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Proclaimed Fishing Harbours

Site Specific Maintenance Management Plan for Laaiplek Harbour

Coega Development Corporation

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Document prepared by:

Aurecon South Africa (Pty) Ltd
Reg No 1977/003711/07
Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City
Cape Town 7441
PO Box 494
Cape Town 8000
South Africa
T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W aurecongroup.com

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Author signature		Approver signature	
Name	Mieke Barry	Name	Werner Gous
Title	Principal Env. Consult.	Title	Technical Director

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The information contained in this report have been prepared based on information received from our coastal engineers as well as our sub-consultant, Lwandle Technologies (Pty) Ltd (Lwandle). Aurecon have based this Report on information received or obtained, on the basis that such information is accurate and, where it is represented to Aurecon as such, complete.

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Acronyms and Abbreviations

CDC	Coega Development Corporation
DEA	Department of Environmental Affairs
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
MMP	Maintenance Management Plan
NDPW	National Department of Public Works
NEMA	National Environmental Management Act
NEM: ICMA	National Environmental Management Integrated Coastal Management Act 24 of 2008
NEM: WA	National Environmental Management: Waste Act 59 of 2008
I&AP	Interested an Affected Parties
PPP	Public Participation Process

Glossary

Dumping permit	A permit granted under section 71 of the National Environmental Management: Coastal Management Act, 24 of 2008.
Environment	The external circumstances, conditions and influences that surround and affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Management Measures	Requirements or specifications for environmental management, as presented in the MMP.
Generic MMP	The generic document applicable to environmental management at all the proclaimed fishing harbours. The generic MMP will be appended to, and form part of the Site Specific MMP for each of the individual.
Maintenance dredging	The removal of accumulated sediment to the original depth of the harbour, but excluding any additional deepening or capital dredging. This excludes dredging for the upgrading of structures.
Method Statement	A mandatory written submission by the Contractor to the ECO setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity.
Mitigation Measures	Actions identified to manage (avoid, minimise or optimise) potential environmental impacts which may result from the development.
Operation Phakisa	Operation Phakisa is an initiative of the South African government designed to fast track the implementation of solutions on critical development issues. This is a unique initiative to address issues highlighted in the National Development Plan (NDP) 2030 such as poverty, unemployment and inequality. “Phakisa” means “hurry up” in Sesotho and the application of this methodology highlights government’s urgency to deliver and implement priority programmes. This is a cross-sector programme where various stakeholders engage to implement initiatives and concrete actions to address constraints to delivery in a prioritised focused area for public accountability and transparency.
Site Specific MMP	The Site Specific MMP is applicable to a single finishing harbour only and contains site specific information. The generic MMP will be appended to, and form part of the Site Specific MMP for each of the individual fishing harbours.

Profile of Expertise of EAPs

Aurecon South Africa (Pty) Ltd (hereafter referred to as Aurecon) has been appointed as Consultants to compile the Specific Maintenance Management Plan (MMP) applicable to the Laaiplek Harbour.

As required by the National Environmental Management Act 107 of 1998 (NEMA), the qualifications and experience of the key individual practitioners responsible for this project are detailed below.

Tamryn Johnson

Tamryn Johnson is a Senior Environmental Scientist with 11 years of extensive experience in environmental management, which includes sectors such as mining, roads and transport and water. She also has a diverse range of knowledge within the marine and coastal management sector, specifically within the coastline environment.

She has managed and coordinated various projects in South Africa, Namibia, Swaziland, Mozambique and the DRC which includes scoping and environmental impact assessments (EIAs), environmental management programmes (EMPRs), environmental screening and constraints analysis, water use licensing, environmental audits, environmental baseline monitoring and reporting, waste licence applications, disaster risk assessment and environmental compliance monitoring.

Tamryn obtained a Bachelor of Science (Honours) in Physical Oceanography in 2004, as well as a Bachelor of Science in Environmental and Geographical Science and Ocean and Atmosphere Science in 2003, both from the University of Cape Town (UCT) in South Africa. She is a member of the International Association for Impact Assessment South Africa (IAIAsa).

Mieke Barry

Mieke Barry is a senior environmental consultant with 14 years' experience within the environmental management field. She started her career in a small consultancy firm based in South Africa where she gained experience in providing a wide variety of environmental management services.

Prior to joining Aurecon, she worked for a large engineering firm in London for seven years where she gained experience in project managing environmental impact assessment (EIA) and environmental and socio-economic impact assessment (ESIA) projects within the urban regeneration sector in London and the oil and gas sector with projects in Azerbaijan and Bulgaria. This also included providing environmental support services to BP Major Projects on a number of projects involving offshore drilling, subsea pipelines and upstream facilities. Since joining Aurecon, Mieke has been involved in EIA projects in South Africa, Mozambique and Namibia which have included gas to power, renewable, mining and linear projects.

Mieke obtained a Master of Arts in Environment and Society from the University of Pretoria, South Africa, in 2000 as well as a Bachelor of Arts (Honours) in Geography and Environmental Studies in 1999 and a Bachelor of Arts in Geography and History in 1998, both from the University of Stellenbosch in South Africa. She is a member of the International Association for Impact Assessment South Africa (IAIAsa).

Statement of Aurecon Independence

Aurecon hereby confirms that we and any of our sub-consultants have no business, financial, personal or other interest in the activity and that there are no circumstances that may compromise our objectivity in performing our work excluding, fair remuneration for work performed in connection with that activity.

1 Introduction

1.1 Background and Introduction

The National department of Public Works (NDPW) has appointed the Coega Development Corporation (CDC) as Implementing Agent for the repair, maintenance and upgrade of the 13 proclaimed fishing harbours in the Western Cape. Repair of the 13 fishing harbours has been split into four discrete work packages as follows:

- Work package 1: Saldanha Bay and Pepper Bay;
- Work package 2: Hout Bay, Kalk Bay, Gordons Bay and Hermanus;
- Work package 3: Lambert's Bay, Laaiplek, and St. Helena Bay; and
- Work package 4: Stilbaai; Struisbaai; Arniston and Gansbaai.

CDC has appointed SRK Consulting (South Africa) (Pty) Ltd (SRK) to compile a Generic Maintenance Management Plan (MMP) applicable to all 13 fishing harbours and based on which Site Specific MMPs can be compiled for each harbour. The Generic MMP (Appendix A), together with the Site Specific MMP, (collectively referred to as "the MMP") aims to meet the requirements of the National Environmental Management Act 107 of 1998, as amended (NEMA) and the Environmental Impact Assessment (EIA) Regulations, 2014, for an approved MMP for maintenance activities.

Aurecon (Pty) Ltd (hereafter referred to as Aurecon) has been appointed by CDC for the professional consulting services required to repair, maintain and upgrade the marine infrastructure for Work Package-3, and has in turn appointed Aurecon's Environmental team to compile the Site Specific MMP for Laaiplek harbour.

The small harbours programme aims to drive the rejuvenation and upgrading of the small (fishing) harbours forming part of Operation Phakisa, to promote economic growth within the communities they serve. Currently, there are 13 proclaimed fishing harbours in the Western Cape. Within this programme six main project packages have been identified and NDPW has established a Small Harbours Development Unit to implement and facilitate these packages which is already underway.

Small harbours are often the life source and focal point for the neighbouring communities they serve, and integrated into businesses and communities in and around the towns where they are located. In many cases, these harbours are the main source of employment whether that be in the fishing, tourism and manufacturing industries or personnel of the harbour itself. Over time, a number of the existing small harbours along our coastline have been neglected both from an infrastructure and operations perspective as well as governance aspect. This in turn has hindered the growth and development of the harbours and subsequently had a negative impact on the surrounding communities. The long-term potential of the fishing industry, issuing of quotas managed by government, and the interface of the harbour infrastructure with the surrounding town and environment, are all critical aspects to be understood in order to determine future steps for infrastructure related decisions.

Part of the overarching Operation Phakisa initiative is the focus on developing and growing the country's Ocean Economy. It has been estimated that South Africa's oceans could contribute between 129 to 177 billion Rand to the Gross domestic product (GDP) by 2033, as well as hundreds of thousands of jobs. An aspect which is critical to realising this potential is the rehabilitation and rejuvenation of the existing small harbours along the coastline.

This Site Specific MMP is due to be circulated for a 30-day public comment period, as part of the Public Participation Process (PPP). Any comments received will be recorded and responded to in a Comments and Response chapter within the Public Participation Process Report that will be annexed to the Final Site Specific MMP. Likewise this Site Specific MMP Report will be updated in order to address Interested and Affected Parties (I&AP) comments, as/where appropriate.

The Draft and Final Site Specific MMP Reports will be submitted to DEA for review. Thereafter DEA will upon receipt of the Final Site Specific MMP Report, consider it, and in writing –

(a) Accept the report and approve the MMP; or
(b) Reject the MMP in which case the proposed activity cannot commence.

