecological impact due to permanent habitat loss	Operation	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
18. Ecological impact due to habitat modification by the deck-on-pile structure	Operation	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
19.The damage and disruption of paleontological resources as preserved in its host rocks within the developm	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
ent footprints.														
20.Employment creation	Construction	Alt 2	1	1	1	1	1	3	1	1	1	1	1	3
21.Skills development and transfer	Construction	Alt 2	1	1	1	1	1	3	1	1	1	1	1	3
22.Scheduling of Construction	Planning	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
23.Employment creation	Planning	Alt 2	1	1	1	1	1	3	1	1	1	1	1	3
24.Policy and Legislative Context	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
25.Air Quality	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
26.Disturbance of existing land uses and visual impact	Construction	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3

PRE-MITIGATION									POST-MITIGATION					
Impact	Phase	Alternatives	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance	Nature	Magnitude	Spatial Extent	Duration	Probability	Significance
27.Climate Change	Operation	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
28.Safety-Injuries and fatalities during construction	Operation	Alt 2	-1	1	1	1	1	-3	-1	1	1	1	1	-3
29.Improved Jetty stability and safety	Operation	Alt 2	1	1	1	1	1	3	1	1	1	1	1	3
30.Economic stimulation of BCMM	Operation	Alt 2	1	1	1	1	1	3	1	1	1	1	1	3

11.5 Assessment of Potentially Significant Impacts

For the purposes of this EIA Study, potentially significant impacts are defined as those impacts with a significance score greater than 10 and up to greater that 60 points. These are provided in the table below:

Table 19: Assessment of potentially significant impacts

Impact	Phase	Alternatives	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Reversibili	Loss of	Cu,ulative	PF	Final Significance
1.Impacts due to the ingress of non-hazardous solid waste into the port	Construction	Alt 1	-1	5	5	5	4	-60	-1	4	5	5	2	-28	1	1	2	1,333333	-37,3333
2.Environmental deterioration due to spillages from portable toilets	Construction	Alt 1	-1	3	1	2	2	-12	-1	1	1	1	1	-3	2	1	2	1,666667	-5
3.Deterioration in water and sediment quality due to hazardous material spills and leaks	Construction	Alt 1	-1	4	2	4	4	-40	-1	1	1	2	2	-8	2	1	1	1,333333	-10,6667
4.Ecological impacts due to the spillage of construction material and demolition	Construction	Alt 1	-1	1	1	1	4	-12	-1	1	1	1	4	-12	1	1	2	1,333333	-16

Impact	Phase	Alternatives	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Reversibili	Loss of	Cu,ulative	PF	Final Significance
debris into the port																			
5.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Construction	Alt 1	-1	2	1	1	3	-12	-1	2	1	1	3	-12	2	1	1	1,333333	-16
6.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	Construction	Alt 1	-1	1	1	1	4	-12	-1	1	1	1	4	-12	3	1	2	2	-24

Impact	Phase	Alternativ es	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Reversibili	Loss of	Cu,ulative	PF	Final Significan ce
7. Ecological impacts due to the temporary loss of sheet pile wall biological communities	Construction	Alt 1	-1	2	2	3	2	-14	-1	2	2	3	2	-14	3	1	2	2	-28
8. Ecological impacts due to underwater noise	Construction	Alt 1	-1	4	3	2	4	-36	-1	3	2	2	4	-28	2	1	2	1,666667	-46,6667
9. Ecological impacts due to above water noise disturbance	Construction	Alt 1	-1	2	1	2	4	-20	-1	2	1	2	4	-20	2	1	2	1,666667	-33,3333
10. Ecological impact due to permanent habitat loss	Operation	Alt 1	-1	3	2	5	2	-20	-1	3	2	5	2	-20	1	2	1	1,333333	-26,6667
11.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Construction	Alt 1	-1	3	2	4	3	-27	-1	1	1	1	3	-9	1	2	1	1,333333	-12

Impact	Phase	Alternatives	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Nature	Magnitud	Spatial	Duration	Probabilit	Significan	Reversibili	Loss of	Cu,ulative	PF	Final Significance
12.Employment creation	Construction	Alt 1	1	4	2	2	5	40	1	4	2	2	5	40	2	1	1	1,333333	53,33333
13.Skills development and transfer	Construction	Alt 1	1	4	2	2	5	40	1	4	2	2	5	40	2	1	1	1,333333	53,33333
14.Scheduling of Construction	Planning	Alt 1	-1	1	2	3	4	-24	-1	1	2	2	3	-15	3	1	1	1,666667	-25
15.Policy and Legislative Context	Construction	Alt 1	-1	5	2	3	3	-30	-1	3	2	3	2	-16	2	1	1	1,333333	-21,3333
16.Air Quality	Construction	Alt 1	-1	2	2	2	3	-18	-1	2	2	2	2	-12	2	1	1	1,333333	-16
36.Disturbance of existing land uses and visual impact	Construction	Alt 1	-1	2	2	2	4	-24	-1	2	2	2	4	-24	3	1	2	2	-48
17.Climate Change	Operation	Alt 1	-1	3	2	5	3	-30	-1	3	2	5	2	-20	2	1	2	1,666667	-33,3333
18.Safety-Injuries and fatalities during construction	Operation	Alt 1	-1	5	3	2	3	-30	-1	3	2	2	2	-14	2	1	2	1,666667	-23,3333
19.Improved Jetty stability and safety	Operation	Alt 1	1	4	3	5	5	60	1	4	3	5	5	60	2	1	2	1,666667	100
20.Economic stimulation of NMBM	Operation	Alt 1	1	2	2	3	3	21	1	2	2	3	3	21	2	1	2	1,666667	35

11.6 Mitigation Measures

Appendix 3 of the EIA Regulations, 2014 requires that possible mitigation measures that could be applied to avoid or mitigate negative impacts and optimize positive impacts must be identified in the EIA Report. Many of the impacts can be readily mitigated and it is not foreseen that they are likely to pose a significant risk. Where necessary, the EMPr will identify and recommend specific mitigation measures applicable to the project.

Error! Reference source not found. identities mitigation measures that have been proposed by specialists in the respective reports as well as those tabled by the EAP as identified during the Environmental Impact Assessment. These mitigation measures will also be included in the EMPr for implementation during the construction and operational phases.

Table 20: Mitigation measures

Impact	Nature	Mitigation measures
1.Impacts due to the ingress of non-hazardous solid waste into the estuary	Negative	• The construction contractor must provide comprehensive and compulsory environmental awareness training for the site workforce. The training must sensitise construction personnel to the negative environmental impacts of non-hazardous solid waste (especially plastic waste) on estuarine and marine environments and the consequent need to limit the ingress of such waste into the estuary. Environmental awareness training should be ongoing through the life of the project for the workforce involved in the project since inception and must be provided to contractor personnel appointed and brought onsite after project inception (*e.g.* sub-contractors). • A reduce, reuse, recycle waste philosophy should be followed at the construction site. • The intentional disposal of non-hazardous solid waste into the estuary must be strictly prohibited. Procedures to remove personnel from site if they have received environmental awareness training yet intentionally dispose of non-hazardous solid waste into the estuary should be formulated, and if necessary, implemented. • Construction personnel must be encouraged to collect plastic litter and other non-hazardous solid waste they see in the construction area, even if it does not originate from the construction site. • If necessary, litter sweeps should be carried out across the construction site. • If non-hazardous solid waste from the construction site enters the estuary this must be recovered immediately where practicable. This might be difficult from the quayside, but pool cleaning nets can be used for this purpose if a construction support vessel is available. • Onsite temporary storage areas for non-hazardous solid waste must be clearly demarcated, signposted, and maintained. These should ideally be situated as far as practicable from the water's edge. • Bins, skips, and/or other receptacles for the temporary storage of non-hazardous solid waste must be sealed and secured to avoid them becoming a source of litter in the estuary, noting the proposed project area is often characterised by gale force winds that can blow plastic and other light non-

