# CRUZ ENVIRONMENTAL

Report No. 11

# Review of Abiotic & Biotic Reports produced for Priority Habitats in Transnet Capital Projects Richards Bay Port Expansion Project

A report prepared for AECOM SA (Pty) Ltd, Westville, Durban

by

**DP CYRUS & L.VIVIER**

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CRUZ Environmental
PO Box 357
Empangeni
3880
Telephone: 082 4559197
Telefax: 035 9026750
Email: cyrus@iafrica.com

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# 1. INTRODUCTION

## 1.1 TERMS OF REFERENCE

As part of the brief related to Specialist Studies associated with the Marine and Terrestrial Ecological Impact Assessment for the EIA of the Transnet Capital Projects (TCP) Richards Bay Port Expansion project (Option 3A), CRUZ Environmental (CRUZ-E) was requested to undertake reviews of reports produced by other specialists for the Final Scoping Report for the project (AECOM 2014). These included;

## 1.2 CSIR - REPORTS ON WATER QUALITY, TURBIDITY & SUSPENDED SOLIDS

The CSIR produced four reports for the Scoping Report as well as developing sediment dispersal models related to the planned dredging activities. The latter were not available in time to be reviewed by CRUZ-E and are not covered by this report. The reports are as follows:

CSIR (2013a) Richards Bay Expansion Programme: Metal contamination of sediment and implications for dredging - technical report. CSIR Report CSIR / NRE / ECOS / ER / 2013 / 0022 / C.

CSIR (2013b) Port of Richards Bay expansion programme: Turbidity and total suspended solids. CSIR Report CSIR/NRE/ECOS/ER/2013/0027/C.

CSIR (2013c) Port of Richards Bay expansion programme: Implications of a basic water quality survey. CSIR Report CSIR/NRE/ECOS/ER/2013/0028/C.

CSIR (2014) Definition of Turbidity and Suspended Solids Concentration Thresholds for Dredging Compliance Monitoring in and near Richards Bay. CSIR Report CSIR/NRE/ECOS/ER/2014/00XX/B.

## 1.3 BKS - IDENTIFIED OPTIONS FOR DREDGE SPOIL DISPOSAL

BKS produced the following report on options for dredge spoil disposal:

BKS (2013). Richards Bay Port Expansion Programme Dredge Disposal Site Selection. Unpublished Report for Transnet SOC Limited. Project J02031, 31 pages.

## 1.4 MER - MARINE & TERRESTRIAL ECOLOGICAL BASELINE REPORT

The following report was produced by MER:

MER (2013). Baseline Ecological Assessment for the Port of Richards Bay Expansion Programme – Selected Aquatic and Terrestrial Habitats. MER Report 7/2013.

# 2. REVIEW OF CSIR REPORTS

## 2.1 REVIEW OF THE TURBIDITY AND TOTAL SUSPENDED SOLIDS REPORT

### 2.1.1 INTRODUCTION AND TERMS OF REFERENCE

The objective of the study was to determine whether there is sufficient turbidity and total suspended solids concentration data from the proposed Richards Bay Port Expansion project footprint for the definition of baselines for these water quality indicators, and if so to then define baselines. However, after an analysis of the areas for which data is available, it became clear that the data is inadequate for establishing baselines for the entire expansion footprint. The focus of this study thus shifted to the analysis of existing turbidity and total suspended solids concentration data, to highlight the limitations of the data and to identify future study needs.

### 2.1.2 REVIEW OF THE REPORT

The report provides a comprehensive overview of TSS and water turbidity, the availability of relevant data on these parameters in the port, the need for continued focused monitoring and the potential effects associated with elevated levels of these parameters. It also provided an overview of the relationship between the TSS concentration and turbidity of surface and bottom water samples collected from Richards Bay in 2013. The limitations and the risks associated with the use of current data was adequately explained, and in view of this, suitable motivation was provided for detailed monitoring and expansion of the database prior to and during dredging.

The primary conclusions from the report were:

1. The turbidity and total suspended solids concentrations at all stations in the port, based on recently collected data, was relatively low, with the implication that the water in the port (at least at the 15 sites sampled) was relatively clear and there was no cause for concern related to elevated TSS concentrations.
2. Cognisance should be taken of the fact that, without considering the influence of weather conditions prior to monitoring, elevated turbidity and total suspended solids concentrations could erroneously be associated with dredging during construction or some other anthropogenic disturbance, when in fact it was attributable to a natural

event such a heavy downpour increasing sediment-laden freshwater into the area via stormwater drains.

3. Baselines and threshold TSS and Turbidity levels based on predictive modelling were provided for 5 sites (see Figure 2.1 for site location) in the port which could be used for the Richards Bay Port Expansion and the Port of Richards Bay Coal Terminal Development projects if the same stations are used for compliance monitoring during dredging (the latter project has been terminated). These would however not apply to the Inner Basin complex, where turbidity is naturally somewhat lower compared to the Mudflats and Bhizolo Canal. It was concluded that there is at present too little data to define turbidity and total suspended solids baselines for all areas of Richards Bay, notably for the Inner Basin complex, where the majority of construction activities for proposed expansion footprint will be. As a result, further monitoring/research prior to and during construction will be required for the definition of baselines and to estimate the potential ecological risks associated with dredging (covered in CSIR 2014). Baselines for turbidity and total suspended solids should therefore be defined for different habitats (areas) within the proposed expansion footprint, as part of the dredging compliance monitoring plan for the Richards Bay Port Expansion project.


Figure 2.1 Sites in Richards Bay Harbour for which current predictive modelling provide baseline and threshold TSS and Turbidity levels. (Reproduced from CSIR 2013a).

4. It was also recommended that the relationship between turbidity and total suspended solids under simulated dredging conditions should be established in the laboratory for the purpose of compliance monitoring and importantly also for the Environmental

Impact Assessment process. In addition, telemetered loggers could be deployed to provide real-time turbidity data during dredging.

In conclusion, the report provided a detailed overview of the issues related to TSS and Turbidity levels during port development associated dredging, the limitations of the available data and finally, provided details for the monitoring of TSS and Turbidity levels during dredging and construction activities.

## 2.2 REVIEW OF THE CSIR IMPLICATIONS OF A BASIC WATER QUALITY SURVEY

### 2.2.1 INTRODUCTION AND TERMS OF REFERENCE

The objective of the study was to report on the levels of a suite of basic water quality and nutrient parameters at 15 sites in Richards Bay Harbour, as part of the turbidity and total suspended solids concentration survey. The purpose of this report was to present the findings of the water quality survey and to discuss the potential implications for the Richards Bay Port Expansion programme.

### 2.2.2 REVIEW OF THE REPORT

This report deals with a once-off survey by CSIR of water quality and Chlorophyll-a profiles conducted in 2013 as part of the environmental work required for Richards Bay Port Expansion programme. A total of 15 sites were sampled across the harbour.