1.2 Purpose and Structure of the MMP

The MMP aims to ensure that all future repairs and maintenance to the fishing harbours are undertaken in an environmentally responsible manner, in compliance with relevant environmental legislation.

The MMP consists of two components:

- The Site Specific MMP: which contains only site specific information applicable to a single fishing harbour; and
- The Generic MMP: which contains information and requirements applicable to the management of all fishing harbours and will allow for consistency in environmental management for all harbours in the Western Cape.

For each harbour, the Generic MMP will supplement (and be appended to) the Site Specific MMP.

1.2.1 Structure of the Site Specific MMP

The Site Specific MMP (this document) contains only information specific to Laaiplek harbour and consists of the following sections:

Section 1: Background and Introduction

Provides an introduction and background to the project, outlines the purpose of the Site Specific MMP and how it relates to the Generic MMP.

Section 2: Site Description

Describes the location and characteristics of Laaiplek harbour, provides property owner details and an overview of the receiving biophysical and socio-economic environment.

Section 3: Description of Proposed Works

Describes the maintenance and repair works currently proposed, noting that the MMP will also be applicable to future works, the details of which may not yet be available.

Section 4: Potential Impacts

Identifies and provides a qualitative assessment of the significance of the potential impacts of the proposed works on the receiving environment, assuming the specifications of the MMP are adequately implemented.

Section 5: Site Specific Environmental Management Requirements

Provides the management measures applicable to the maintenance and repair of the harbour including the roles and responsibilities for implementation of the Site Specific MMP, compliance and monitoring requirements as well as detailed environmental management measures to be implemented.

1.2.2 Structure of the Generic MMP

The Generic MMP consists of the following sections, which would be applicable to all fishing harbours:

Section 1: Background and Introduction

Provides an introduction and background to the project and outlines the purpose of this document, as well as the Site Specific MMPs.

Section 2: Governance Framework

Provides a brief summary and interpretation of relevant legislation.

Section 3: Potential Impacts

Provides a generic description of the potential environmental impacts associated with repair and maintenance works within harbour environmental as well as identifying (high level) generic mitigation measures.

Section 4: Environmental Management Measures

Provides the management measures applicable during the long-term maintenance of the harbour including the roles and responsibilities for implementation of the MMP, compliance and monitoring requirements as well as detailed environmental management measures to be implemented.

1.3 Scope of the MMP

The scope of repair and maintenance activities addressed in the MMP includes:

- Placement of rock (more than 10 m^3) within the footprint of existing rock revetments;
- Maintenance dredging of the harbour basin; and
- Disposal or deposition of dredged material either below or within 100 m of the high-water mark of the sea.

The following activities, if proposed in any of the fishing harbours, does not require an MMP in terms of NEMA and are excluded from the scope of this MMP. These activities should be undertaken in compliance with the Generic Environmental Management Plan (EMP) for the proclaimed fishing harbours (SRK Report Number 509310/02) to ensure compliance with the "*duty of care*" requirement in terms of Section 28(1) of NEMA:

- Removal of sunken fishing vessels in accordance with the removal of sunken vessels notification;
- Repair and maintenance of existing marine structure including (but not limited to) breakwaters, quays, slipways, jetties, copings etc.;
- Maintenance and repair of quay furniture (bollards, fenders and access ladders);
- Repair and maintenance of harbour machinery and equipment e.g. cranes;
- Placement of rock (less than 10 m^3) within the footprint of existing rock revetments;
- Placement of armour units within the footprint of existing breakwaters; and
- Maintenance or replacement of fencing.

The following activities, if proposed in any of the fishing harbours, are not considered maintenance activities and are excluded from the scope of this MMP. Such activities may require more extensive authorisation procedures and would require screening of relevant legislation:

- The construction of any new structures in the harbour, coastal public property or within 100 m of the high-water mark of the sea and any maintenance or repair works which increase the development footprint of the harbour;

- The dredging, excavation, infilling or deposition of more than 10m^3 of material either below or within 100m of the high-water mark of the sea, which is not for maintenance purposes (e.g. capital dredging or construction of new rock revetments); and
- The removal of 300m^2 or more of indigenous vegetation within 100m of the high water mark of the sea.

1.4 Review and update of the MMP

The MMP will be reviewed and updated every 5 years particularly in response to changes in relevant legislation. Review of the MMP will be done in consultation with the competent authority (in this case the National Department of Environmental Affairs [DEA]) and will be subject to any public consultation required by the competent authority.

1.5 Specific Governance Framework

This section provides the specific legislative framework for Laaiplek harbour that has informed and guided the preparation of this MMP. The overarching applicable legislation is presented in Chapter 2 of the Generic MMP whereas this section specifically focuses on the municipal and local strategic plans or bylaws that could have an influence on the maintenance and repair works to be undertaken within Laaiplek harbour.

The Bergrivier's Municipality's Spatial Development Framework (SDF) and Integrated Development Plan (IDP) considers that Laaiplek's main functions include the local fishing industry and tourism development. According to the SDF, in Velddrif and Laaiplek the upgrading of the sanitation system is the highest priority need, whilst housing (subsidized and other) and water infrastructure also need attention (Figure 1-1).

The harbour area of Laaiplek is identified as a Phakisa project which has amongst its objectives to enhance the ocean economy and revitalise the small harbour and harbour infrastructure. This harbour is classified as a number 7 priority project to be scoped and implemented.

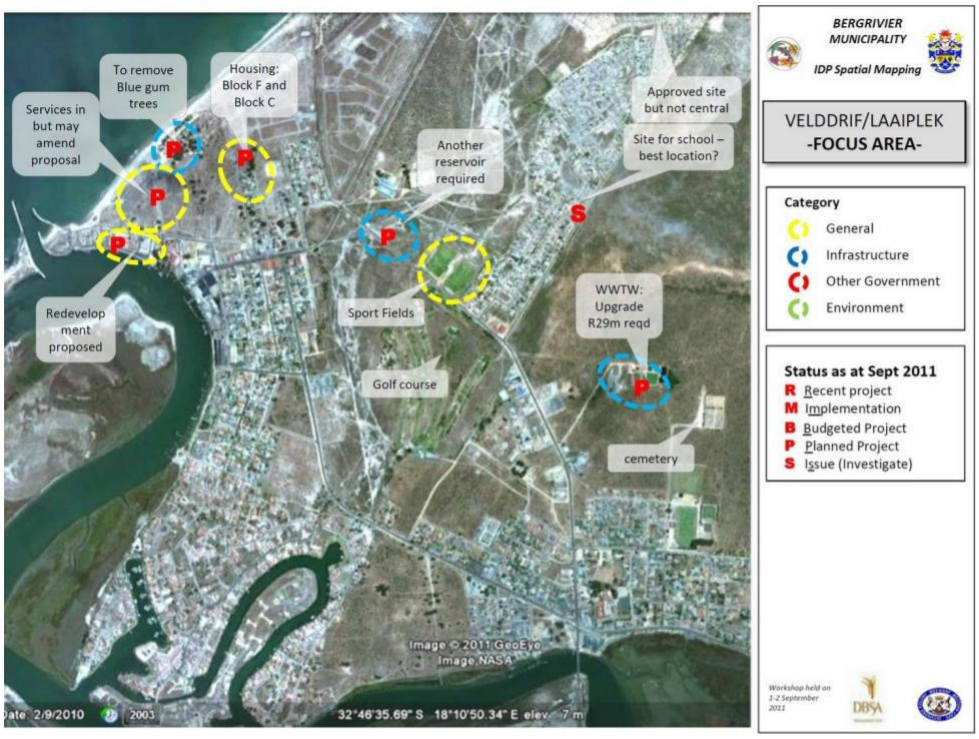

Figure 1-1 Development needs and projects, Velddrif (Bergrivier SDF, 2012 - 2017)

2 Site Location and Description

2.1 Location

Laaiplek is a small fishing town located on the northern shore of the Berg River estuary, along the west coast (refer to Figure 2-1, Laaiplek is denoted by the letter 'B'). It is located within the Bergrivier Local Municipality and the West Coast District Municipality, within the Western Cape Province. Laaiplek is situated north of the adjoining town of Port Own, which lies adjacent to the town of Velddrif. Laaiplek is approximately 150 km north of Cape Town.

Figure 2-1 Location of Laaiplek Harbour (DELTA Status Quo Assessment, 2013)

2.2 Bio-physical Environment

2.2.1 Climate

The Western Cape has a semi-arid Mediterranean climate, which is strongly influenced by the cold Benguela current and coastal wind conditions. The climate at Laaiplek is typical of the West Coast with long, hot dry summers and cool, wet winters. The average rainfall is around 300mm per annum.