Impact	Nature	Mitigation measures
		hazardous solid waste from unsealed receptacles, and can blow light waste receptacles over. • Non-hazardous solid waste receptacles must be vermin proof. • Non-hazardous solid waste must be regularly removed from the construction site and disposed at a registered waste disposal site in accordance with national and local waste legislation, using a licensed waste disposal contractor. The waste contractor must provide proof the waste was disposed at a registered waste disposal site. The contractor should keep such records onsite for the benefit of an Environmental Control Officer. • Non-hazardous solid waste receptacles must not be washed onsite unless the wash water is captured and disposed to sewer. The washing water must not be allowed to enter surface runoff channels or stormwater drains as these will flow to the estuary.
2.Deterioration in water and sediment quality due to spillages from portable toilets	Negative	• Portable toilets must be maintained in a good, clean condition. • Portable toilets must be regularly checked for signs of leaks. Should a leak be found a sorbent material must be used to contain and absorb the waste. The portable toilet should be removed and replaced as soon as is practically possible and the sorbent material used to clean the leaked waste must be treated as hazardous waste and disposed accordingly. • Portable toilets must be placed in areas where there is little possibility of them being toppled over by the gale force winds that are common in the proposed project area. If necessary, portable toilets must be secured to the ground to avoid them being toppled over by wind or any other cause. • Portable toilets must be placed in areas where there is little possibility of potential leaks or overflows reaching the estuary. Portable toilets should not be positioned near surface (stormwater) runoff drains or surface water drainage areas as these will inevitably lead to the estuary. If these controls are not possible then portable toilets must have secondary containment. • Portable toilet waste must be regularly removed from site by a licensed waste disposal contractor and disposed at a permitted wastewater treatment works. The waste disposal contractor must provide proof of that the waste was disposed at a registered wastewater treatment works. The contractor should keep such records onsite. • If other forms of temporary sanitary facilities are provided onsite, such as showers, the water must either be adequately contained in storage devices until it can be removed from the site or these must be connected to the existing sewer infrastructure. .
3.Impacts to soil, sediment, and geology	Negative	As little geological material should be removed or brought onto the construction site as possible, and the geological material disturbed should be restricted to the minimum.

Impact	Nature	Mitigation measures
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	Negative	General • A Hazardous Material Spill Response and Contingency Plan must be developed by the Contractor/s. • The Hazardous Material Spill Response and Contingency Plan must identify appropriate response procedures in the event of a hazardous material spill on land and in water. The plan must provide specific responses for spills of different types of hazardous materials that may be handled onsite. • Hazardous materials must be stored and handled in accordance with appropriate legislation and standards, including the Hazardous Substances Act (Act No. 15 of 1973) and Occupational Health and Safety Act (No. 85 of 1993). • Hazardous material spills and leaks must be reported immediately. The contractor personnel to whom a spill or leak must be reported must be outlined in the Hazardous Material Spill Response and Contingency Plan. The plan must also outline subsequent lines of reporting as deemed necessary (*e.g.* Transnet National Ports Authority, relevant authorities). • Spill containment and clean-up kits must be readily available onsite in areas where there is a risk of a hazardous material spill or leak and must be appropriate to the type of possible spill or leak. • Responsible and trained personnel must be available to deal with hazardous material spills and leaks. Training/drills must be implemented to enable personnel to respond appropriately to hazardous material spills and leaks. • Appropriate methods for the disposal of cleaned up spilled material and clean-up materials must be identified in the Hazardous Material Spill Response and Contingency Plan – this material must not be disposed with 'normal' waste but rather at an appropriately licensed waste disposal site. • The intentional disposal of hazardous materials into the estuary or into stormwater drains and surface drainage channels is strictly prohibited. Procedures to remove contractor personnel from site if they have received environmental awareness training yet are observed intentionally disposing of hazardous waste into the estuary or into stormwater or other drainage channels that lead to the estuary should be formulated, and if necessary, implemented. Construction personnel must be educated that stormwater drains lead to aquatic ecosystems, and in the case of the construction site for the proposed project these will lead to the estuary. • All construction personnel must receive comprehensive environmental awareness training and must be sensitised to the negative environmental impacts of hazardous material spills and leaks on the environment. Environmental awareness training must be ongoing through the life of the project.

Impact	Nature	Mitigation measures
		• Only authorised and trained personnel must be allowed to handle hazardous materials. <u>Landside</u> • Develop a site drainage plan that shows the positions of sewers, surface drainage channels, and stormwater drains, including where the channels and drains flow into the estuary. • Only authorised and trained personnel must be allowed to refuel or lubricate construction machinery, equipment, and vehicles, and to perform emergency repairs of machinery, equipment, and vehicles onsite. Refuelling of construction machinery, equipment, and vehicles, and emergency repairs of the same onsite must take place in areas demarcated for this purpose. These areas must be as far as practically possible from the edge of the estuary, on hard topped (impermeable) surfaces, and must include measures to prevent the migration of possibly spilled or leaked hazardous material from the area (*e.g.* bunding, drip trays). If construction machinery and equipment cannot be easily removed for refuelling but this must be down from a bowser, a drip tray must be used to capture any spillage that might occur. • No routine maintenance (servicing) of construction machinery, equipment, and vehicles should be performed onsite. However, it is recognised that it might not be possible to easily move certain construction machinery and equipment that might require emergency repairs to a dedicated repair site (*e.g.* pile driving machinery). In this case emergency repairs should be allowed onsite, but the contractor and Transnet National Ports Authority must reach agreement in this regard. • Construction machinery, equipment, and vehicles must be properly maintained and regularly checked for leaks of hazardous materials. No vehicles should be allowed onsite if they have visible leaks, including the vehicles of suppliers. • Hydraulically operated machinery should ideally use a synthetic biodegradable hydraulic oil. • Hazardous material storage containers must be labelled, sealed, and stored in accordance with Material Safety Data Sheet requirements. • Only authorised and trained personnel must be allowed access to areas where hazardous materials are stored or used. Personnel with responsibilities for the use, handling, and storage of hazardous materials must be provided with competency training and environment, health, and safety training. The training should enable the personnel to perform their tasks efficiently without resulting in any contamination, as well as knowing the appropriate actions to take in response to an emergency (*e.g.*

Impact	Nature	Mitigation measures
		fire) or spill incidents. • All hazardous materials must be stored with adequate spill protection (bunding) in secured (locked) and covered areas to prevent wash-off of hazardous material by rainfall/surface runoff as far as is practicable (fuel bowsers, for example, might need to be stored in the open). Secondary containment (including bunding) must be appropriate to the volume and nature of the hazardous material being stored but should at a minimum be ≥110% of the volume of the stored material. The base and bund walls must be impermeable to the material stored and of adequate capacity. • Hazardous materials storage and handling areas should not be positioned near surface (stormwater) runoff drains or surface water drainage areas as these will lead to the estuary. If this is impossible, stormwater drains must have protection facilities. • The volume of hazardous materials stored onsite should be kept to the minimum practicable. • A register/inventory of chemical and hazardous materials stored/used on-site should be maintained and regularly updated. • Construction machinery, equipment, and vehicles must not be washed onsite unless this is unavoidable, and measures are in place to retain and then remove the wash liquid (*e.g.* in conservancy tanks). • Photographic records of hard surfaces should be maintained to provide an Environmental Control Officer (if required) with evidence that hazardous material spills and leaks have not occurred, or if they did occur were properly contained and cleaned. • Sufficient, marked receptacles for the disposal of hazardous waste, such as oily rags, sorbent material used to clean up spills, and so must be present onsite. <u>Waterside</u> • Construction vessels must be properly maintained and regularly checked for leaks of hazardous materials. • Emergency equipment to contain spills on water must be easily accessible, including floating booms. Fuel tanks of small vessels should not be refilled onboard, but at a dedicated site on land.
5. Ecological impacts due to the spillage of construction material and demolition debris into the estuary	Negative	• A demolition and reconstruction method for the Ferry Landing should be prepared before any demolition and reconstruction work take place, to identify the most practicable and safest strategy for dismantling the existing infrastructure while at the same time minimising the loss of materials into

Impact	Nature	Mitigation measures
		the estuary. This is because the greatest potential for the entry of demolition waste will be during this phase of the project. The survey should identify materials that can be reused or recycled (*e.g.* metal items) and procedures to recover large items that might be lost into the estuary. The method should also identify the most practicable strategy for reconstructing the Ferry Landing such that this minimises impacts on the estuary. Based on the method it might be necessary to reconsider the potential impacts identified for the dismantling and reconstruction of the Ferry Landing and to identify appropriate mitigation. • During demolition alongside and over water, structurally adequate debris shields should be used where practicable to contain debris and prevent it from entering the water. • The intentional disposal if construction material and waste into the estuary must be strictly prohibited. Any construction material and waste spilled onto the quay apron must not be swept into the estuary but must be recovered and disposed at an appropriate waste disposal site by a licensed contractor. • Implement appropriate controls to minimise wind and surface runoff erosion of construction materials stored onsite, including soil and other fine-grained materials. If erosion from construction material stockpiles onsite becomes a problem, then these must be covered. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the water's edge as possible. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed is excessive. • Fresh concrete and cement are highly alkaline and corrosive and can cause significant water and sediment quality impairment. The use of wet concrete and cement near, over, and in the estuary thus requires careful control to minimise the risk of spillage. Wherever possible, pre-cast concrete structural elements should be used. • Concrete and cement batching should ideally not occur at the construction site but concrete and cement should rather be delivered in ready-mix form. It is, however, acknowledged that some batching will probably be required at the construction site. • If concrete is poured with a concrete pump, ensure that hoses and couplings are sealed and secured.