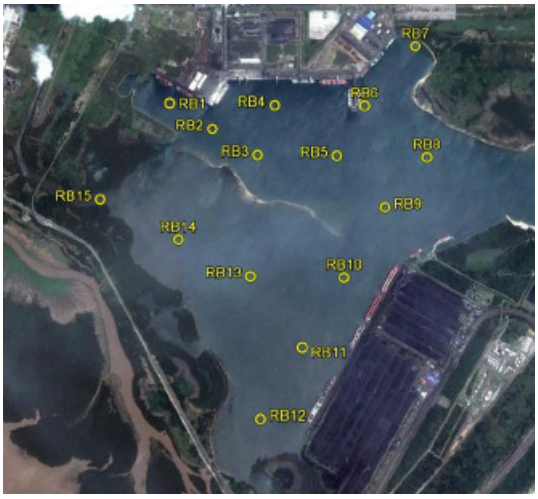


Figure 2.2 Sampling sites in Richards Bay Harbour used for basic water quality and Chlorophyll-a profiles. (Reproduced from CSIR 2013b).

The report provided a detailed overview of the water quality of the port related to the data collected and the potential implications for the Richards Bay Port Expansion programme. The implications of elevated nutrient concentrations from surface runoff and anthropogenic activities, in particular, are discussed in detail and raises a few issues of concern related to the proposed Richards Bay Port Expansion programme.

The following primary findings and conclusions were reported:

1. The water column was only moderately stratified with regard to temperature, salinity and oxygen concentrations and there was little difference between top and bottom values in the majority of the areas sampled. The limited stratification, particularly in salinity, testifies to the strong marine influence in the port and the extent of water displacement with tidal currents. The exception to the above pattern was found at the entrance to the Bhizolo Canal and at the Inner Basin 3 (see Figure 2.2), where freshwater inflow caused lower surface salinities.
2. Similarly, relatively uniform pH levels throughout the port showed the strong influence of marine water, whereas at the Bhizolo Canal and at the Inner Basin 3, input of contaminated water caused changes in the pH level.
3. Again, surface chlorophyll-a concentration at station 7 in Inner Basin 3 (see Figure 2.2) was somewhat higher compared to other stations, suggesting a nutrient source fuelling the growth of microalgae at this station, possibly introduced by inflow of freshwater from stormwater outfalls situated on the northern bank of this basin. Elevated chlorophyll-a concentrations were also evident in surface water at station 1 in Inner Basin 1 and station 2 situated nearby in Inner Basin 2 (see Figure 2.2). These elevated primary production levels in dead-end basins is potentially an area of concern for the future developments in the port. It was stated: "*The implication for the proposed expansion programme is that if port development further restricts the exchange of water between 'dead-end' basins and the greater Richards Bay and anthropogenic nutrient inputs continue then there is strong possibility that eutrophic conditions may manifest. This will ultimately lead to the development of hypoxia and possibly even anoxia in bottom water and sediment, with a host of associated adverse ecological impacts. Careful consideration must, therefore, be given during the infrastructure design phase for achieving the maximum possible water exchange between 'dead-end' basins and the greater Richards Bay*"
4. Although not of direct concern to the proposed development, the low pH of the water column off the Bhizolo Canal was seen as an indication of an anthropogenic source

of contamination to the Bhizolo Canal that was driving the low pH, which could ultimately affect the water quality in the port.

5. It was further emphasised that consideration must be given during the infrastructure design phase as to where surface runoff (stormwater) from quay surfaces will be discharged. Discharging surface runoff into 'dead-end basins', where water exchange with the greater Richards Bay is poor, will increase the probability for water and sediment quality impairment.
6. One of the most important issues raised in the report was related to the concentrations of contaminants in the Inner Basins. The magnitude of metal contamination in some parts of these basins has been shown to be such that the Department of Environmental Affairs may prohibit the unconfined openwater disposal of dredged sediment, with significant developmental and financial implications. The introduction of contaminated runoff from the quays could be partially eliminated by diverting runoff to detention ponds to facilitate the settlement of particulate material, with the overflow then discharged to the Bay.

In conclusion, the report provided a detailed overview of potential issues related to water quality in the port, in view of the proposed Richards Bay Port Expansion programme.

## 2.3 REVIEW OF THE CSIR METAL CONTAMINATION OF SEDIMENT AND IMPLICATIONS FOR DREDGING – TECHNICAL REPORT

### 2.3.1 INTRODUCTION AND TERMS OF REFERENCE

The ecological implications of the dredging of contaminated sediments during port infrastructure expansion programmes is of concern worldwide and will be one of the primary issues during the proposed Richards Bay Port Expansion programme. In view of the anticipated dredging for the port expansion and the ecologicals risks associated with such dredging, the CSIR was commissioned to assess the potential toxicological issues associated with dredging of sediment in the port.

The objectives of this study were to:

1. Determine whether sediment in the proposed Richards Bay Port Expansion programme footprint is contaminated by metals.

2. Identify spatial trends in metal enrichment/ contamination of sediment in the expansion footprint,
3. Estimate the likelihood that metal contamination of sediment in the expansion footprint will pose an unacceptable ecological risk when the sediment is dredged and/or disposed at an openwater spoil disposal ground offshore of Richards Bay, and
4. Identify the implications of metal contamination of sediment in the expansion footprint for a permit application authorising openwater disposal of dredged sediment.

Sediment was collected from a total of 97 sites in the harbour, following a grid-pattern, which was analysed for sediment particle size, organic content and metal concentrations.

### 2.3.2 REVIEW OF THE REPORT

This report provides a detailed and, to date, the most comprehensive overview and assessment of sediment metal concentrations in the port and the potential implications for dredging and construction activities associated with the Richards Bay Port Expansion programme.

The primary findings and conclusions were:

1. The number of metals enriched in sediment at any particular station in Richards Bay was highest in close proximity to quays in the Inner Basin complex. It was concluded that the fact that sediment with the highest number of metals enriched was alongside and near quays provides sufficient evidence that the excess metal concentrations had an anthropogenic source.
2. Concentrations of copper, chromium, nickel, lead and zinc exceeded the Warning Level (see CSIR 2013c for explanation of the level descriptors) in the Inner Basin complex.
3. Stations where the Level II was exceeded were alongside quays in Inner Basin 2 and near quays in Inner Basin 3. The potential toxicological issues in these areas were further emphasised by the fact that, based on all three methods used, i.e. the exceedance of sediment quality guidelines, the mean sediment quality guideline quotients and logistic regression modelling, the highest potential for adverse effects to bottom-dwelling organisms due to metal contamination of sediment was alongside and near quays in the Inner Basin complex. This is clearly illustrated in Figure 2.3.

4. No metal concentrations in sediment from the Richards Bay Coal Terminal Basin and Mudflats, and indeed also a large part of the Inner Basin complex exceeded sediment quality guidelines.