2.2.2 Currents

There is no readily available nearshore current data however, the dominant offshore Benguela Current travels northwards along with western coastline of South Africa. As this offshore current moves closer to the shoreline and into small bay areas, the dynamics of the localised current system can change and it is this localised system which is important for the harbour. Currents at Laaiplek Harbour are dominated by the Berg River hydrodynamics and tidal changes at the river mouth.

2.2.3 Waves

The following wave rose illustrates that the dominant wave direction originates from the SW to WSW. The predominant offshore wave height experienced in the area ranges from 1m to 2m whilst wave heights in the order of 3m to 4m are not uncommon. Laaiplek Harbour basin is fairly well protected against these dominant offshore wave conditions.

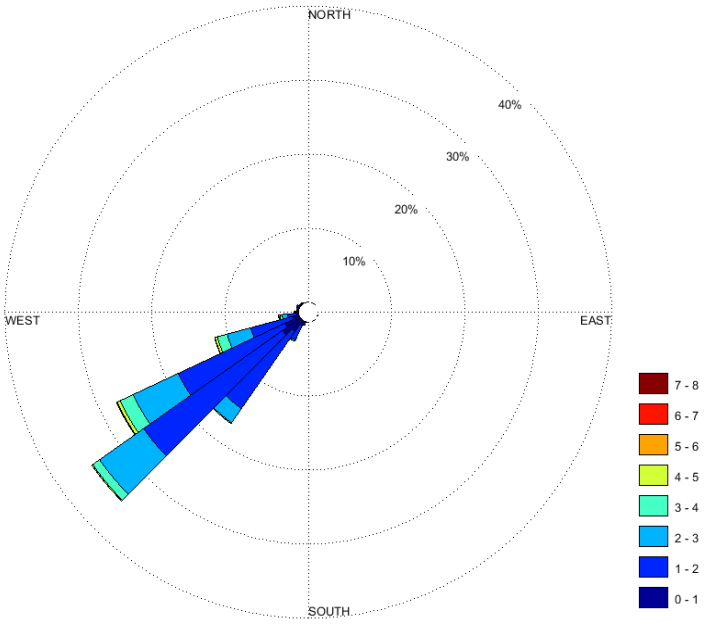

Figure 2-2 Offshore wave rose (extracted from NOAA NCEP database)

2.2.4 Tides

The tidal levels within Laaiplek Harbour are tabulated below.

Table 2-1 Tidal Levels (admiralty chart SAN 1009)

Tide	HAT	MHWS	MHWN	MSL	MLWN	MLWS	LAT
Tidal Level (m CD)	-	1.76	1.26	1.01	0.76	0.26	-

2.2.5 Wind

The dominant wind direction is from the southerly direction with the majority of wind speeds ranging from 4m/s to 12m/s (refer to Figure 2-3).

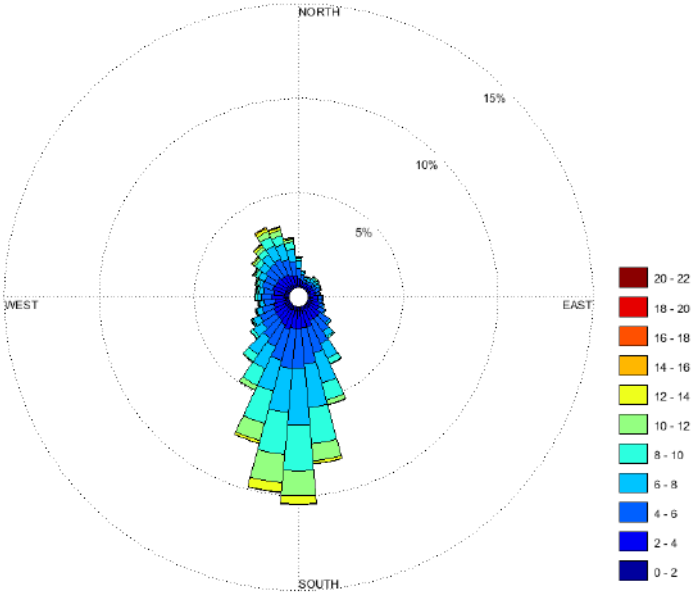

Figure 2-3 Offshore wind rose (extracted from NOAA NCEP database)

2.2.6 Bathymetry

The admiralty chart provides an indication of the original charted depth at Laaiplek Harbour however, due to the lack of maintenance dredging operations within the harbour in recent years and the continuous movement of sediment in and out of the harbour mouth, it does not represent the present day situation (refer to Figure 2-4).

The formally dredged portion of the harbour basin is charted at -3.0m below Chart Datum (CD LAT). The non-dredged portions of the river range in depth from -0.4m CD to -1.0m CD. Due to the river dynamics and processes of the Berg River it is anticipated that relatively large volumes of sediment are transported by the river to the Atlantic Ocean which likely influences the available water depth.

Figure 2-4 Laaiplek Harbour charted depths (Admiralty Chart SAN SC 3)

The completed bathymetric survey for Laaiplek harbour confirmed the existence of irregular seabed topography due to the occurrence of sand bars, rocky outcrops and areas of scouring. The river banks, if not constrained by concrete infrastructure, are composed of sand or finer sediments, rich in organic matter. The navigation channel and harbour entrance mainly comprise of rocky outcrops, often covered by seaweed growth, otherwise with a thin veneer of sediments. A large depression, scoured within the hard seabed, is located at the entrance to the harbour, with two smaller depressions in front of the concrete retaining walls.

2.2.7 Geology and Soils

The geology of the area were Laaiplek Harbour is located consists of Quaternary sediments, primarily aeolian sands consolidated or unconsolidated with marine shells (Veldrif Formation) and consolidated or unconsolidated limestone and lime-rich sands (Langebaan Formation). These formations are all grouped and referred to as Cenozoic deposits (DWAF Report - Berg River Baseline Monitoring Study – Volume 1: Introduction, Ground water and Hydrology, 2007).

Laaiplek Harbour is located at the mouth of the Berg River, which is dominated by Alluvium soils. These soils typically exhibit a negligible to weak profile development, which is typical of recent floodplain areas (Cape Farm Mapper, 2016).

As far as the geomorphology is concerned, the riverbed area, were Laaiplek is located, comprises mainly quartzitic sands topped by a layer of mud. The main river is canal-like, without pools, runs and islands and there are numerous floodplain pans that fill during the wet season, providing refuge for birds. The river merges with the estuary about 3 km downstream of the Farm Kersefontein, which is the upper limit of tidal intrusion (DWAF Report, 2007).

A sediment study of the harbour basin was undertaken in November 2016. Sediment within the harbour was classified as medium to course sands. The highest percentage of gravel was observed at the eastern part of the harbour and harbour mouth, which is likely to be indicative of local flow dynamics preventing deposition of finer particles at these areas (Lwandle, 2016).

2.2.8 Geohydrology and Drainage

Groundwater in the lower Berg River catchment area occurs in two distinct primary aquifers, namely the upper unconfined aquifer system comprising sediments of the Bredasdorp Formation and the lower confined aquifer in the Elandsfontyn Formation. While the overlying Bredasdorp Formation aquifer has a greater extent, poor water quality results in it having limited potential for development for bulk water supply purposes (DWAF Report, 2007).

The lower Berg River aquifer systems are classified as major aquifer systems. Major aquifer systems are highly permeable formations, that may be highly productive and able to support large abstractions for public supply and other purposes, and their water quality is generally very good (less than 150 mS/m). Due to their characteristics, the primary aquifer systems in the lower parts of the Berg River Catchment are deemed to be highly vulnerable to anthropogenic impacts (DWAF Report, 2007).

As far as the hydrology and drainage is concerned, the Berg River has its source in the Drakenstein and Franschhoek Mountains and discharges into the Atlantic Ocean near Velddrif, some 285 km away. Major tributaries of the Berg River include the Franschhoek, Wemmershoek, Dwars, Kompagnies, Klein Berg, and Twenty-four Rivers (eWISA, undated). The Berg River is approximately 294 km long with a catchment area of 7,715 km² and drains into St. Helena Bay on the west coast of South Africa, where it interacts with the Benguela upwelling system.

Several major dams have been built in the catchment - Wemmershoek Dam, Voëlvlei Dam and, more recently, Berg River Dam. Numerous smaller farm dams are found throughout the eastern part of the catchment.

Total natural runoff from the Berg River Catchment amounts to 931 million m^3/a. DWAF (1993) estimated present-day annual runoff of the Berg River amounted to 682 million m^3/a, with the modified flow attributed to direct abstraction from the river for irrigation, storage and abstraction for urban water supply, development of forestry within the basin, irrigation return flow, and releases from the dams.

Flow and quality characteristics of the Berg River have been severely modified by abstraction from the river and the release of some 17 million m^3/a of summer irrigation water from the Theewaterskloof Dam (Breede River Catchment) into the upper Berg River at the Berg River Syphon upstream of Berg River Dam site.