Impact	Nature	Mitigation measures
		• Concrete forms or tubular piles must not be filled to overflowing. • For concrete placed under water, fast-setting concrete should be used to limit losses from shuttering and to minimise the period over which impacts can occur. • Concrete should ideally not be poured when the weather is adverse. • Concrete forms must be properly sealed to prevent the loss of concrete into the estuary. Concrete mixing and pouring equipment must not be washed onsite unless this unavoidable. In these instances the wash water must be collected in a dedicated wastewater collection system and disposed of appropriately.
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	Negative	• A demolition and reconstruction method survey for the Ferry Landing should be performed prior to any demolition or reconstruction work, to identify the most practicable and safest strategy for dismantling the existing infrastructure while at the same time minimising the loss of materials into the estuary. This is because the greatest potential for the entry of fine-grained materials is during this phase of the project. The survey should identify materials that can be reused or recycled (*e.g.* metal items) and procedures to recover large items that might be lost into the estuary. The survey should also identify the most practicable strategy for reconstructing the Ferry Landing such that this minimises impacts on the estuary. Based on the survey it might be necessary to reconsider the potential impacts identified for the dismantling and reconstruction of the Ferry Landing, and to identify appropriate mitigation. • The intentional disposal of construction material and waste into the estuary must be strictly prohibited. Any construction material spilled onto the quay apron must not be swept into the water but must be recovered and reused, or must be disposed at an appropriate waste disposal site by a licensed contractor. • During demolition works over water or near the water's edge, debris shields should ideally be used to contain debris and prevent it entering the water. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the estuary edge as possible, and on level ground. Stockpiles of construction materials must not be stored near surface runoff (stormwater) drains or surface runoff drainage channels.

Impact	Nature	Mitigation measures
		• If losses from construction material stockpiles onsite become a problem, these must be covered with a tarpaulin or similar fabric. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed is excessive or during heavy rainfall. If increases in suspended sediment concentrations are observed to be more frequent and wide ranging in spatial extent than predicted, construction methods must be reviewed to identify areas for improvement to prevent this occurrence.
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	Negative	• A demolition and reconstruction method survey for the Ferry Landing should be performed prior to any demolition or reconstruction work, to identify the most practicable and safest strategy for dismantling the existing infrastructure while at the same time minimising the loss of materials into the estuary. This is because the greatest potential for the entry of fine-grained materials is during this phase of the project. The survey should identify materials that can be reused or recycled (*e.g.* metal items) and procedures to recover large items that might be lost into the estuary. The survey should also identify the most practicable strategy for reconstructing the Ferry Landing such that this minimises impacts on the estuary. Based on the survey it might be necessary to reconsider the potential impacts identified for the dismantling and reconstruction of the Ferry Landing, and to identify appropriate mitigation. • During demolition over water, construct structurally adequate debris shields to contain debris and prevent it from entering the water. • Implement appropriate controls to minimise wind and surface runoff erosion of construction materials stored onsite, especially soil and other fine-grained materials. • Where practicable and possible, minimise the amount of construction materials stored onsite that can be easily mobilised or eroded by wind and rain. • Where practicable and possible, store stockpiles of construction materials that can be easily mobilised or eroded by wind and rain as far from the water's edge as possible, and on level ground. Stockpiles of construction materials must not be stored near surface runoff (stormwater) drains or surface runoff drainage channels. • Where practicable and possible, and without unduly delaying the project, the handling of construction materials that can be easily mobilised by wind (such as soil) should be avoided when the wind speed

Impact	Nature	Mitigation measures
		is excessive. • If losses from construction material stockpiles onsite become a problem, then these must be covered. • The intentional disposal of construction material and waste into the estuary must be strictly prohibited. • Any construction material and spilled onto the quay apron must not be swept into the estuary but recovered and reused, or must be disposed at an appropriate waste disposal site by a licensed contractor. If increases in suspended sediment concentrations are observed to be more frequent and wide ranging in spatial extent than predicted, construction methods must be reviewed to identify areas for improvement to prevent this occurrence.
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	Negative	None required due to the very low significance rating.
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	Negative	No mitigation is required due to the very low significance rating.
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	Negative	No mitigation is required considering the VERY LOW significance rating for this impact.
11. Ecological impacts due to the temporary loss of quay wall biological communities	Negative	None required due to very low significance rating. No mitigation is in fact possible.
12. Ecological impacts due to underwater noise	Negative	• In so far as conditions permit, vibratory piling should be used in preference to percussive piling. • Piling should ideally be limited to a time outside the breeding period for fauna likely to be most adversely impacted by underwater noise, since noise exposure might force fauna to forage or breed in sub-optimal areas or to avoid the area entirely. The ideal period is autumn/winter. It is, however, acknowledged that this might not be practical for the project and that the piling period may extend over several months. • A pre-piling survey for the presence of marine mammals (in this case likely to be restricted to dolphins) of the area near the piling activity should be performed for 15 minutes. If dolphins should be observed, piling must not commence until at least 15 minutes after dolphins were last observed.

Impact	Nature	Mitigation measures
		It is especially important to ensure that dolphins left the area in the direction of the estuary mouth, to avoid them being trapped in the upper part of the estuary by an underwater noise barrier. • A 'soft-start'/'ramp-up' regime should be followed at the commencement of piling on each day to allow those fauna that can an opportunity to move away from the area before the sound pressure increases to a level that they might be injured. This procedure should also be followed if there is a temporary halt in piling on any given day. • If dolphins are observed near the piling operation when in full power, there is no need to cease piling as the dolphins can be assumed to have entered the area 'voluntarily' and to not be overly disturbed by the underwater noise. • Driving tubular steel piles into the substrate one at a time will reduce the magnitude of underwater noise exposure. However, this will prolong the period over which high intensity underwater noise is generated by piling. No recommendation is thus made on whether piles should be driven individually or concurrently, although it is probable this will ne individually. • If dead fish are observed near the piling operation the ramp up regime should be lengthened.
13. Ecological impacts due to above water noise disturbance	Negative	• In so far as conditions allow, vibratory piling must be used in preference to percussive piling. • Piling should ideally be limited to a time outside the breeding period for fauna likely to be most adversely impacted by underwater noise, since noise exposure might force the fauna to forage or breed in sub-optimal areas or to avoid the area entirely. The ideal period is autumn/winter. It is, however, acknowledged that this might not be practical for the project and that the piling period will extend over many months. • A 'soft-start'/'ramp-up' regime should be followed at the commencement of piling on each day to allow any dolphins that might not have been observed and fish to move away from the area before the sound pressure increases. This procedure should also be followed if there is a temporary halt in piling on any given day. • Driving tubular steel piles into the substrate one at a time will reduce the magnitude of underwater noise exposure. However, this will prolong the period over which high intensity underwater noise is generated by piling. No recommendation is thus made on whether piles should be driven individually or concurrently, although it is probable this will be individually. .
14. Impact of altered quay wall geometry on hydrodynamics	Negative	None.