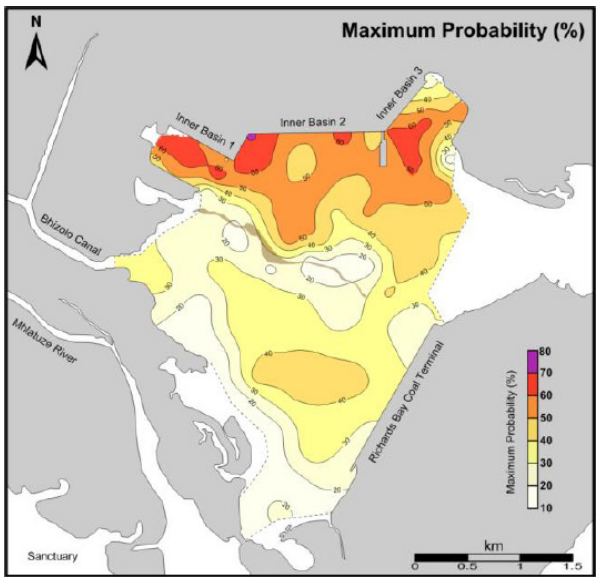


Figure 2.3. Maximum probability (Pmax) for observing toxicity in sediment collected from Richards Bay, as modelled through the logistic regression modelling approach (Reproduced from CSIR 2013c).

5. The most significant anthropogenic sources of metals to the Bay was shown to be port associated activities. It was stated that this was mostly related to accidental spillage of metal ore fragments and scrap metals, notably chromium, during vessel loading, with the most important areas in this context being the 600 and 700 series of berths.
6. Although it is stated that metal inputs to the Bay from surrounding urbanised and industrialised areas appears to be minimal, because the Bay's immediate surroundings are not highly urbanised and industrialised areas, this needs to be investigated, as the Manzamnyama Canal drains the industrialized area adjacent to Hillside Alusaf and Foskor, and drainage for the contaminated Upper Thulazihleka Pan flow via the Bhizolo Canal in the port. Data from this report do however, suggest that there is limited sediment contamination in the Bhizolo Canal.
7. It was also recommended that the introduction of metals to the Bay by surface runoff from the quay should be investigated and where appropriate source control procedures such as retention dams should be formulated and implemented.

8. The report concludes that the most important implication for the proposed Richards Bay Port Expansion programme is the possibility that the DEA may prohibit unconfined openwater disposal of sediment dredged from certain contaminated areas of Inner Basins 2 and 3, where concentrations of some metals exceeded the Level II of the South African sediment quality guidelines.

In conclusion, this report provided a high resolution spatial understanding of metal contamination of sediment, not only in the expansion footprint, but across the port. It has provided much needed insight into the potential ecological implications of dredging of potentially contaminated sediments required for the port expansion. Recommendations were made with regard to mitigation of the current contamination levels and also how to approach the environmental and legal issues related to the dredging of the sediment.

## 2.4 REVIEW OF THE DEFINITION OF TURBIDITY AND SUSPENDED SOLIDS CONCENTRATION THRESHOLDS FOR DREDGING COMPLIANCE MONITORING REPORT

### 2.4.1 INTRODUCTION AND TERMS OF REFERENCE

The first report reviewed above (see Section 2.1) aimed to determine whether there is sufficient turbidity and total suspended solids concentration data from the proposed Richards Bay Port Expansion footprint for the definition of baselines for water quality indicators, and if so to then define baselines. However, after an analysis of the available data, it was clear that the data was inadequate for establishing baselines for the entire expansion footprint.

As a follow-up to this study, and with the primary aim to define turbidity and suspended solids concentration thresholds for dredging compliance monitoring in Richards Bay Harbour, the 2014 CSIR report was produced. The objectives of the study were:

1. To generate turbidity and suspended solids concentration data for the definition of thresholds for compliance monitoring during dredging in the western part of the port, associated with the Option 3A expansion in the port.
2. To define thresholds for openwater spoil disposal compliance monitoring, based on historical data generated through the spoil disposal compliance monitoring

component of the Richards Bay Coal Terminal (RBCT) expansion programme during development of Berth 306.

3. To define the relationship between turbidity and suspended solids concentrations for the water column in Richards Bay under typical and simulated dredging conditions, such that if suspended solids concentration limits are stipulated in the dredging permit these can be converted to turbidity equivalent limits by using the relationships. This was done to simplify compliance monitoring since in terms of the cost and time required for compliance monitoring.

### 2.4.2 REVIEW OF THE REPORT

The report provides a detailed and comprehensive overview of the importance of accurately defined turbidity and suspended solids concentration thresholds for compliance monitoring during dredging, and the factors that affect and drive the relationship between the two variables. It also included a review of the ecological impacts of turbidity and suspended solids on the receiving estuarine environment. Compliance monitoring during dredging activities require that certain pre-defined “water clarity” thresholds not be exceeded, otherwise unacceptable ecological consequences might be the result. In order to set these environmentally as well as economically acceptable and workable thresholds, a proper understanding of the area specific behaviour of suspended solids and the associated turbidities are required.

A range of physical and chemical water quality parameters were recorded at, and sediment collected at 15 stations covering the dry bulk terminal, the sand spit in the center of the port as well as the Kabeljous Flats intertidal mudflats and the Bhizolo Canal system. Six surveys were performed between 5 September 2013 and 12 February 2014. In addition, laboratory testing of the relationship between turbidity and suspended solids concentration were performed.

The primary findings and conclusions were:

1. Turbidity measurements made in situ and measured in the laboratory were comparable and required no correction to accommodate differences between field and laboratory measurements.
2. At deepwater stations, turbidities and suspended solids concentrations were generaly low (<6 NTU), only the upper part of the water column will be significantly influenced by wind induced turbulence. Higher turbidities were recorded in the Bhizolo canal.

3. There were strong positive and comparable correlations between turbidity and suspended solids concentrations for field collected and laboratory generated data, suggesting that turbidity provides an accurate estimate of suspended solids concentrations and can thus be substituted for suspended solids concentrations measurements. This has important consequences for compliance monitoring during dredging activities as it reduces the time and cost involved in generating compliance data during monitoring.
4. Turbidity thresholds were defined based on the 95th percentile of the equivalent suspended solids concentrations calculated. The turbidity threshold ranged between 13.91 - 79.56 NTU and the suspended solids concentration threshold between 34.45 - 195.00 mg.l-1.The use of the 95th percentile of the equivalent suspended solids concentrations reduces the risk of "outlier" turbidity values affecting the outcome of the compliance monitoring and is in line with the methodology used in previous compliance monitoring surveys. This is an important factor, as it allows comparison with historical data collected during pre and post-dredging monitoring.
5. These thresholds were deemed sufficiently high, or protective of the surrounding aquatic biotic communities, based on the 10th percentile of the endpoints, which will at most have a chronic sub-lethal effect on stations on the mudflat and in the Bhizolo canal, but not in the deeper openwater areas.
6. The report provided a detailed account of the possible approach to dredging compliance monitoring for the Richards Bay Port Expansion Programme. This provide port and environmental managers with adequate guidelines to be used for compliance monitoring during dredging. Of importance is the recommendation that these guidelines be incorporated into an Environmental Management Programme for the Richards Bay Port Expansion. Two issues are highlighted, the first of which is the frequency and duration of compliance monitoring, while the second issue deals with to the spatial extent of the sacrificial zone. Both these issues are carefully argumented and different scenarios stemming from previous studies and from the literature are presented.
7. An important outcome of the report is the finding that, based on the RBCT dredging data, it is estimated that there is a strong possibility that turbidity and suspended solids concentrations will exceed thresholds beyond the sacrificial zone for the Richards Bay Port Expansion Programme (should this zone be set at 500 m) unless appropriate mitigation is identified prior to dredging. This implies that careful consideration should be given to the areas included in the sacrificial zones and that

steps should be taken to avoid dredging activities exceeding the turbidity tolerance limits in these areas.