2.2.9 Estuary

The Berg River estuary is one of the largest of South Africa's 279 estuaries, with a total area of 61 km^2. It is one of the most important estuaries in the country from a conservation perspective (rated among the top three estuaries in South Africa in terms of its conservation importance), particularly in respect of its bird and fish fauna. The extensive floodplain that surrounds the middle and upper reaches of the system make it unique in the south-western Cape. Mounting pressures are, however, threatening this estuary, including freshwater abstraction and pollution, over fishing, housing developments and high intensity recreation (Cape Action for People and the Environment - Berg Estuary Situation Assessment, 2008).

Based on the extent of tidal influence, the estuary is estimated to be 65 km long (including floodplain), although seawater does not penetrate this far upstream. The main channel at Veldrif is about 100-200 m wide, becoming progressively narrower and shallower upstream. Depth is about 3-5 m on average, but extends up to 9 m in places. The total volume of the estuary is estimated to be about 12 Mm^3 (CAPE 2008).

The Berg estuary mouth is stabilised between the concrete breakwaters of Laaiplek Harbour and dredged and therefore has remained permanently open since 1966. Freshwater flow to the estuary varies from around 1.5 m^3/s in summer (Nov-Feb) to 35 m^3/s in winter (May-Aug), but reaches between 90 to 600 m^3/s when in flood. Saline seawater penetrates the estuary up to at least 40 km from the mouth during the summer low-flow period, but freshwater inflow to the estuary during winter is sufficient to push the salt water back to within 10 km of the mouth. Estuarine waters are well-oxygenated throughout the year, but are slightly more oxygen rich in winter than summer. Temperature is fairly uniform along the estuary during winter, typically 12-15°C, but tends to be warmer in the upper reaches during summer (typically above 20°C). The lower reaches remain cool during summer due to upwelling at sea.

Nutrients enter the estuary with both the sea and the river, with sea inputs dominating in summer (low flow season), and river inputs dominating in winter (high flow season). Nutrient inputs from the sea have changed little over time but inputs from the catchment have escalated dramatically in recent decades as a result of agricultural inputs and runoff. Total nitrogen concentration at the head of the estuary for example, has increased from less than 300 ugl-1 prior to 1980 (which was roughly equal to the input from the sea) up to almost 2 000 ugl-1 in 2005 (CAPE 2008).

Vegetation of the estuary can broadly be grouped into four types:

(1) Macroalgae (*Enteromorpha* sp.) which forms extensive mats that cover sand and mud flats in the lower reaches of the estuary, and is a source of concern owing to the impacts on invertebrate populations and their predators (birds);

(2) Submerged macrophytes comprise eelgrass (*Zostera capensis*), which forms dense beds in the lower reaches and provides important habitat for juvenile fishes, and fountain grass (*Potamageton pectinatus*), which occurs in low densities in the upper reaches;

(3) Salt marsh, which is also concentrated in the lower reaches and on the floodplain, and contributes to system productivity and biotic diversity, providing important feeding areas, habitat and shelter for numerous invertebrate and birds; and

(4) Reeds and sedges, which are not able to tolerate high salinity, occur in abundance in the middle and upper reaches of the estuary.

In addition to the river channel, the floodplain encompasses eight major wetland types: ephemeral pans, commercial salt pans, reedmarsh, sedgemarsh, saltmarsh, halophytic floodplain, xeric floodplain and intertidal mudflats.

The ecological functioning of the estuary is determined by seasonal changes in river discharge and consequent changes in salinity and turbidity. In winter, when the estuary is flooded by muddy, fresh river water, most of the marine species disappear. As the floods receded in spring, the salinity increases and the system shifts back to a predominantly marine environment. As the shallow pools on the floodplain start to dry up in spring, there is a marked increase in the number of birds the wetlands support.

The terrestrial vegetation within the catchment has been dramatically altered and consists primarily of an agricultural matrix, with patched of Strandveld near the coast, and a mosaic of invasive *Acacia* spp.

2.2.10 Water Quality

The overall quality and sustainability of the estuarine system is currently under threat due to a number of anthropogenic activities. The most significant impact to the estuarine system is the variation in freshwater input, which can have a significant effect on both the physical and ecological functions of the estuary. Other impacts include the loss and destruction of habitat due to development along the river edge, as well as the deterioration of water quality due to industrial, agricultural and residential pollution.

During a site visit which was undertaken during the preparation of Spatial and Economic Development Framework for Laaiplek (2013), it was noted that no surface or groundwater contamination was observed.

2.2.11 Aquatic Ecology

Fish are particularly reliant on estuaries for sheltered habitat in southern Africa, and different species depend on them to different extents. A total of 35 fish species from 30 families have been recorded in the Berg River Estuary, of which 17 (48%) can be regarded as either partially or completely dependent on the estuary for their survival. These include some highly valuable species such as white steenbras and elf, as well as lower value species such as harders (CAPE 2008).

The estuaries on the west coast, particularly the Berg, are crucial in maintaining the range and stock integrity of estuarine and estuarine dependent species along the entire west coast. The decline in the harder stock and marine gill net fishery catches on the west coast has been attributed to over-fishing in the Berg and Olifants estuary by gill net fisheries. However, strong recoveries in fish abundance in the Berg River estuary have been observed since gill netting in this estuary was banned in 2003. Harder and estuarine round herring are the dominant fish species in the estuary, while elf also make up a significant proportion of fish numbers. Estuary dependent species are most abundant from 10-30 km from the mouth, and the area from 12-22 km upstream is considered to be the best core area to conserve for these species (i.e. from the railway bridge upstream to Kruispad) (CAPE 2008).

Laaiplek Harbour is also the location for the offloading of small pelagic fish species (sardine and anchovy) mainly to supply the processing factories located in the area and Snoek and harders line fish and West Coast Rock Lobster caught offshore.

2.2.12 Avifauna

The lower Berg River Wetlands (including the Berg River Estuary) has been designated as an Important Bird Area (IBA). Since 1975, approximately 250 bird species have been recorded on and adjacent to the lower Berg River, 127 of which are water birds.

The Berg supports the highest recorded density of shorebirds on the West Coast of Africa, and supports nationally important populations of several species. Some 92 water bird species have been regularly recorded over the past 10 years, with an average of about 60 species being recorded on the estuary at any one time. An average of 14 000 non-passerine water birds are typically recorded in mid-summer counts, this number decreasing to about 12 300 in mid-winter. Charadriiformes (waders, gulls and terns) account for 41% of the species recorded, with most of these being wader species. Many species are associated with particular habitats or micro-habitats, and some are more sensitive to salinity than others. Distinct communities occur at the mouth (dominated by cormorants, gulls and terns), the lower estuary (dominated by waders and flamingos in summer and flamingos, coots and waders in winter), and the upper estuary (dominated by ducks and waders and wading birds in summer and ducks, flamingos, coots and resident waders in winter). In recent years, a large cormorant roost has developed near the mouth, probably a result of loss of suitable areas elsewhere (CAPE 2008).

The most important breeding sites are riparian marshes and the commercial saltpans. During the desktop study and site visit undertaken in preparation of the SEDF (2013) Curlew Sindpipers, Kittlitz's Plover, Avocet and White Pelicans were observed in the wetland and river area.

During site inspections undertaken in August 2016 by Aurecon's engineers and in September 2016 by Aurecon's environmental consultants, Cormorant's were observed resting on the western breakwater and sunken vessels in the harbour (refer to Figure 2-5).

Figure 2-5 Cormorant's resting on a sunken vessel

2.2.13 Areas of Significance and Protected Areas

Laaiplek Harbour is located at the mouth of the Berg River, parts of which have been identified as Critical Ecological Support Areas (CESA), Critical Biodiversity Areas (CBA) and wetland areas. Although the Berg River Estuary is not formally protected it is recognised as one of the most important wetlands in the country. It forms one of only four perennial estuaries on the arid west coast of southern Africa.

The nearest formally protected area is the Racherpan Nature Reserve, which is located approximately 25km north of Velddrif. The reserve was established in 1967 and consists mostly of a seasonal wetland, which is usually dry between March and June. An adjacent section of the Atlantic Ocean was declared a Marine Reserve in 2008. When full, the pan is less than two metres deep and covers an area of 110 ha. The reserve is synonymous with birding, with a total of 183 species recorded, of which 70 are

waterbird species. Within the marine reserve, southern right whales can be observed between June and September.

2.3 Socio-economic Environment

2.3.1 Demographics and Socio Economy

Laaiplek and Velddrif are classified as coastal towns characterised by an economic landscape that recently changed from a centre for services and processing of fish and agricultural products to a more service-based tourism town. With a population of 11 017 people in 2011 and a projected growth rate of 5-6%, it is estimated that the population will steadily grow to about 18 800 people by 2020 (Bergrivier SDF, 2013).