Impact	Nature	Mitigation measures
15. Ecological impact due to permanent habitat loss	Negative	None.
16.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	Negative	• The initial mitigation involves the detailed assessment of geological detrital for the paleontological footprints. •The unearthing of the geological portion of the development area must be done with precautions and due observation, considering the possibility of discovering new paleontological data. • Though the present deduction suggests the mutilation of the development footprints, should a fossil discovery be made, the SAHRA must be reached to oversee the extraction and safeguarding of the resource for sampling and preservation purposes. • A licensed or professional paleontologist must extract and recover the fossil.
17.Employment creation	Positive	No mitigation required, however, use of local labour and businesses wherever possible is encouraged.
18.Skills development and transfer	Positive	No mitigation required, however, use of local labour and businesses wherever possible is encouraged.
19.Scheduling of Construction	Negative	• The duration of the construction phase should be kept to a minimum, to reduce the period of disturbance on fauna; and • Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, sediment traps must be used to ensure the watercourses are not negatively impacted by construction activity
20.Employment creation	Positive	Use of local labour and Small to Medium Enterprises is recommended whenever it is possible.
21.Policy and Legislative Context	Negative	• Application for required environmental authorisations and licences prior to commencement of construction. • The applicant must appoint an ECO to monitor compliance throughout construction by undertaking monthly audits until rehabilitation is completed. The contractor's appointed DEO must be on site on a daily basis to monitor implementation of the environmental specifications contained in this EMPr and all authorisations • Copies of all applicable licenses, permits and managements plans (EA, EMPr, Water Use Licenses, Permits, etc.) must be always available on-site. Should ECO audits identify that additional authorisation is required during construction due to non-compliance or deviation from the approved EMPr, the contractor will be responsible for the process of EA application. • Environmental Awareness Training must be provided by the ECO at the start of the construction phase all personnel involved in the project.
22.Air Quality	Negative	Cleared surfaces must be dampened whenever possible, especially during dry and windy conditions, to avoid excessive dust generation.

Impact	Nature	Mitigation measures
		• Any soil excavated, and not utilised for rehabilitation, must be removed from site or covered and no large mounds of soil may be left behind after construction. Record daily dust observations, and where excessive dust is found, detail measures implemented to control dust • Dust suppression using water trucks or a hosepipe
23.Disturbance of existing land uses and visual impact	Negative	• The construction footprint must be surveyed and demarcated prior to construction commencing to ensure that there is no unnecessary use of land areas within the port. • Laydown and stockpiling of construction materials must be done in areas that have been approved by the ECO and Engineer. • No construction related activities should take place outside of the development footprint. •Minimize disturbance of new areas. • The site camp must be decommissioned, and the area rehabilitated once construction has been completed. • All waste, materials and equipment must be removed from site. • The project area is to be kept tidy and free of litter.
24.Climate Change	Negative	Consider the anticipated sea level rise over the next 100 years the engineering design team to conduct analysis on the sufficiency of the cope levels of the proposed structure.
25.Safety-Injuries and fatalities during construction	Negative	• The contractor must ensure that workers adhere to all safety regulations as per Occupational Health and Safety Act. • Appropriate PPE must be worn by workers at all times. • Regular training/talks must be given to all workers on site regarding safe working procedures. • Appropriate warning signs must be in place to notify the public regarding construction activities. • The construction site and camp must have access control and be demarcated, where possible. • Hazardous Chemical Substances Regulations promulgated in terms of the Occupational Health and Safety Act 85 of 1993 and the SABS Code of Practise must be adhered to. This applies to solvents and other chemicals possibly used during the construction process. • The individual(s) that will be handling hazardous materials must be trained to do so. • All hazardous chemicals must be stored properly in a secure, bunded and contained area. • The contractor must ensure that operational firefighting equipment is present on site at all times as per Occupational Health and Safety Act. • All construction foremen must be trained in fire hazard control and firefighting techniques. • All flammable substances must be stored in dry areas which do not pose an ignition risk to the said substances.

Impact	Nature	Mitigation measures
		• No open fires will be allowed on site unless in a demarcated area identified by the ECO. No smoking near flammable substances. • All cooking shall be done in demarcated areas considered safe in terms of runaway or uncontrolled fires. • The level of firefighting equipment must be assessed and evaluated thorough a typical risk assessment process. • Fires shall only be allowed in facilities or equipment specially constructed for this purpose. The need for a firebreak shall be determined in consultation with the Engineer and the relevant authorities, and if required a firebreak shall be cleared and maintained around the perimeter of the camp and office sites.
26.Improved Jetty stability and safety	Positive	A maintenance and management plan must be compiled for the quay walls and ferry landing.
27.Economic stimulation of BCMM	Positive	No mitigation required.

11.7 Motivation for Not Considering Alternative Development Footprints

No other development footprint alternatives were considered for this project because the location of the replacement works is defined and dictated by the position of the existing infrastructure which needs to be constructed in order to improve structural stability.

The options for rehabilitation of the deteriorating structure were complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete. The decommissioning and replacement of the existing wall was the only practical solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing and alignment with Quay 4. Before the quay wall can be replaced, it must be decommissioned first given its advanced stage of deterioration to ensure the structure can fulfil its functional requirement into the future. Several options have been considered and the options for rehabilitation of the deteriorating structure were found to be quite complex. To clad or locally repair the structure would be impractical and would at best delay the continuous deterioration of the surrounding concrete but not stop the deterioration. This implies that at some point in future, the repairs and upgrades would then still be required. The decommissioning and replacement of the existing wall therefore, remained as the only practical long-term solution that would provide certainty with regards to the future life span of the facility, address the adjacent Ferry Landing position and alignment with Quay 4.

The preferred development footprint will be kept to what is required for safe and efficient construction and operation of the structures. The mitigation measures proposed in the specialist reports will be implemented in order to avoid or minimize negative social and environmental impacts. Compliance with the Environmental Authorisation, EMPr and any other permits obtained will be monitored by the appointed ECO on a regular basis.

12. SUMMARY OF SPECIALIST FINDINGS

The following specialist studies were conducted as part of the EIA. A summary of each specialist findings is integrated into Section 10, Section 11 and Section 14 of the report while the full specialist reports are found in Appendix D.

Name and Surname	Role	Years of Experience	Qualifications	Professional registrations	Project Functions
Specialists					
Dr Brent Newman	Estuarine Ecology, Water and Sediment Quality Specialist Aquatic Biodiversity	33	PhD Zoology (Marine)	Pr.Sci.Nat Reg No. 123899 (SACNASP)	• Estuarine Ecology water and sediment quality impact assessment Water sampling and analysis
Dr Solomon Owolabi	Palaeontological Specialist/ Landscape Assessment	21	PhD Geology	-	• Palaeontological Impact assessment • Site and desktop investigation
Dr Anton De Wit	Social Impact Assessment	30	PhD Geography	-	• SIA
Mrs Jennifer Mokakabye	Heritage Specialist	14	M. Arts Archaeology	ASAPA Professional (No. 299)	• Heritage Application to destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a Provincial Heritage Site or a Provisionally Protected Place, or to alter or demolish a Structure 60 years old or more, as protected in terms of the National Heritage Resources Act 25 of 1999.

All specialist studies will be prepared in line with Appendix 6 of the EIA Regulations of 2014 as amended and will be undertaken by qualified, experienced, and registered specialists with experience in the region. The specialist studies will take into consideration the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Section 24(5) (a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation ("the Protocols") promulgated in Government Notice ("GN") No. 320 on 20 March 2020, which came into effect on 09 May 2020. All the recommended specialist studies will be initiated after 09 May 2020; therefore, the requirements apply.

13. ENVIRONMENTAL IMPACT STATEMENT

13.1 SUMMARY OF FINDINGS OF THE EIA

A summary of the key findings of the environmental impact assessment is outlined below:

- The project application area falls on a property which is owned by the applicant, thus no landowner consent is required.
- No alternative development options or footprints were feasible for this project due to the site specific nature of the proposed replacement of quay wall 3 and 4 and ferry landing. The only alternatives assessed in the EIA were the preferred alternative and the no-go alternative. The preferred alternative involves construction of a Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.
- Most of the biophysical environmental impacts identified will directly and indirectly affect a small area at and near the proposed project site or in the estuary and are not anticipated to have major nor long-lasting consequences as most impacts are fully reversible. As stated above the proposed project will result in the permanent loss of open water and sediment habitat. The amount of habitat that will be lost is small in relation to available similar habitat in the estuary and its loss is not anticipated to result on major changes to populations or ecological processes in the estuary.
- In the present work, no fossil was discovered.
- project such as the proposed development is certain to contribute to increased local economic activity and the creation of employment opportunities and other impacts following relevant economic multipliers and knock-on effects.
- No vegetation will be affected by the proposed development.
- The paleontological and archaeological sensitivity of the site is very high.