8. It is also stated that, given the definition of threshold concentration, pre-dredging monitoring will probably not be necessary. In addition, long term turbidity monitoring after dredging has stopped is also not deemed to be necessary, based on the outcome of previous studies.

In conclusion, this report provides a detailed and comprehensive overview of the importance of turbidity and suspended solids concentrations during compliance monitoring for dredging during the upcoming Richards Bay Harbour Expansion project. Relevant turbidity and suspended solids threshold concentrations were derived based on field and laboratory data and using appropriate regression methods. Importantly, guidelines are provided for compliance monitoring in terms of the frequency and duration of monitoring and the methodology to be used. Guidelines are also provided for openwater spoil disposal compliance monitoring, based on the outcome and lessons learnt during previous monitoring programmes.

# 3. REVIEW OF DREDGE SPOIL DISPOSAL RECOMMENDATIONS

## 3.1 INTRODUCTION

CRUZ Environmental was requested to review and comment on the proposed options for Land Based disposal as determined by BKS (2013) as this was being considered by AECOM (2014) as the option for the proposed TCP Capacity Expansion Option 3A. An evaluation of offshore disposal did not form part of this brief.

**In the Final Scoping Report (AECOM 2014) under Section 2.2.1 Proposed Richards Bay Port Expansion Programme (page 26) the last bullet indicates that 'Disposal of the dredged material (will take place) off-shore' and Figure 2-5 in the report is referred to. It needs to be noted that this figure depicts the location of Land Based dredge spoil disposal sites as recommended by BKS (2013).**

## 3.2 REVIEW OF REPORT

The BKS (2013) report contains a comprehensive review of a wide range of issues associated with the disposal of dredge spoil as well as an evaluation of all the site options, these include both land based and offshore disposal. The shortcoming of the report is that much of the information, particularly related to land based disposal, is drawn from a previous report (CSIR 2004). Figure 3.1 below from BKS (2013) depicts the options for land based spoil disposal based against a full port development layout. The preferred sites for disposal (numbers 4, 5 & 6) have been put forward in the Final Scoping Report for the TCP Richards Bay Port Expansion project Option 3A in Figure 3.2 (AECOM 2014). The layout from CSIR (2004) used by BKS (2013) was discarded and replaced by a new TCP 'Preferred' Development Layout in 2009 (Figure 3.3 from Cyrus & Vivier 2009). These preferred land based disposal sites, despite being evaluated for developments that are currently planned as only taking place within the current harbour boundary, should be considered invalid as they will all impact on the TNPA 'Preferred' long term development plan. Sites 4 & 5 lie right in the path of the proposed harbour development (Figure 3.3), whilst Site 6 lies directly within part of the area identified for Offset development in relation to the TNPA 'Preferred' Development Layout (Figure 3.4 from Elliott *et al.* 2009).

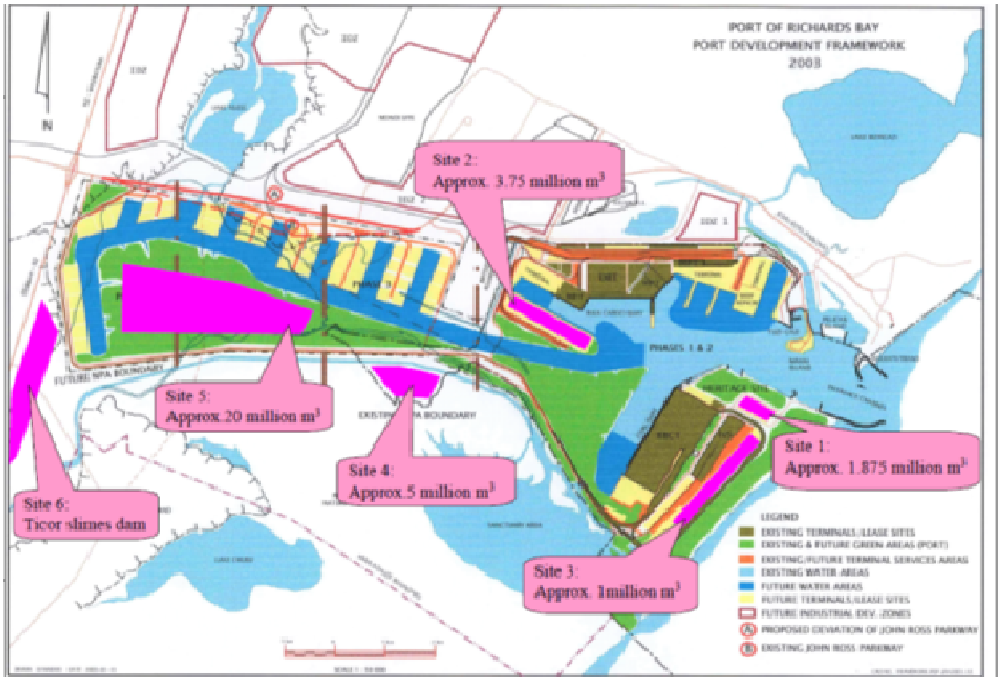


**Figure 3.1** Location of potential dredge disposal sites on land (Figure 3-1 – BKS 2013, reproduced from CSIR 2004).

The assessment by BKS (2013) of all potential options for spoil disposal is comprehensive and despite them concluding that the land based disposal should be the preferred option, they do state that;

1. Disposal on the Northern beach would result in reasonable pumping distances for most planned expansions and the supply of sand that would allow medium term recovery of the depleted beaches to the north. Therefore, this is an appealing disposal option;
2. Barge/vessel disposal offshore will limit impacts to a designated offshore region. However, with the loss of sand offshore and the relatively high expense, this option is not favourable. Yet, it may prove viable if other options prove impractical (or have excessive impact) and/or if conducted in association with a sand winning operation.

**Photo 1:** Dredger transporting spoil for disposal to an offshore disposal site.

Cyrus & Vivier (2009), in their review of the impacts of dredge disposal associated with the TNPA Due Diligence study (Illifa Africa Engineers (Pty) Ltd. 2010; Cyrus & Vivier 2009), concluded that, despite potentially raising a Red Flag, offshore disposal was environmentally the best option. They noted that registered disposal sites in the offshore environment are available for use and dredge disposal should be restricted to these carefully selected sites. Large scale disposal of dredge material during port expansion will cause smothering of the biotic communities at the dump site, while increased turbidities will affect primary productivity not only at the dump site, but down-current of the affected area, depending on prevailing wind and current conditions. The impact of these activities needs to be carefully monitored

and minimized, including the influence of potentially elevated trace metal and organic contaminant concentrations in the sediments and water column. This should include pre- and post-dredging monitoring of water and sediment quality, sediment deposition, metal and other contaminant concentrations in the water and sediment as well as changes in community structure of selected faunal groups such as benthic macrofauna, plankton and reef fish.