The GGP was at approximately R970 million in 1997 steadily increasing to a high of R1 445 million in 2008. The manufacturing sector employs the highest percentage of the population in the area in and around Laaiplek, followed by agriculture and the wholesale sector.

2.3.2 Fishing

The harbour was central to the origin of the town, with fishing the main industrial sector in the area. Fresh fish is sold to individuals at the harbour, local fish shops or out-of-town markets. Fish is also canned and processed for fishmeal in local factories at the harbour. Despite challenges, the fishing industry and the Cerebos salt refinery operations are two of the main employment creation drivers in the area.

Whilst a declining mullet population was once a concern, the strong recovery of the stock has been observed ever since gill net fishing in the estuary was banned in 2003. Other abundant fish species include pilchards, round herring and a variety of linefish (SEDF 2013). Fishing activities at the harbour are mostly centred on small pelagics such as anchovies, pilchards and round herring. The family-owned Eigevis moors two pelagic fishing vessels on the main quay.

West Coast Rock Lobster is also landed at the harbour but not to the same extent as other harbours along the west coast. Snoek is also popular during the snoek-run.

Bokkom Laan, situated close to Laaiplek Harbour in Velddrif, is the base for the traditional small-scale net-fishing operations in the area. Fishermen set their nets in the open sea just off Laaiplek, since the banning of gillnetting in the estuary in 2003. The main species caught is Mullet/Harders, which is dried out to make the Bokkoms the area is renowned for.

Marine Products is the largest fishing processing factory in Laaiplek, dating back to the 1950s. The factory is the biggest employer in the Laaiplek and Velddrif area, employing approximately 490 seasonal workers and 80 permanent employees. The old Eigelaar fish processing facilities have closed down and is an example of the declining profit margins of other fish processing facilities in the area.

Fishing related opportunities are listed below:

- Fishing, including small scale artisanal fishing;
- Fishing and food processing;
- Small scale fish and rock lobster processing;
- Maintain commercial processing;
- Retail and wholesale;
- Local fish market;
- Branded artisanal and local products;

- Marine activities and support services; and
- Small scale/community based boat building, storage and/or maintenance (adjacent harbour land)

2.3.3 Tourism and Recreation

The surrounding area of the town is popular amongst tourists, especially nature enthusiasts, due to the close proximity of the berg river estuary and the rich ecosystem it supports. There are also a variety of other recreational activities that the area has to offer (SDEF 2013).

Main attractions in the area include:

- The SA Fisheries Museum, located at the Laaiplek Hotel complex. In addition to illustrating the diverse history within the fishing community and industry, this museum now contains exhibits previously housed by the Hout Bay fishing museum.
- The Berg River Estuary is considered as a premier destination for bird watching and recreational fishing, and remains one of the area's biggest draw cards.
- Boat trips and river tours operate from, in and around the Port Owen Marina. The Port Owen Yacht Club has a busy and varied calendar, which includes events such as regattas and land-based social meetings.
- Bokkoms Laan, located in Velddrif is also a special historic tourist attraction. Tourism related opportunities include:
  - Retail and Wholesale;
  - Small/medium retail (including restaurants, curio shops, etc) – waterfront area;
  - Informal Trade;
  - Community based craft market;
  - Marine Activities and Support Services;
  - Inclusion in West Coast Sailing Route; and
  - Tourism information centre.

2.3.4 Heritage

The towns of Laaiplek and Veldrif share a close history. Veldrif was named by a farmer called Thuenis Smit, in reference to a drift in the veld which his livestock used to cross the Berg River to graze. Laaiplek was established approximately 100 years ago when the wheat, which was harvested from Sandveld, was transported down to the Berg River mouth to be loaded onto the ships heading to Cape Town. This loading zone eventually become known as Laaiplek, 'loading place' in Afrikaans (SEDF 2013).

In 1968, a channel was blasted to link the Berg River with St. Helena Bay, thus completing the formation of Laaiplek Harbour. Figure 2-6 includes an aerial photo from 1938 illustrating Laaiplek before the opening of the channel and an image from 1971 which clearly shows the new channel. The Laaiplek Harbour was developed to service the needs of the commercial, as well as subsistence fishing sectors. The harbour was proclaimed a fishing harbour in 1990 in terms of Section 26(1) of the Sea Fisheries Act (Act no. 12 of 1988).

Laaiplek 1938

Laaiplek 1971

Figure 2-6 Development of Laaiplek Harbour

During a site visit for the Laaiplek Harbour SEDF (2013) no protected structures were identified in and around the harbour area. The South African Museum, located in Velddrif, opened in 2009. The museum exhibits the history of the fishing industry along the West Coast, from the days of whaling to the present-day rock lobster fishing. The museum offers guided tours and insight into the history and culture of fishing along the West Coast.

The South African Heritage Resources Agency (SAHRA) was consulted and no protected structures were identified in and around the harbour area (refer to Section **Error! Reference source not found.** or further information).

2.4 Existing Harbour Infrastructure

Laaiplek Harbour contains a main wharf with approximately 330 m quay length and a number of smaller jetties. The wharf consists of a wooden piled structure with timber plank decking and small bollards. Two boat ramp slipways with training walls are also present. Fishing vessels of up to 40 metres can be accommodated. The infrastructure elements of the Laaiplek Harbour are indicated in Figure 2-7.

The physical dimensions of each of the infrastructure elements is summarised in Table 2-2 (sourced from WC Proclaimed Harbours SEDF – Laaiplek Phase 2: Options Generation, October 2013).

Table 2-2 Infrastructure element summary at Laaiplek Harbour

Infrastructure Element	General Description
Eastern Breakwater	Approximately 162m in length with concrete sheetpile walls
Middle Breakwater	Approximately 50m in length with concrete sheetpile walls
Middle Training Wall	Approximately 184m in length with concrete sheetpile walls
Western Breakwater	Approximately 238m in length with concrete sheetpile walls
Western Training Wall	Approximately 135m in length with concrete sheetpile walls
Timber Quay	Timber wharf with an approximate length of 340m
Boat Launch Ramp	Approximately 10m wide concrete slab
Shore Crane	Derrick crane had a capacity of 7.5t when operational

Figure 2-7 Layout and infrastructure of Laaiplek Harbour

2.4.1 Need for maintenance and repair

The Aurecon engineering team undertook a site inspection with representatives of the Department of Agriculture, Forestry and Fisheries (DAFF) in August 2016. The following information regarding the current status of the infrastructure elements of the harbour, and the requirements for repair and maintenance of these elements has been obtained from the site inspection report.

The eastern and middle breakwater, as well as the middle training wall, all show evidence of the concrete sheetpiles separating and deflecting. This has resulted in loss of sand fill, settlement of the concrete deck (Figure 2-8), and the consequential widespread cracking and spalling of concrete. The western breakwater could not be inspected due to lack of access.

Figure 2-8 Evidence of Concrete Deck Settlement on the Eastern Breakwater

The existing boat launch ramp is in a generally good condition, although the expansion thereof to improve capacity is a potential future requirement.

The entire timber quay deck structure is in a relatively poor condition, with several timber deck panels loose and rotten. The quay is currently utilised by vessels larger than it is designed to cater for, resulting in unstable conditions due to increased mooring loads during northerly winds. The electrical cable runs unsecured across the quay's support beams, and the electrical kiosks are often out of service due to leaking in periods of rainfall. The fixed, shear-leg shore crane at the eastern end of the quay is in a poor condition. There are also two sunken vessels along this quay, one at either end, hampering operations and capacity (Figure 2-9).

Figure 2-9 Sunken Vessel at the Western end of the Timber Quay

All bollards and fenders require general service maintenance, but the majority of tyre fenders along the timber quay as well as some of the bollards are in a poor condition. A lack of potable water supply at suitable points along the quay and in the snoek shed was also identified.

The navigation channel in the harbour experiences sedimentation issues, resulting in a safe navigable width of 20m, which only allows for one-way traffic. The navigation aid at the head of the eastern

breakwater is out of service and requires maintenance. Within the harbour limits, on the Hangbos side, there is significant evidence of coastal erosion at the eastern end of the rock revetment, which has apparently been exaggerated over the last two years according to the harbour officials (Figure 2-10).

Figure 2-10 Evidence of Coastal Erosion on the Hangbos Side of the Harbour

2.4.2 Current harbour area land uses

The Municipality has holiday resorts in Laaiplek and Dwarskersbos which need to be maintained at a high standard at all times as they contribute to local tourism. The harbour is identified as having economic potential whereby optimal use needs to be made of potential opportunities arising from this (Fourth Generation IDP, 2017-2022).

Property within the harbour jurisdiction boundary contains very little land use activity. This is limited to the ramp, quay and harbour administration offices.