13.2 FINAL COMPOSITE MAP AND MAP SHOWING EXPANSION

The environmental sensitivities/constraints of the site are illustrated in Figure 18 below.

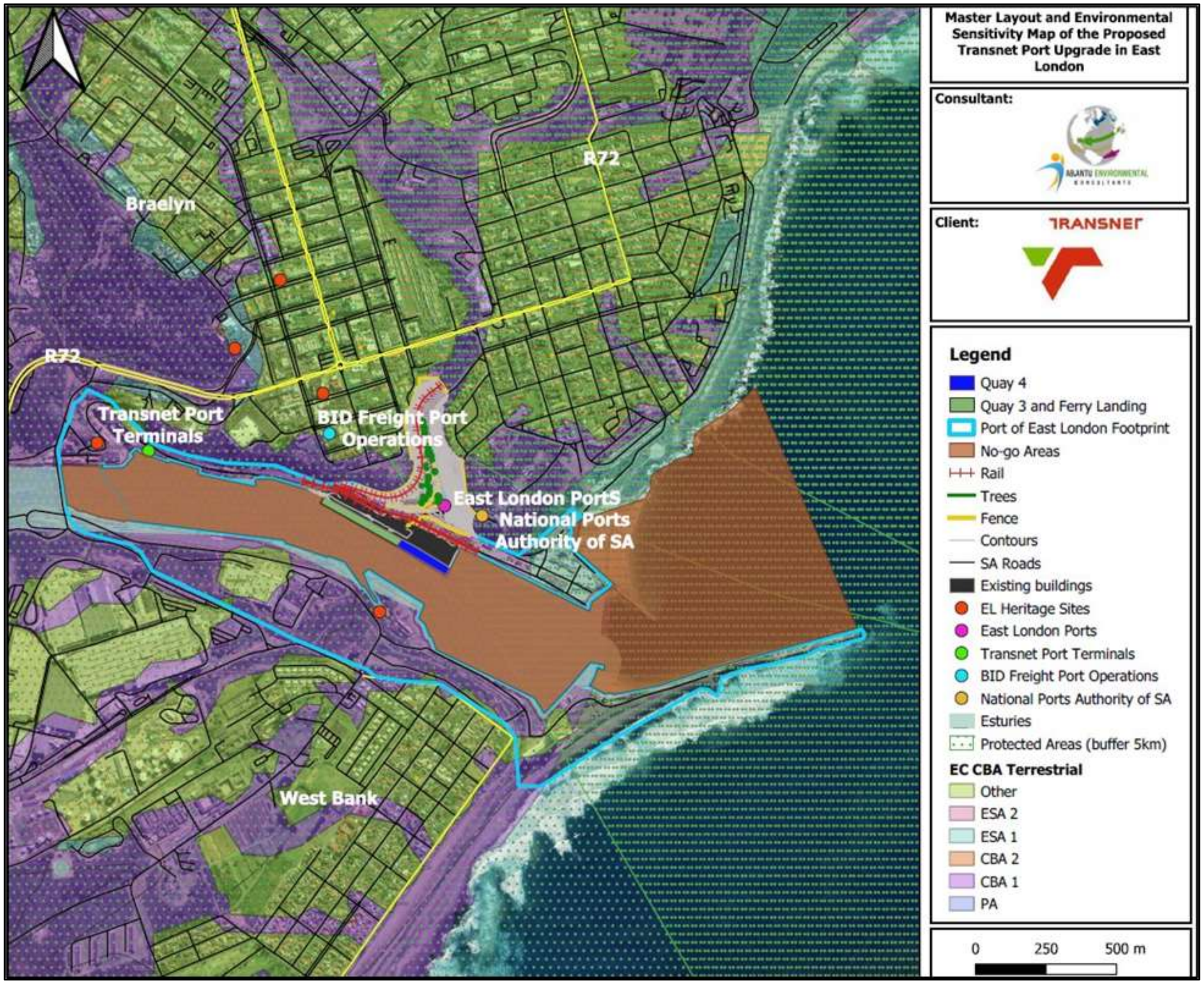


Figure 18: Final Composite Map

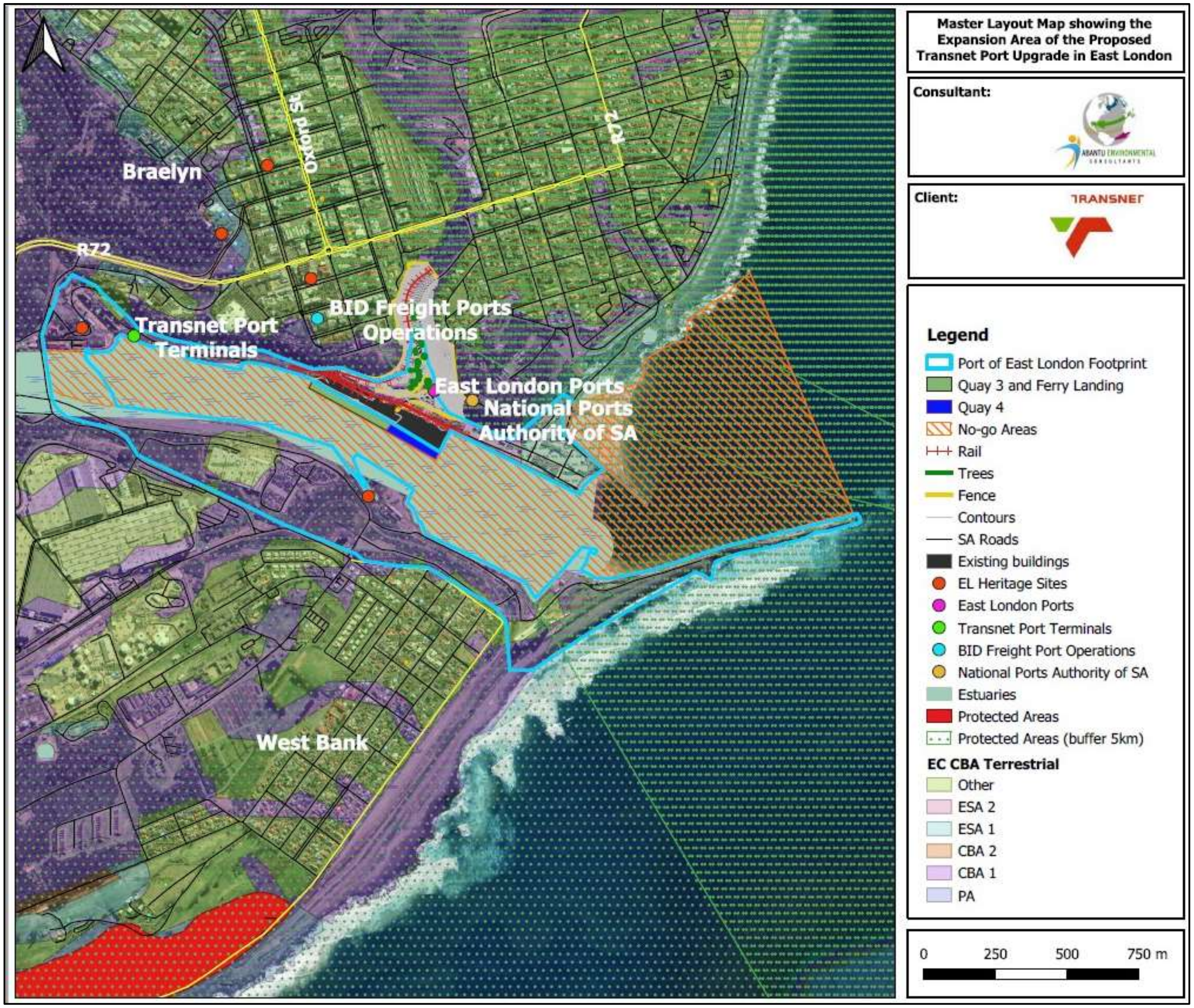


Figure 19: Map showing expansion into estuary

13.3 POSITIVE AND NEGATIVE IMPLICATIONS OF THE PROPOSED PROJECT

The following negative and positive impacts are anticipated from the proposed development:

NEGATIVE IMPACTS	POSITIVE IMPACTS
1.Impacts due to the ingress of non-hazardous solid waste into the port	1.Employment creation
2.Environmental deterioration due to spillages from portable toilets	2.Skills development and transfer
3.Impacts to soil, sediment, and geology	3.Improved Jetty stability and safety
4.Deterioration in water and sediment quality due to hazardous material spills and leaks	4.Economic stimulation of NMBM
5.Ecological impacts due to the spillage of construction material and demolition debris into the port	
6.Deterioration in water quality due to increased suspended sediment concentrations and turbidity caused of construction activities	
7.Ecological impacts due to the deposition of sediment mobilised and introduced into the water column by construction activities	
8.Deterioration in water quality due to the release of oxygen depleting substances from sediment by construction activities	
9.Deterioration in water quality due to the release of nutrients from sediment by construction activities	
10.Deterioration in water and sediment quality due to the mobilisation of toxic chemicals from sediment by construction activities	
11.Deterioration in water quality due to the release of oxygen depleting substances from sediment during disposal	
12.Deterioration in water quality due to the release of nutrients from sediment during disposal	
13.Ecological impacts due to the transfer of toxic chemicals in dredged sediment to the dredged spoil disposal site	
14.Ecological impacts due to physical effects of sediment disposal at the dredged spoil disposal site	
15. Ecological impacts due to the temporary loss of quay wall biological communities	
16. Ecological impacts due to underwater noise	
17. Ecological impacts due to above water noise disturbance	
18. Impact of altered quay wall geometry on hydrodynamics	

NEGATIVE IMPACTS	POSITIVE IMPACTS
19. Ecological impact due to permanent habitat loss	
20.The damage and disruption of paleontological resources as preserved in its host rocks within the development footprints.	
21. To alter or demolish a Structure 60 years old or more, as protected in terms of the National Heritage Resources Act 25 of 1999.	
22.Scheduling of Construction	
23.Policy and Legislative Context	
24.Air Quality	
25.Disturbance of existing land uses and visual impact	
26.Climate Change	
27.Safety-Injuries and fatalities during construction	

13.4 CUMULATIVE IMPACTS

The following potential cumulative impacts have been identified through specialist assessments:

- The ingress of non-hazardous solid waste into the estuary by construction activities will add to the burden of such solid waste entering the estuary from the surrounding urban area. It is, however, not possible to assess of the significance of this possible cumulative effect as the amount of waste entering the estuary is unknown.
- The ingress of waste from portable toilets into the estuary would add to the burden of contaminants entering the estuary from the surrounding urban area and port activities. As discussed above, the counts of faecal indicator bacteria in the estuary water column are often very high due to influx of sewage contaminated.
- The ingress of hazardous materials to the estuary will add to the burden of contaminants entering the estuary from the surrounding urban area and port operations. However, with effective mitigation the additional impact posed by spilled and leaked hazardous materials should be minimal.
- The proposed project will coincide with the berthing and de-berthing of vessels in the port. The proposed project may coincide with maintenance dredging in the port. There is thus a possibility that sediment mobilised by vessel propeller wash and maintenance dredging will magnify the impact of increased suspended sediment concentrations and turbidity for the proposed project, and vice versa, because vessel movements and dredging will occur very near the proposed project area. However, the cumulative impact will probably not be highly significant considering the small amount of sediment that is anticipated to be mobilised into the water column by construction activities. To mitigate this potential cumulative effect construction for the proposed project and maintenance dredging in the port should be scheduled so they do not overlap, although this is not a necessity considering the significance rating for the impact without mitigation.
- The proposed project will coincide with the berthing and de-berthing of vessels in the port. The proposed project may coincide with maintenance dredging in the port. There is a probability that sediment mobilised by vessel propeller wash and maintenance dredging will magnify the impact of sediment deposition associated with the proposed project, and vice versa, because vessel movements and dredging will occur very near the proposed project area. However, the cumulative impact will probably not be highly significant considering the small volume of sediment that is anticipated to be mobilised or introduced by construction activities The

scheduling of construction for the proposed project and maintenance dredging so they do not overlap will avoid this cumulative impact, but is not a necessity.

- Certain port operations, such as vessel propeller wash and potentially maintenance dredging, could disturb sediment and mobilise oxygen depleting substances into the water column and in this way could magnify the impact of oxygen depletion because of sediment mobilised by construction activities for the proposed project. However, this is not considered significant since the depletion in dissolved oxygen due to construction activities for the proposed project is anticipated to be minimal.
- Certain port operations, such as vessel propeller wash and potentially maintenance dredging, could disturb sediment and mobilise nutrients into the water column and in this way could magnify the impact of nutrients released because of sediment mobilised by construction activities for the proposed project. However, this is not considered significant since the total concentration of nutrients that is anticipated to be released by construction activities for the proposed project is very small.
- The proposed project will coincide with the berthing and de-berthing of vessels in the Port of East London. The proposed project may coincide with maintenance dredging in the Port of East London. There is a possibility that sediment mobilised by vessel propeller wash and maintenance dredging may also release toxic chemicals into the water column and this might magnify the impact of toxic chemicals released by construction activities associated with the proposed project, and vice versa, because vessels movements and dredging will occur near the proposed project area due to the narrow channel in the Port of East London. However, the cumulative impact of these activities is unlikely to be significant as sediment across most of the Port of East London area of the Buffalo River estuary is either not contaminated or is not severely contaminated by chemicals. To mitigate this possible cumulative effect, the proposed project and maintenance dredging should be scheduled so they do not overlap.
- Underwater noise generated by construction will add to the underwater noise generated by other port operations, such as the movement of tugs, large vessels, and dredging vessels.
- Above water noise generated by construction activities for the proposed project will add to the above water noise generated by other (normal) port activities, such as the movement of tugs, large vessels, and dredging vessels. This will probably magnify the degree of disturbance to birds that feed in the Buffalo River estuary.
- Transnet National Ports Authority has no plans for projects in the short-term in the Port of East London that will lead to the further loss of open water and sediment habitat (TNPA, 2019). However, longer-term plans may lead to the further loss of open water and sediment habitat and ecological productivity in the estuary. However, in the absence of confirmed and concrete longer-term plans it is difficult to estimate the significance of the cumulative loss.

13.5 FATAL FLAWS

There are no fatal flaws identified for this project.

14. CONCLUSION AND RECOMMENDATIONS

14.1 RECOMMENDATIONS FROM SPECIALIST REPORTS AND IMPACT MANAGEMENT OUTCOMES

ESTAURINE ECOLOGY

The rehabilitation of the Ferry Landing, Quay 3 and Quay 4 area of the Port of East London in the Buffalo River estuary is needed to prevent the ongoing deterioration of this infrastructure to a degree that it poses operational, human health, and environmental risks. The proposed rehabilitation will impact on the biophysical environment in the estuary and potentially also the adjacent marine environment. A total of 13 impacts were identified for the construction phase and two impacts for the operational phase of the proposed project. Most of the construction phase impacts are anticipated to be site specific in their spatial extent and of a minor or low intensity since the affected area and associated biological communities is already disturbed by existing port operations. Most of the identified impacts are fully reversible and biological communities in the affected area, and hence also ecological processes, will recover and re-establish after construction ceases to a degree permitted by ongoing port activities and notwithstanding the permanent loss of some open water and sediment habitat.

A comparable project to the proposed project of concern in this Environmental Impact Assessment was recently completed at Latimer’s Landing in the Buffalo River estuary. The Latimer’s Landing project also involved the rehabilitation of a quay wall and thus many of the same activities that will be required for the rehabilitation of the Ferry Landing, Quay 3 and Quay 4. There is no evidence the latter project resulted in the significant disruption of ecological processes in the Buffalo River estuary, either at the time of construction or after its completion. The Latimer’s Landing project and the proposed rehabilitation of the Ferry Landing, Quay 3 and Quay 4 do, however, differ in the extent of the area that will be affected by construction activities. The Ferry Landing, Quay 3 and Quay 4 rehabilitation will also occur over a longer period. The Latimer’s Landing project is, however, important in that it shows that ecological processes that were disrupted by construction activities were not affected over the long-term. This lends confidence that the proposed rehabilitation of the Ferry Landing, Quay 3 and Quay 4 will also not have a major impact on ecological processes in the estuary over the long-term.

Certain aspects of the proposed rehabilitation of the Ferry Landing, Quay 3 and Quay 4 are yet to be finalised, including the final engineering design and construction methods. The identification and assessment of environmental impacts in the current assessment provides an opportunity to mitigate some impacts through the engineering design and construction method. There is similarly an opportunity to include in the engineering design strategies for reducing existing impacts, such as surface runoff storage systems to limit the ingress of contaminants into the estuary.