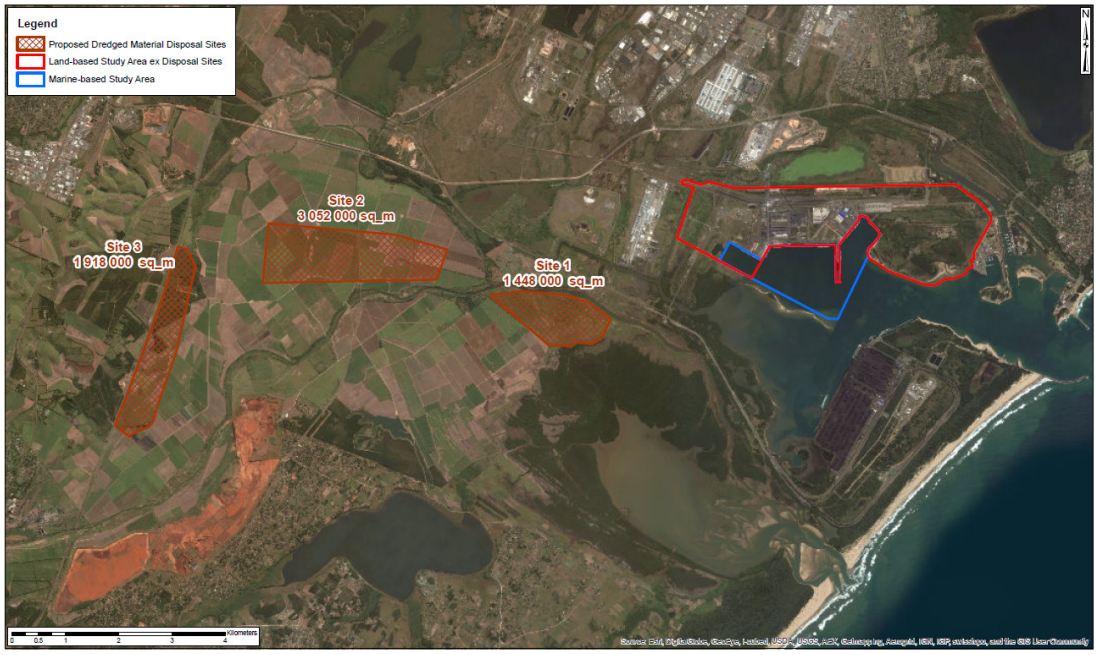


**Figure 3.2** 'Proposed offshore dredging disposal sites' = Proposed Land based dredging disposal sites (Figure 2-5 - AECOM 2014).

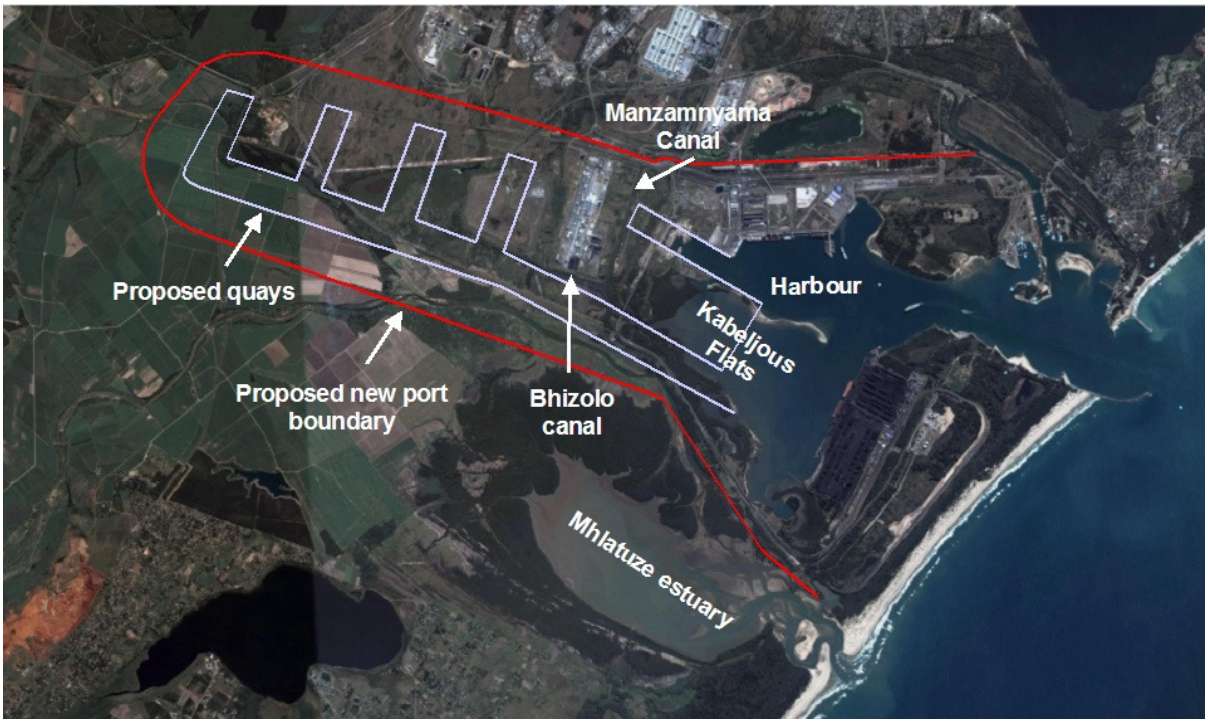


**Figure 3.3:** Layout of the proposed new port boundary of TNPA's preferred development option (from Cyrus & Vivier 2009).

## 3.2 CONCLUSIONS

While the review of options for dredge spoil disposal are treated comprehensively, the BKS (2013) report falls well short on matters associated with land based disposal and the recommendations are considered flawed. In addition CRUZ-E believe that the assessment of environmental impacts related to spoil disposal may not be as comprehensive as they should be in line with the significance of the ecosystems in the Port of Richards Bay and the adjacent Mhlathuze Estuary that may be impacted by these activities. Furthermore land based dispersal of spoil containing a high salt content would have substantial impacts on the fauna and flora. Based on the selected sites in BKS (2013) study and results of previous investigations into dredge spoil disposal, it is concluded that offshore disposal would ecologically be the best option.