Land uses on adjacent properties are mixed light industrial with some small retail facilities (refer to Figure 2-11). Some marine support services are present (the private slipway, Caterpillar Marine) in the functional area of the harbour, but a number of the land uses do not have any functional relationship to the harbour. The area beyond the slip way contains a hotel and a fish factory. The area beyond the hotel and fish factory is predominantly residential with some commercial land-uses along Jameson St.

Figure 2-11 Laaiplek Harbour Land Uses (WC Proclaimed Harbours SEDF – Laaiplek Harbour, 2013)

2.5 Property Owner Details

The details of the property owner are presented in Table 2-3.

Table 2-3 Property Owner Details

Name of Company	National Department of Public Works
Contact Person	Vuyo Ngonyama
Position	Director: Property Management
Postal Address	Private Bag X9027, Cape Town, 8000
Telephone	(021) 402 2102
Fax	(021) 419 2978
Email	vuyo.ngonyama@dpw.gov.za

3 Description of Proposed Works

3.1 Current Works

The maintenance and repair activities required at the harbour will include the following five aspects (refer to Figure 3-1):

- Concrete repair including sealing and grouting;
- Replacement of the timber quay;
- Replacement of shore crane;
- Routine dredging of the harbour basin;
- Routine maintenance dredging of the harbour basin,
- Disposal of dredged sediment on the beach; and
- Removal of two sunken vessels.

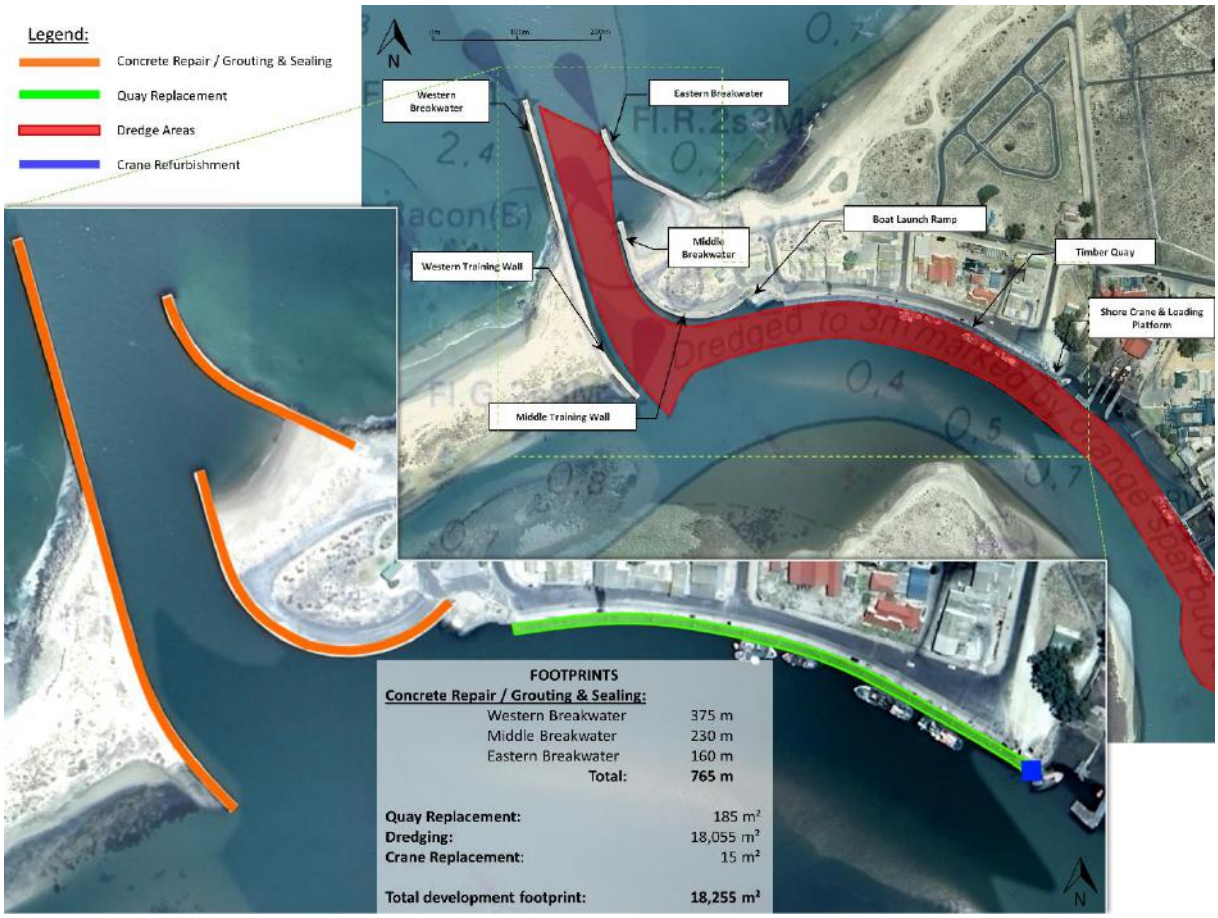

Figure 3-1 Site map indicating the location of the proposed works

Concrete Repair

Structural repair will be undertaken on the breakwaters and training walls. This will include resealing and grouting of concrete on these structures in order to stabilise the embedded sand layers. This is done to prevent the loss of sand fill from behind the sheetpile walls in these breakwaters, as is currently experienced.

Timber Quay

The upgrade of the timber quay will involve the removal of the existing quay and replaced with a new quay. It is anticipated that approximately 350 piles will be installed. The piles will be installed by initially drilling through the existing rip-rap/hard material layer and installing a steel circular tube (to maintain the drilled hole). The precast concrete circular pile will be guided through the steel sleeve and hammered/impacted down through the underlying material until the required bearing capacity is obtained. It is anticipated that the placement of approximately 230m3 of concrete will be required in order to bind the rip-rap material together as to allow the drill bit to be able to drill through the hard material. It is expected that the placed concrete for the binding of the rip-rap material will cover a surface area of approximately 0.5m by 0.5m (area = 0.25m2) per pile.

The precast concrete U-beams will be installed with the aid of a crane which will lower the precast beams into position alongside the installed piles and connected/fastened to the piles to create the initial structural frame (support structure). Installed on-top of the precast U-beams will be the precast concrete deck panels which will be supported by the U-beams and form the sub-deck of the quay. Along the quay line (berth line) precast concrete fender panels will be hung which will be concreted to the front row of piles and U-beams. Both the precast fender and deck panels will be placed using a crane. Once the precast sub-structure is installed the cast in-situ concrete topping will be poured on-top of the deck panels until the final design level of the quay (refer to Figure 3-2).

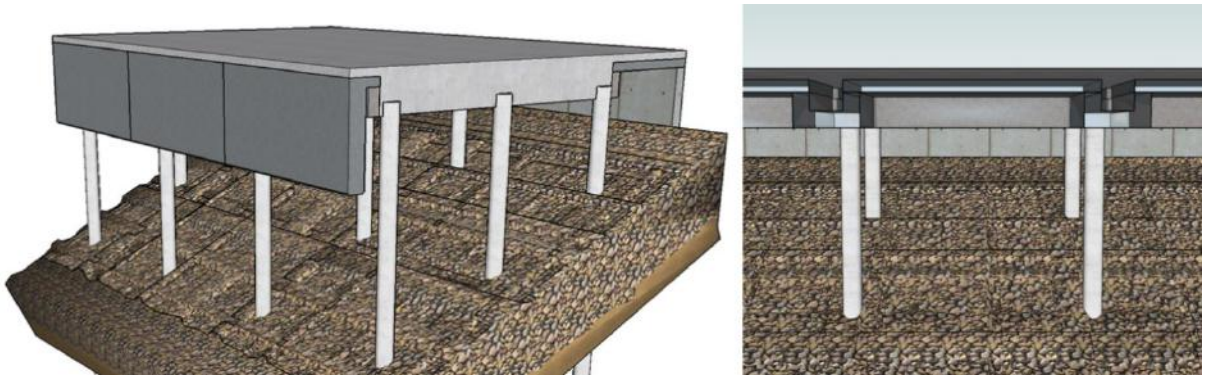

Figure 3-2 Proposed quay structure, side elevation (left) and front cross section (right)

Shore crane

The existing shear-leg/derrick crane on the timber quay will be replaced with a new knuckle crane.

Routine maintenance dredging of the harbour basin

Dredging of the harbour basin is a standard maintenance requirement for harbour operations, and should occur regularly to ensure the proper functioning of the harbour activities. This maintenance activity has been neglected in Laaiplek Harbour in recent years. Based on bathymetric survey and required navigational depth, the estimated volume of dredge material requiring removal, handling and disposal is approximately 9 400 m^3. It is proposed that the reinstated dredge depth be -3.5m CD which includes 0.5 m allowance for overdredging.