Palaeontology

A detailed palaeontological study has been engaged to explore the geological resources and identify any concealed heritage resources within the proposed development footprint of East London port around the damaged quay 3 wall, East Cape, as sensitized by the environmental screening tools of the SAHRIS paleomap. The lenticular incisions of red mudrock within the Middleton Formation are a typical red flag indicating the need for a detailed geo-palaeontological study considering the scientific relevance of the site. The proposition to reconstruct quay wall 3 of East London Transnet port, Eastern Cape, is of high socio-economic importance. Without due verification of the vicinity's paleontological significance, embarking on the reconstruction of the quay 3 wall would render the environment inaccessible for future geoscientific study.

The study vicinity's eastern wing (shoreline), as obtained from the field study, showed the primary surficial arenaceous sedimentary strata, thickly overlaid as a floodplain deposit. Validated by sequence stratigraphy correlation, the geologic portion of the study area was covered by weathered Kazanian argillaceous arenite of the Middleton Formation. The Middleton Formation geologic cover is mainly light grey sandstone, as purportedly documented in the regional map. The detailed field geo-palaeontological study reviewed that the portion is thickly overburdened while the outcropping footprints were heavily weathered. There was no fossil discovery across the entire layout, supposedly due to the deep burial and high degree of weathering and detrital baking, contrary to the presumed Shale rock sensitivity. The review suggests that the study portion is roamed by Cistecephalus assemblage zones, which include the Namaichtbys digitata, Rhinesuchoides species, parareptilia (such as Pareiasuchus nasicornis and Nomaparia luckhoffi), Eureptilia (which include the Youngina capensis), Synapsida, and the Therapsida during the Kazanian to the Mid-Tatarian when the present geologic detrital was laid.

In the present work, no fossil was discovered; however, a substantial threat to the local fossil heritage is imminent should a fossil be recovered during the construction phase. Consequently, the study recommends that a subsurface geological prognosis be carried out to address the paleontology integrity of the proposed footprint. At the same time, it is anticipated that the palaeontological significance of the area is unlikely according to review and field evaluation. The impact risk assessment showed that the site is low (very low) on risk without (with) mitigation. Should fossil remains be discovered during the detailed geological inspection, the EVO responsible for the developments would be alerted immediately. Such discovery must be protected so that a professional paleontologist will make appropriate mitigation.

14.2 THE FINAL PROPOSED ALTERNATIVES

The preferred alternative (Alternative 1) is the final proposed alternative for the proposed replacement of quay wall 3 and 4 and the ferry landing. After consideration on the types of alternatives that exist (i.e. property, type, design, technology, operational and the no-go options), no other feasible fundamental alternatives other than the preferred (Alt 1) and No-Go (Alt 2) alternatives could be identified. The selection of the preferred alternative was based on pre-feasibility studies undertaken by Transnet to assess the extent of the structural deterioration of the quay walls and ferry landing.

The preferred alternative entails the use of Steel Tubular Combi Wall: Bury the existing wall behind a new steel sheet pile retaining wall. This option allows for the burial of the existing wall but minimises the required step out of the cope line. Tubulars piles are preferred, as the king piles, as they offer more options for installing the pile to final toe levels in rock. Structural stability is ensured through the installation of ground anchors to tie back the pile head.

This preferred option has been designed according to EN 1997, Design Approach 1 Combinations 1 and 2, using recommendations from BS6349-2:2010. The piles, and tie rod sections have been verified against structural failure according to the provisions in EN 1993. The selection of a tubular combi-wall section was governed by the installation requirements. The anticipated presence of shallow hard Hornfels layers in the soil profile requires a section that can withstand the high installation stresses resulting from heavy driving and allow for socketing into the hard layers to achieve the required embedment. The combi-wall has been designed for maximum durability in the marine environment with minimum requirements for major in-service maintenance over its design working life.

The no-go alternative means doing nothing, which would eventually result in the abandoning or condemning of the quay due to safety concerns.

The combined pre-mitigation significance of Alternative 1 is higher than that of Alternative 2. Although alternative 1 will result in disturbance within the sea and thus has a higher impact on the aquatic ecosystem without mitigation, it has the positive impact of improved stability and safety of the infrastructure. The implementation of Alternative 1 will lead to employment opportunities, the resultant post- mitigation significance of Layout Alternative 1 becomes lower Alternative 2 due to the positive impacts anticipated.

14.3 ASPECTS TO BE INCLUDED AS CONDITIONS OF AUTHORISATION

The following aspects should be included as conditions of authorization:

1. The construction Site Manager, appointed independent Environmental Control Officer, and/or the local Transnet National Ports Authority environmental specialist must audit the construction site against the mitigation recommended above and/or that which is included in an Environmental Management Programme Report prepared by the appointed consultant and approved by Transnet National Ports Authority, by regularly (ideally daily in the case of the Site Manager or nominated representative) walking through the construction site. If there is evidence for litter or other solid waste entering the port the procedures, checks, and controls in the Environmental Management Programme Report should be reviewed and revised to eliminate the source of litter or any other solid waste entering the port.
2. It is strongly recommended that all parties routinely take photographs of the construction site to document the occurrence or absence of leaks from portable toilets on the site.
3. The construction Site Manager, appointed independent Environmental Control Officer, and/or the local Transnet National Ports Authority environmental specialist must verify through observations from the quay wall that construction activities are not resulting in such intense and large plumes of suspended sediment in the port that these are clearly visible from the water surface and are causing a marked increase in suspended sediment concentrations over a large area. If this is the case, the construction method/s should be reviewed to identify areas for improvement to ensure sediment is not excessively mobilised into the water column.
4. If construction for the proposed project coincides with water quality surveys for the Long-Term Ecological Monitoring Programme for the Port of East London then the turbidity of the water column could be measured at stations positioned along a gradient from very near to distant from the construction activities to provide a measure of the validity of the impact significance rating.
5. A discovery of any palaeontological resource must be protected so that a professional paleontologist will make appropriate mitigation. If fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations the ECO/site manager in charge of these developments must be notified immediately. These discoveries ought to be protected (if possible, in situ) and the ECO must report to SAHRA (Contact details: ECPHRA, Corner Scholl and Amalinda Drive, East London Tel: 0437450888/0434921942; Fax: +27 (0)43 7450889. Web: www.ecprha.org.za) so that correct mitigation (recording and collection) can be carry out by a palaeontologist.

15. ASSUPMTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The following assumptions and limitations are extracted from the various specialist studies undertaken for this project. The following assumptions are applicable:

- It is assumed that all information received from the client is true and correct

Estuarine Ecology

The Environmental Impact Assessment process is not a precise science and relies on the expertise and experience of impact assessors and specialist scientists. A measure of professional judgement is thus involved in assessing the significance of identified impacts associated with an activity. It is assumed the professional judgement of the specialist scientist that assessed the significance of identified impacts is valid.

The emphasis of the Environmental Impact Assessment process is on identifying and assessing 'significant' impacts. It is not possible to identify and assess all impacts that might arise from a proposed project. It is assumed the identified impacts and the assessment of their significance addresses more complex interactions in the environment that might arise because of an impact but are not specifically discussed or assessed.

At this stage several components of the proposed project have not yet been finalised, including:

- A detailed engineering design.
- A detailed geotechnical survey.
- A detailed method of construction, including how often vibratory versus percussive piling will be used, how often drilling will be performed during piling, whether support vessels will be used, the degree of concrete mixing onsite, and the extent of demolition of existing structures that will be required to allow the project to proceed.
- A detailed contractor site plan, including where hazardous and construction materials will be stored and handled.
- The spatial extent of the dredging footprint, the method of dredging, and the method of dredged sediment disposal.

Much of the above information and detail will probably only be finalised shortly before the proposed project is implemented. In the absence of a final engineering design, construction site plan, and methods of construction it is assumed the impacts identified and assessed cover the range of possible scenarios that might arise due to the proposed project.

There is a limited amount of information for some components of the affected physical and biological environment in the Buffalo River estuary. It is assumed the specialist's assessment of impacts that might affect these components of the affected environment are valid.