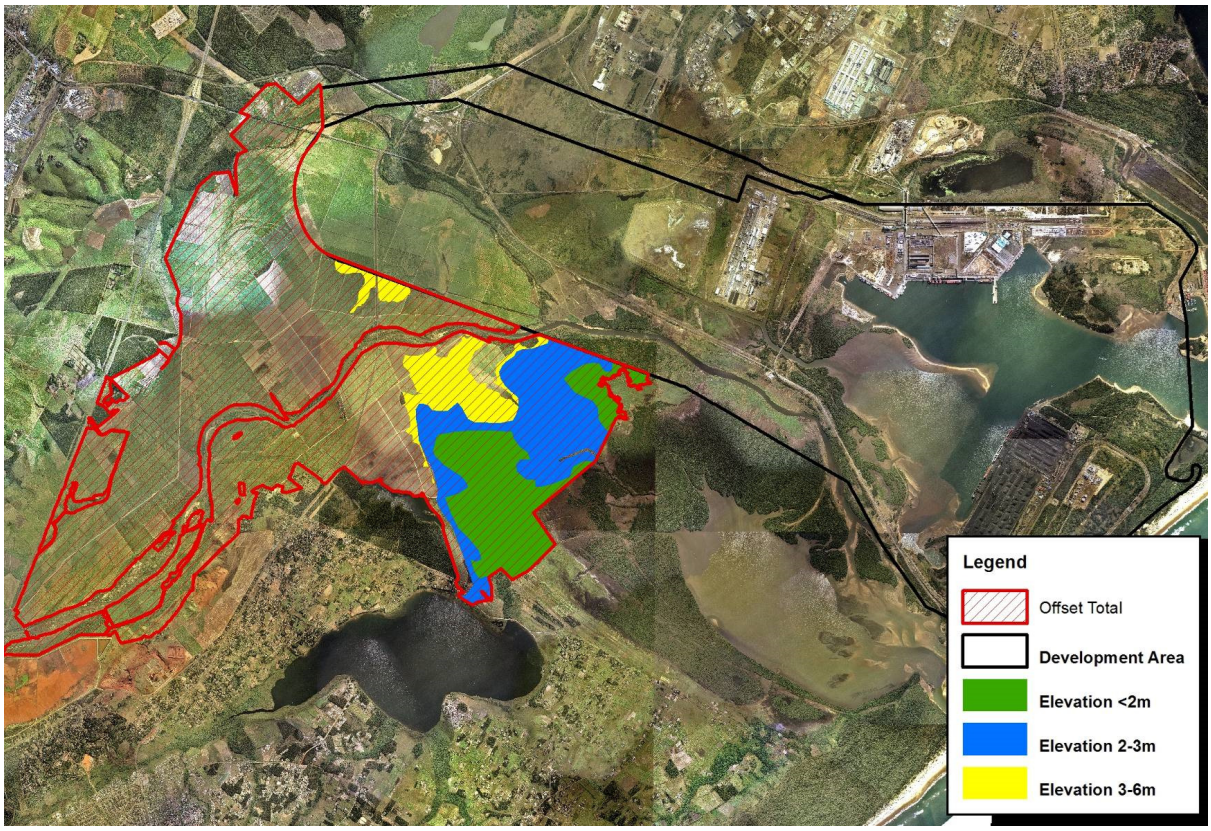


**Figure 3.4:** Total area available for offset (with engineering) from Elliott *et al.* (2009).

# 4. REVIEW MARINE & TERRESTRIAL ECOLOGICAL REPORT

## 4.1 BRIEF FOR THE STUDY

For the purposes of this report, the study boundary includes the larger Richards Bay environment and its various linked and adjacent habitats and are dealt with using four broad area groupings within the Port. These are illustrated graphically in Figure 4.1 and described below:

1. The estuarine bay including the water surface area, intertidal and supratidal habitats.
2. The 500 series berths located to the south west of the existing bay situated approximately at 28˚47'37"S/32˚01' 37"E.
3. The area between the break bulk and repair quay positioned at 28˚47'45"S/32˚47' 06"E.
4. The south dunes development option located on the frontal dune cordon positioned approximately at 28˚49'15"S/32˚04' 26"E.

The Terms of Reference were as follows:

BKS requested that MER conduct a baseline ecological assessment of the terrestrial and aquatic habitats that would be directly or indirectly influenced by the development proposals currently mooted for the expansion of the Port of Richards Bay. An agreed Terms of Reference prior to appointment of MER and Phase 1, includes the following components:

1. Literature survey
2. Present status and condition of the various habitats within the study area and/or affected by the proposed development. Terrestrial habitats would be sampled as part of this study but due to time constraints only limited sampling of the estuarine / marine habitats would be undertaken as part of the EIA phase where this is recommended by authorities and / or by specialist studies.
3. Existing disturbance within each unit;
4. Environmental assessment to identify environmental constraints and opportunities within the study area

## 4.2 REVIEW OF REPORT

The strength of this study is that its brief focussed on virtually the entire area of the Port of Richards Bay including the area identified for the full development of the port which is referred to as the Berth 500 Series. As a result of this, the report provides a holistic overview of both the complex and significant aspects of the port area. Pertinent information relating to the findings of an extremely wide range of previous studies are included and used to develop an overview of the importance of Richards Bay Harbour as a functional estuarine ecosystem.