Bathymetric surveys have been done at Laaiplek to understand the status quo and to enable quantification of the dredging requirements. These surveys were supplemented with sediment sampling, also done at all three harbours, which informed the seabed material composition and then compared against National Action List (DEA 2012) and the BCLME (2006) sediment quality guidelines to determine their suitability for disposal at sea. Laboratory testing was also undertaken to verify whether the in-situ material is appropriate for offshore dumping. Minimal dredging is required at Laaiplek harbour, presumably due to its location within a major river estuary.

Removal of Sunken Vessels

Two sunken vessels will need to be removed from the harbour. The South African Heritage Resources Agency (SAHRA) was contacted to provide assistance in determining if the removal of sunken vessels will require permitting in terms of the National Heritage Resources Act (Act no. 25 of 1999) (NHRA). Ms Lesa le Grange of SAHRA confirmed that the sunken vessels are modern and therefore would not require a permit in terms of the NHRA for the removal thereof.

The Listing Notices as defined in GN No. R.983, R.984 and R.985 of 4 December 2014 in terms of NEMA Environmental Impact Assessment Regulations, 2014 as amended was examined and DEA was consulted. DEA confirmed in an email dated 16 March 2017 that no listed activities are triggered for the removal of sunken vessels.

An Environmental Management Specification (EM Specification) for the removal of sunken vessels was prepared by Aurecon's Environmental Team, for the Specialist Service Provider who will be removing them. The EM Specification covers the standard requirements for controlling the impact of sunken vessel removal activities on the environment including the coastal environment. Due to the specialist nature of sunken vessel removal works, detailed Method Statements from the Specialist Service Providers have been requested during the tender process. These Method Statements will be evaluated with particular emphasis placed on compliance to the EM Specification and Safety Management Plans, which will include a plan for reuse, scraping and/or disposal.

3.1.1 Alternatives considered

The disposal of dredge material is an ecologically sensitive activity, and one which requires approval for the designated site by DEA: Oceans and Coasts. Therefore, the risks associated with this activity need to be mitigated before sites and permits are allocated. For the Laaiplek harbour dredged material, potential locations were identified that could serve as dredge disposal sites.

For the Laaiplek harbour dredged material, potential locations were identified that could serve as dredge disposal sites. These potential locations were then assessed to determine which is most appropriate for the dredging activities in the harbour. Four options were considered for the disposal of dredge material at Laaiplek harbour. These four options are assessed in Table 3-2 below.

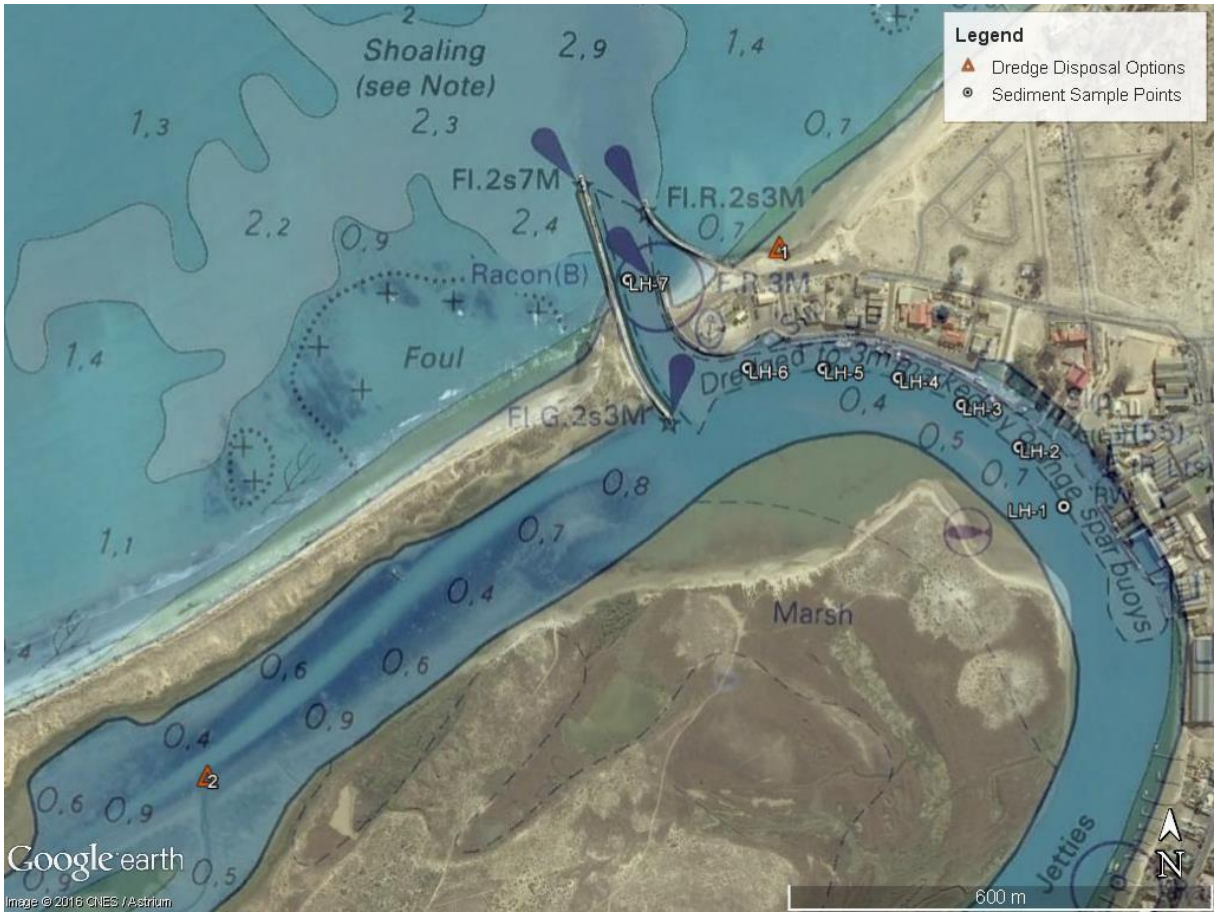

Figure 3-3 Proposed offshore dredge disposal site options (1 & 2) at Laaiplek Harbour

The assessment of these four options can be found in Table 3-1 below.

Table 3-1 Dredge disposal options assessment for Laaiplek harbour

Option	1	2	3	4
Disposal Method	Nourishment	Offshore (Nearshore location)	Offshore (Deep water location)	Landfill
Location / Site description	The eroded beach behind the eastern breakwater.	Inside estuary, west of harbour entrance in shallow area, very sheltered from waves.	Area fairly exposed to open ocean waves (±2.5km offshore) with adequate depth	Vissershok Landfill
Cost	Low to moderate	Low to moderate	Moderate to high	Very high due to associated transport costs, i.e. high number of trucks and trips required. Therefore not deemed feasible.
Spatial requirement	Focussed to eroded beach area	Very shallow area, thus large area required, estimated at 116,250m²	Small area required, approximately 140m x 140m, estimated at 18,600m²	N/A

Option	1	2	3	4
Available information	Bathymetry available nearshore. Nearest sediment sample LH- 7 (in entrance channel)	Nearest sediment sample LH-6 (near boat launch)	Outside previous bathymetric survey area – only charted depths available	N/A

Based on the assessment above and since beneficial use of the dredge spoil is favoured over disposal in the ocean, nourishing the eroded northern beach adjacent to Laaiplek harbour (

) is the preferred disposal option. This could reinstate the undermined beach profile and avoid large costs in transporting the dredge material far offshore.

Figure 3-4 Sediment sampling sites in Laaiplek Harbour at the proposed beach nourishment location

The need for beach nourishment was evident during field investigations where extensive erosion on the beach was observed (Figure 3-5, Figure 3-6 and Figure 3-7). Additionally, the beach exhibited a steep profile and anti-erosion rock armouring was present in some areas. Sand appears to be moving away from the investigated beach in a north easterly direction. Cross shore and down shore beach sediment transects were carried out to determine whether the targeted dredge material was similar in nature to the beach sediment and thus suitable for disposal on the beach. Sediment samples were collected at five sites for particle size analysis.