It is assumed the mitigation measures identified are reasonable, feasible, and will be implemented, or that adequate and effective alternate mitigation that might be identified will be implemented, and that the implementation of mitigation will enhance the significance of positive impacts and limit the significance of negative impacts as intended and assumed.

It is assumed that any significant changes made to the proposed project will be communicated to the CSIR to allow for the reassessment of impacts, should this be necessary.

Palaeontology

The following assumption and limitations inhibit the reliability and suitability of desktop approaches often used for corroborating paleontological impact assessments:

- Many fossil records are yet to be transferred into a recent computer repository, a stable archive, a website, and a geographic information system platform.
- The ambiguity of GIS knowledge, geocoding, and georeferencing makes detailed palaeontological mapping difficult.
- An inadequate number of professional paleontologists are interested in field-based assessment.
- Inaccessibility of survey area or lack of detailed palaeontological survey at critical and potential regions of fossiliferous rocks.
- The quality of the base map and the geological map used during the characterization of the fossil record may hamper the extent of accuracy.
- Often, the resolution of a geological map may cut out the potential zones of the palaeontological materials or possibly where geological mapping was done with little consideration for palaeontological materials.
- Due to the capital intensiveness of field works, paleontological recoveries, storage, and preservation, the quality of service provided by the contracted private companies are often delimited.

Fossil records of some geological sites in South Africa have not been adequately covered. Fossil data collected from areas with similar assemblage zones would give a good insight into fossilization potential in many unexplored environments. Desktop studies have served as a valuable tool for conducting a reconnaissance survey for investigating and drawing inferences on the fossilization potential of a geological area. A more reliable palaeontological analysis with limited uncertainty can be actualized in regions with adequate exposure to sedimentary stratification in a study area as samples can be taken and forensically investigated by a professional paleontologist.

16. REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

Estuarine Ecology

The Estuarine Ecology Specialist Study has identified and assessed impacts to the biophysical environment in the Buffalo River estuary that might or will arise due to the proposed rehabilitation of the Ferry Landing and Quays 3 and 4. As stated elsewhere in this report, if the proposed project proceeds it will entail unavoidable impacts to the biophysical environment. Section 31 (n) of the National Environmental Management Act: Environmental Impact Assessment Regulations, GNR. 543 of 2010 (as amended in 2014), requires that the Environmental Assessment Practitioner provide an opinion on whether the proposed project (activity) should or should not be authorised. The purpose of this section is to provide a reasoned opinion in this context for impacts to the biophysical environment that might or will arise because of the proposed project.

The proposed project will involve improvements to existing infrastructure at the Ferry Landing and Quays 3 and 4 in the Port of East London. The improvements will result in an increase in the footprint of the existing infrastructure and will thus lead to the permanent loss of open water and sediment habitat. The project will primarily affect an already disturbed environment in the Buffalo River estuary and will not substantially affect pristine natural resources. Some rare, threatened, or endangered species may periodically enter the port and/or use the area near the proposed project site but these areas, as far as could be established, do not constitute critical habitat for rare, threatened, or endangered species. Most of the biophysical environmental impacts identified will directly and indirectly affect a small area at and near the proposed project site or in the estuary and are not anticipated to have major nor long-lasting consequences as most impacts are fully reversible. As stated above the proposed project will result in the permanent loss of open water and sediment habitat. The amount of habitat that will be lost is small in relation to available similar habitat in the estuary and its loss is not anticipated to result on major changes to populations or ecological processes in the estuary. In those instances where the significance of identified environmental impacts was rated as greater than low the implementation of mitigation and responsible practices during the construction and operational phases should reduce the significance to acceptable levels. None of the impacts is considered unacceptably significant such that they constitute a fatal flaw for the proposed project.

The proposed project will thus have a very low to low negative overall impact on the biophysical environment. The specialist that prepared this specialist report is thus of the opinion that, based on purely biophysical environmental considerations, the proposed project can be approved provided recommended and/or other more effective mitigation that might be identified is implemented and the final engineering design and construction method statement do not identify additional environmental impacts or increase the significance of assessed impacts. In the event of the latter, the significance assessment of some of the identified environmental impacts might need to be revisited.

It is the recommendation of the EAP that the preferred alternative for this project may be authorised on condition that the applicant will ensure compliance with all mitigation measures and recommendations contained in this report and associated EMPr.

17. EAP DECLARATION AND UNDERTAKING

I, Aphiwe-Zona Quvile, hereby confirm that the information provided in this report is correct at the time of compilation and the report was compiled with inputs provided by the applicant and some of the specialists appointed for the project.

I hereby also confirm that:

- *I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;*
- *All relevant information pertaining to the project has been submitted to potential interested and affected parties;*
- *All comments received from I&APs will be attended to and/or included in the final EIA Report that will be submitted to the DFFE;*
- *A record will be kept of any subsequent comments received and submitted with the final EIA. This will be in the form of a Comments and Responses Report (CRR);*

Prepared by

____

Zona Quvile

Senior Environmental Scientist

Cert.Sci.Nat, EAPASA (Professional EAP)

27 July 2023

____

Date

18. REFERENCES

Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. 2014. Edited by Michael F. Bates, William R. Branch, Aaron M. Bauer, Marius Burger, Johan Marais, Graham J. Alexander & Marienne S. de Villiers. SANBI, Pretoria.

Barnes, K. (2000). The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.

Berliner, D. and Desmet, P. 2007. Eastern Cape Biodiversity Conservation Plan Technical Report. Department of Water Affairs and Forestry Project No 2005-012, Pretoria.

Branch, W. (1988). Terrestrial reptiles and amphibians. In R. Lubke, F. Gess, & M. Bruton (Eds.), A Field Guide to the Eastern Cape Coast (pp. 251-264). Grahamstown Centre for the Wildlife Society of Sothern Africa.

Bromilow, C. (2001). Problem plants of South Africa, Pretoria: Briza Publications.

Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

DEA. (2017). Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs, Pretoria, South Africa.

DEA. (2017a). Guideline on Need and Desirability, Department of Environmental Affairs, Pretoria, South Africa.

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K., & Strauss, T. (2005). National Spatial Biodiversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

Integrated Development Plan Review of Buffalo City Metropolitan Municipality. 2020/21.

Jacobsen, N. (2005). Remarkable reptiles of South Africa. Briza, South Africa.

Kleynhans CJ, Louw MD. 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report

Kleynhans, C.J., Mackay, H. and Guest, L. 1999. R7: Assessment of Ecological Importance and Sensitivity. Version 01. Institute for Water Quality Studies. Resource Directed Measures for Protection of Water Resources: River Ecosystems. Department of Water Affairs and Forestry.

Koekemoer, M., Steyn,H.M. and Bester,S.P. (2014). Guide to plant families of southern Africa, edition 3. Strelitzia 31. South African National Biodiversity Institute, Pretoria.

Le Roux, J. (2002). The Biodiversity of South Africa (2002): Indicators, trends and human impacts. Struik Publishers. Cape Town

Low, A.E. and Rebelo, A.G. (eds). (1998). Vegetation of South Africa, Lesotho and Swaziland.

Mucina, L., & Rutherford, M. (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management Act (No 107 of 1998) as amended.

Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J., Nienaber, S., van Deventer, H. Swartz, E. and Smith-Adao, L.B. (2011). Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission, Gezina. WRC Report No. TT 500/11

South Africa. 1998. National Water Act 38 of 1998. Pretoria: Government Printer

South African Government. (No 107 of) 1998. National Environmental Management Act.

South African Government. (No 25 of) 1999. National Heritage Resources Act.

19. APPENDICES

Appendix A: CV of the EAP

Appendix B: Public Participation:

B-1: I&AP Database

B-2: Site Notices & Adverts

B-3: I&AP Notification

B-4: Background Information Document

B-5: Comments and Responses Report

B-6 Correspondence with CA & Stakeholders

B-7: Minutes of site inspection undertaken on 06/06/2023

Appendix C: Environmental Management Programme (EMPr)

Appendix D: Specialist Reports

D1: Estuarine Ecological Impact Assessment Report

D2: Palaeontological Impact Assessment Report

D3: Social Impact Assessment Report

D4: Heritage Report/Application

D5: Condition Assessment (FEL 2 Study Report)

D6: Aurecon Geotechnical Investigation

D7: Transnet Geotechnical Investigation

Appendix E: Specialist Declarations

Appendix F: Site Verification Report

Appendix G: Additional Information:

G1: Application Form

G2: Outline of comments from CA