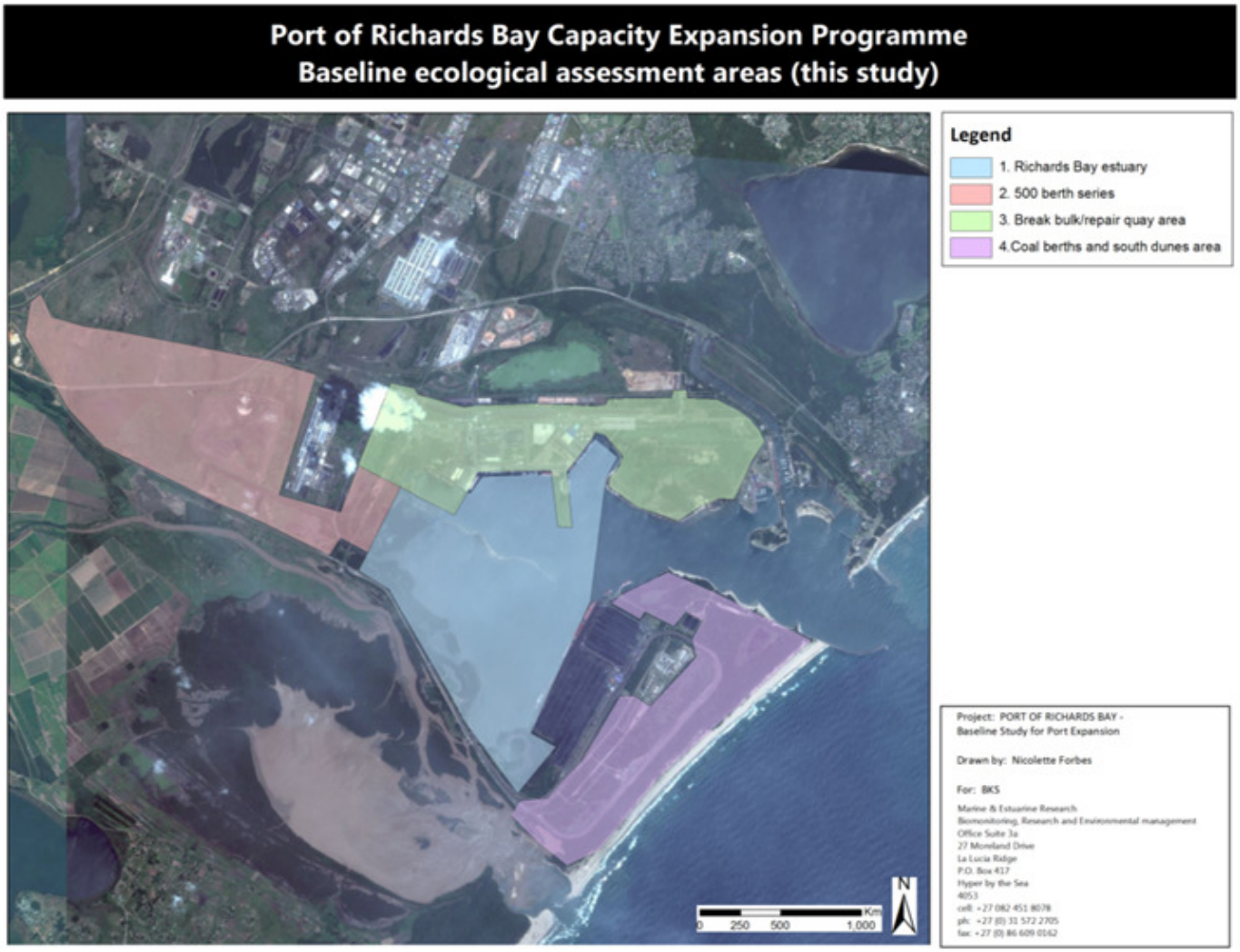


**Figure 4.2** Areas assessed as part of the MER (2013) ecological evaluation

The report highlights the extreme ecological significance of Richards Bay Harbour in both a KwaZulu-Natal and National context, with it being ranked within the top five in the country for the importance of much of its biota. Some of the assessment criteria include Abundance Rating, Conservation Value Index, Endemism Index and Population Size Index to name a few.

While the major part of this report focuses on the aquatic environment of the port the terrestrial environment is also assessed in some detail.

The overview in MER (2013) related to ecosystems within the report and the protection that should be accorded them is of significance and is repeated below.

"The due diligence report by Ilifa Africa Engineers (2010) for the acquisition of land for future port expansion states the following: *'All of this planned port development will impact significantly upon sensitive ecosystem assets and the services they provide and this may negatively affect the ecology of the port, the surrounding area and possibly the entire north coast of KwaZulu-Natal'*.

However, the DAERD (2011) Environmental Management Framework Report suggested that development within the Port could be conducted to allow for the protection of critical biodiversity. The following points were included under the section dealing with conservation priorities and are of relevance *'There is significant potential for advancing conservation priorities in this zone. The Port Estuary is relatively healthy, contains critical ecological assets and fulfills an important biological function. This biological state is maintained by the existing hydrological linkages in the landscape such as the Mhlathuze River entering the intertidal bay area, the Mzingazi Canal and the tidal interchange between the two estuaries. The land-sea interface is also important. For example, intertidal areas within the port estuary support a diversity of invertebrates and are used as refuges, feeding and breeding grounds by a number of species. These areas support the regional prawn trawling industry and fisheries. The port area further has a high visual quality and the amenity value associated with open water bodies may place limitations on development'.*

*'The port estuary must function as a natural system and must complement port activities. Port operations must also secure the ecological-hydrological interrelationship between the port estuary and the sanctuary estuary'.* This was considered to be possible (Thornhill & van Vuuren 2009) by protection and careful management of the critical ecological assets and linkages that support the estuary. They further recommended that serious efforts must be made to avoid damage or loss of habitat that will compromise local, regionally and nationally important populations of ecologically, recreationally and commercially important faunal species; and development must not interfere with the hydrological linkages that supports ecological processes and the integrity of habitats and species. They state clearly that the biodiversity richness of the estuary and its surrounding areas is of global significance and vulnerable to change.

It is therefore clear from previous assessments and this baseline ecological study that terrestrial, aquatic and estuarine ecosystem types are closely connected and spatially related to each other and processes that link these systems happen at the landscape level. Together they constitute an ecosystem that plays a significant role in the maintenance of ecosystem goods and services, including maintenance of the adjacent marine environment. These systems are under pressure due to existing and planned developments and will require careful management of the open spaces to enable the system to sustain itself and the social and economic systems of the area (Thornhill & van Vuuren 2010).

Detailed assessment of the significance and protection status of the range of habitat types which occur within the port is provided.

Preliminary findings of the baseline ecological assessment of terrestrial, wetland and estuarine in selected areas of the port were as follows;

a) **Mangroves**: Forest types and forest patches listed as threatened ecosystems have to be taken into account during the planning of any expansion within the Port. In the case of Richards Bay three forest types, Mangrove Forest, KwaZulu-Natal Coastal Forest and Swamp Forest, occur within the site boundary and are designated as Endangered. The guidelines for the protection of Endangered forest habitats suggest that no activities or development should be considered that would destroy these habitats unless of strategic provincial or national importance with no feasible alternatives. It is important that the future designs and planning consider these habitats and tree species to preserve and protect wherever possible and implement appropriate mitigation if the impact is completely unavoidable.

b) **Intertidal areas**: Although these habitats are relatively small areas within the Richards Bay estuary, this is only found within four or five estuaries in KZN. Some surveys of these intertidal areas have been conducted over the last ten years and it is recommended that finer scale investigation of the physical and biological composition of these communities are carried out to inform the more detailed phases of port expansion planning.

c) **Biodiversity targets and ecological goods and services**: It may be argued that the habitat that exists is modified, but it is a part of the regional estuarine resource, which provides essential goods and services to the city, coastline and its residents. The potential remains for the goods and services provided by this estuary to be maintained with careful development planning and implementation. This would maintain biodiversity value and ecological function and ensure continuing value to the coastal system.

d) **Ecological consequences of changes in turbidity, suspended solids and sediment contamination**: The ecological consequences of changes to the local environment in the areas of construction as a result of dredging, piling and infilling will require further assessment at a much more local level during future port planning.

e) **Thulazihleka Pan**: The area occupied by this highly significant wetland is mooted for further development. The current IDZ plans will result in development in close

proximity with the possibility of a variety of impacts including run-off, dust and noise. No recent work with the exception of the Co-ordinated Waterbird Counts (Taylor *et. al.,*1999) has been carried out on this wetland and the future planning should include the more detailed surveys of this wetland.

Preliminary findings associated with the mesic ecology of the sites under consideration indicate that:

**a) The Bayside Smelter 500 series berth site**: A literature review and preliminary field work has indicated that this site, while constituting a wetland – estuary interface has been highly transformed. In addition, the site may be subject to a high level of contamination.

**b) The South Dunes site**: Initial assessment of the coastal and supratidal dynamics driving processes at the South Dunes suggests that this be given more detailed consideration during future port planning. A narrowing of the stabilized dune cordon has significant medium to long term effects on coastal processes, as well as the stability and security of RBCT structures built within this area.

**c)** The proposed development area between the Break Bulk and Repair Quay shows little ecological value in terms of the mesic habitat present on site. The site constitutes a stabilized sand bank / dune form. The area does however warrant further consideration of the mangrove community situated landward of this point.

If there is any criticism of this report it would be that despite there being a significant mangrove stand and large intertidal sand flats in the Rail Balloon site (also known as the 'Casuarinas'), these are not included in any part of the review nor are they shown on any of the habitat maps in the report. As pointed out by Cyrus & Vivier (2014), these two habitats may make a major contribution to the ecological functioning of the port's estuarine habitat.

### 4.3 CONCLUSIONS

The review report by MER (2013) provided comprehensive insight into the Marine (& Estuarine) and Terrestrial habitats and their ecological importance and functional contribution. In order for Richards Bay Harbour to continue functioning as the significant ecosystem that it is, cognisance needs to be taken of these habitats and it should be ensured that there is sufficient of each habitat type left after full development of the port so that each can still make a contribution to future overall ecosystem functioning.

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## ABRIDGED CURRICULUM VITAE

## PROF. DIGBY PAUL CYRUS

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| **Occupation:** | Senior Academic & Estuarine Ecologist | | |
| **Positions:** | Head: Department of Zoology (1995 to June 2014)<br>Research Fellow (July 2014 to date) | | |
| **Organisation:** | Department of Zoology, University of Zululand | | |
| **Address:** | Private Bag X1001<br>KwaDlangezwa 3886<br>South Africa | **Tel:** +27 (0)35 9026738/6742<br>**Fax:** +27 (0)35 9026750<br>**Email:** cyrusd@unizulu.ac.za | |
| **Place of Birth:** | Pretoria, South Africa - South African Citizen | | |


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|---|---|---|
| **Qualifications & Courses:** | **BSc** (Zoology, Entomology) | **1977** |
| | **BSc Hons** (Hydrobiology) | **1978** |
| | **MSc (*cum laude)*** (Estuarine Ecology) | **1980** |
| | **PhD** (Estuarine Ecology) | **1984** |
| | **Integrated Environmental Management - Theory & Practice** | **1991** |
| | **Offshore Marine Pollution** | **1997** |
| | **ISO 14001 Environmental Management Systems** | **1998** |
| | **Public Participation in EIA's – Theory & Practice** | **2002** |
| **Awards** | **Southern African Society of Aquatic Scientists – Gold Medal** | **2011** |

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**Academic Experience:** Thirty three years' experience lecturing a wide range of Zoology related subjects as well a supervising numerous MSc and PhD students.

**Research Experience:** Forty years covering Estuarine, River, near-shore Marine and Coastal Lake environments. Have participated in numerous contract research projects such as the determination of the Environmental Reserve for Coastal Lakes and Estuaries, the effects of intrabasin transfer schemes in the area, A Strategic Environmental Scan with reference to Biotic components of the Richards Bay area and Instream Flow Requirements for Rivers. Involved with Freshwater Flow Requirements for Estuaries. Was part of the Scientific team that formulated the biological requirements for the South African Resource Directed Measures Legislation to determine Flow Allocations for Environmental Purposes for Estuaries & Rivers and the monitoring thereof.

**Specialisations:** Estuarine, River and Coastal Lakes Ecology. Flow Allocations for Environmental Purposes for Estuaries and Rivers based on Biotic component requirements. Fish Specialist. Also specialist in ornithological issues related to association of birds with Estuaries, Rivers and Coastal Lakes.

**Environmentally Related Activities:** Have been involved in over 130 research projects concerned with Environmental Impact Assessments on the ecology of nearshore marine, estuarine and freshwater systems and project leader/senior author on some 90 of these. Fields include specialist biological surveys, ecological assessments, biomonitoring, specialist review consulting, Estuarine Flow Requirements and numerous studies on impacts of developments on aquatic environments. Have been involved with Reserve determinations for the Mkomaas, Mhlathuze, St Lucia, Siyaya and Nhlabane Systems as well as with the revision of the estuarine RDM Protocols, Thukela Intermediate EFR study and development of Estuarine Base line and long term Monitoring Protocols for RDM of Estuaries. Assessment of the Environmental Impacts of the development of the Port of Richards Bay over the next 40 years.

**Presentation of Research Findings:**

**Publications:**
146 Scientific Journal Publications (124 on Estuaries)
142 Environmental Project Reports

**Conference Presentations:**
76 National Conferences
67 International Conferences

**Co-operative and Collaborative Research:** Current and past involvement with the Universities of Natal (Durban & Pietermaritzburg) and Port Elizabeth, the SA Institute for Aquatic Biochemistry, KZN Wildlife, World Wildlife Fund - Conservation Division, National Ports Authority, Mondi Forests, Sappi Stanger Environmental Liaison Committee, CSIR, Institute for Natural Resources, Oceanographic Research Institute as well as three overseas based projects (University of Hull, UK & CSIRO, Australia).

**Membership of Scientific Societies:** Southern African Society of Aquatic Scientists (SASAqS), Estuarine and Coastal Shelf Sciences Society (ECSA), Consortium for Estuarine Research and Management (CERM), Zoological Society of South Africa & Ornithological Society of South Africa (Bird Life SA).

2014-11-10

## ABRIDGED CURRICULUM VITAE

## Dr LEON VIVIER

**Occupation:** Academic & Researcher
**Organisation:** Department of Zoology, University of Zululand

**Address:** Private Bag X1001
KwaDlangezwa 3886
South Africa

**Tel:** +27 (0)35 9026741
**Fax:** +27 (0)35 9026750
**Email:** lvivier@pan.uzulu.ac.za

**Place Of Birth:** Cape Town, South Africa - South African Citizen

**Languages:** English, Afrikaans

| | | |
|---|---|---|
| **Qualifications:** | **BSc** (Zoology, Biochemistry) | **1987** |
| | **BSc Hons** (Zoology) | **1988** |
| | **MSc** (Zoology) | **1992** |
| | **PhD (**Zoology) | **2010** |

**Experience:** Twenty two years experience in estuarine ecological research on KZN rivers, estuaries and coastal lakes - mostly on zoobenthos, fish & water quality. Current fields of research include biology and ecology of estuarine zoobenthos and fish, and sediment toxicity bioassay procedure development for nearshore, estuarine and marine sediment and water. Have participated in many co-operative and contract research projects i.e. environmental biotic studies of Richards Bay Harbour and adjacent estuarine and wetland areas, environmental reserve for coastal lakes and estuaries, instream flow requirements for rivers,strategic environmental scan with reference to biotic components of the Richards Bay area, deign and monitoring of fishways in KZN, survey of water quality and biota of the Bivane and Phongola Rivers, ecostatus of the Phongolo river floodplain.

**Specialisations:** Zoobenthic & fish community ecology and water quality assessment of coastal lakes and east coast estuaries. Estuarine water and sediment pollution/quality surveys, including use and development of sediment toxicity assessments and assays.

| | **Publications:** | **Conference Presentations:** |
|---|---|---|
| **Presentation of Research Findings:** | 22 reviewed journal publications, co-author of 38 consultancy reports. | 10 National Conferences<br>9 International Conferences |

**Co-operative And Collaborative Research:** Have participated in joint Unizul, Rhodes, UPE, CSIR & JLB Smith RDM projects on the Mhlathuze and Nhlabane Estuaries. Have collaborated with ORI scientists in a multi-disciplinary MCM funded survey of the drought related impacts on the fish community of St Lucia.

**Membership of Scientific Societies:** Member of the Southern African Society of Aquatic Scientists and the Consortium for Estuarine Research and Management.

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