Figure 3-5 View from the top of the eroded cliffs towards the shore armouring

Figure 3-6 View from site LH 5 looking south west towards the harbour

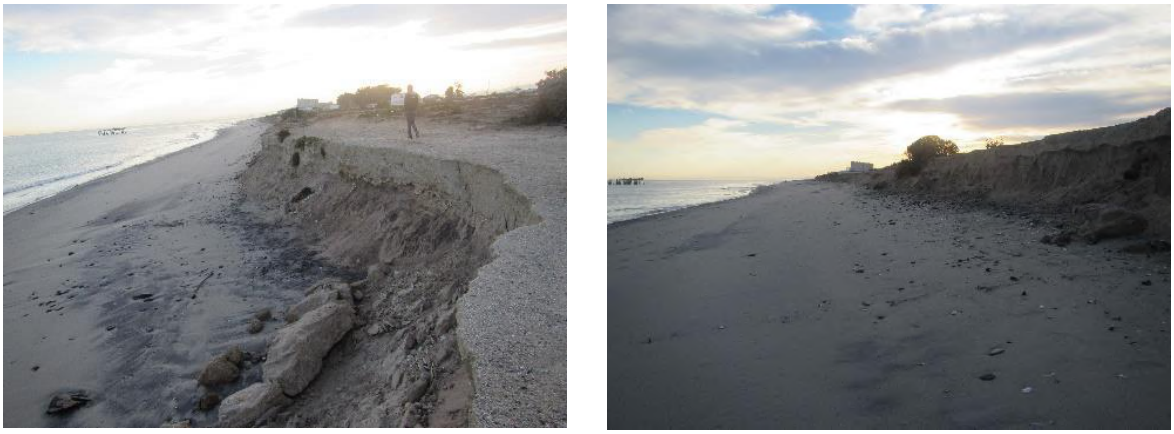

Figure 3-7 Views of the steeply sloping beach profile, alongshore towards the north east

The results of the grain size analysis shown that the dredged material from Laaiplek harbour is similar in grain size distribution to the receiving beach for all sites. The particle size analysis results show that the median particle size (D50) of the beach sediment samples were classified medium to coarse sand, similar to the sediment samples from the targeted dredge areas

As both the harbour and beach sediments comprise predominately sand, the donor sediments are seen as a good match for nourishment of the beach.

3.2 Future Works

This MMP is applicable to current as well as future maintenance and repair activities proposed at Laaiplek harbour. If works fall outside the scope of this document, such activities will need to be assessed and the need for any additional authorisation requirements have to be determined prior to commencement of any activity.

3.3 Specialist Studies

3.3.1 Heritage

A Notification of Intent to Develop (NID) for the Maintenance and Repair of Infrastructure Elements at Laaiplek Harbour was prepared by Aurecon and submitted to the South African Heritage Resources Agency (SAHRA) to be evaluated. The submitted documents reviewed and SAHRA's outcome (Appendix B) was that no work is required under the National Heritage Resources Act (No 25 of 1999). However, with regard to the dredging activity SAHRA provided the following directives that were taken into consideration during the site selection (dredged area and disposal location) process:

- While the proposed dredging activity in the harbour basin exceeds an area of 5 000 m^2 (this would require input from SAHRA in terms of Section 38(1) of the NHRA), it does not extend beyond the area or depth that has been previously dredged; and
- At the time that the NID was submitted the disposal site for the dredged material has not yet been established, SAHRA indicated that the disposal site must not be on or within 200m of any known shipwreck or underwater cultural heritage site.

3.3.2 Other

The following investigations and/or specialist studies have also been undertaken to inform works at Laaiplek fishing harbour:

- Technical Specification: Maintenance Dredging and Disposal Works for St Helena Bay, Laaiplek and Lambert's Bay Harbours by Aurecon;
- Dredge Material Data Report by Lwandle Technologies (Pty) Ltd;
- Sediment Contamination Study by Lwandle; and

The latter two reports can be found in Appendix C.

Sediment contamination study by Lwandle Consulting

Sediment properties were measured in Laaiplek and then compared against National Action List (DEA 2012) and the BCLME (2006) sediment quality guidelines to determine their suitability for disposal at sea. The comparisons show that Laaiplek sediments are uncontaminated by trace metals or the measured organic compounds and would qualify for unconfined open ocean disposal.

4 Impacts on Receiving Environment

A qualitative description of the types of impacts associated with maintenance and repair activities at all fishing harbour is provided in Section 3 of the Generic MMP. The significance and status of the potential impacts associated with the proposed works at Laaiplek are rated below, assuming implementation of the requirements of the MMP.

Table 4-1 Significance of Potential Impacts during Maintenance and Repair Works at Laaiplek Harbour

Impact	Status	Significance	Description
Impact of noise disturbance on communities	Negative	**Low**	Increased noise levels may be generated by the maintenance and repair vehicles and equipment and dredging activities (depending on the dredging methodology). The ambient noise levels are already relatively high and there are no sensitive receptors in close proximity to the works.
Impact of emissions from construction activities on air quality	Negative	**Insignificant**	Emissions from maintenance and repair vehicles and, potentially, dust generated by vehicle movements or the handling of materials could affect the local air quality temporarily. There are no sensitive receptors in close proximity to the works.
Delays to other road users with increased traffic	Negative	**Insignificant**	While repair and maintenance activities are likely to be of short duration with limited need for large construction equipment/vehicles on site, the transport of materials to and from the site may lead to some localised increases in traffic.
Loss of vegetation and habitat	Negative	**Insignificant**	Loss of terrestrial vegetation and habitat is unlikely as the maintenance works are limited to existing harbour facilities. The impact can occur due to the establishment of site camps or storage/laydown areas or associated infrastructure.
Disturbance of marine habitat within the dredge footprint	Negative	**Very low**	Any benthic marine biota within the footprint of (or directly adjacent to) the proposed dredging activities will be removed, disturbed or smothered. As these are exclusively maintenance dredging activities it is expected that these habitats have previously have been significantly disturbed during harbour construction, previous maintenance activities and on ongoing use. As such marine biodiversity is expected to be low and unlikely to include sensitive marine habitats.
Disturbance of marine habitats by the disposal/deposition of dredged material	Negative	**Low**	The materials to be disposed have low contamination levels and the selected deposition areas do not include sensitive marine habitats. This impact will have a temporary effect on the disposal areas but will cease shortly after the deposition operations finalise.

Impact	Status	Significance	Description
Toxicity of trace metals and other contaminants in the dredged sediment to coastal fauna and flora.	Negative	**Low**	The concentration of trace metals of the samples did not exceed the recommended thresholds and are considered acceptable for beach disposal. No sensitive marine habitats were identified in the disposal areas.
Impact of marine pollution during the maintenance operations due to discharge of contaminants	Negative	**Insignificant**	The temporary effects of the maintenance and repair works should be low if all the recommended control prevention measures included in the project are put in place.
Increased employment, income and skills development	Positive	**Low**	Relatively short opportunities for local employment, skills development and support of local industries or services will occur during the maintenance and repair operations
Visual impact of dredging activities	Negative	**Very low**	The dredging and dredge disposal activities are relatively limited in time and space and so dredge plumes should be small and temporary. No sensitive receptors were identified in the area.
Loss of cultural heritage resources	Negative	**Insignificant**	The structures and sunken vessels present in this harbour have not been considered as heritage resources by SAHRA and there is no register of archaeological values in this area.
Impact of constrained functionality of the harbour on other users	Negative	**Low**	During maintenance and repair works, there may be constrained functionality of the harbour which could be disruptive to other users. This should be short-lived and the functionality will improve once the works have been completed.

5 Site Specific Environmental Management Requirements

In additional to the generic environmental management requirements included in the Generic MMP, the following additional management requirements must be implemented at Laaiplek:

Table 5-1 Site Specific Environmental Management Requirements for Laaiplek Harbour

Additional Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure/Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Site establishment	1.	Designate and demarcate the Bird Island as “No go” area for all personnel on site. No vehicles, machinery, materials or people shall be permitted in the “No go” area at any time without the express permission of the ECO.	Contractor	Prior to commencement of maintenance activities and duration of maintenance works.	• Visual inspections of site	• Register of illegal entries. • Site boundaries demarcated and demarcation maintained throughout the duration of the maintenance works. • Signage in place.
Waste management	2.	Remove all waste, and polluting materials from the site at regular intervals and dispose of these materials at Velddrif site.	Contractor	Throughout maintenance activities.	• Check waste disposal slips	• Register of frequency of collection and volume of general waste sent to final destination. • Total volume of general waste stored on site vs onsite storage capacity.
Hazardous waste management	3.	Remove all hazardous materials from the site at regular intervals and dispose of these materials at Vissershok waste management facility.	Contractor	Throughout maintenance activities	• -Check waste disposal slips	• Register of frequency of collection and volume of hazardous waste sent to final destination. • Total volume of hazardous waste stored on site vs onsite storage capacity.

Additional Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure/Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods**	**Performance Indicators**
Disposal of dredged sediment	4.	• All dredged material from the harbour basin to be disposed of at the approved disposal site as per the Dumping at Sea permit. • The location of the dump site is on the beach north of Laaiplek Harbour at Disposal Site 1 (Figure 3-4). • The Bergrivier Municipality is to be notified prior to dumping of the dredged sediment on the beach. • The method of placement of material on the beach is to be done in consultation with the Municipality's environmental and planning team.	Dredge and disposal Contractor	During dredging and disposal operations.	• Dumping at sea permit	• Compliance with the demarcated disposal site/s and requirements for disposal specified in the Dumping at Sea Permit.
Monitoring during dredging and dredge spoil disposal	5.	• Implement monitoring requirements (if any) specified in the Dumping at Sea Permit issued by the DEA: O&C during dredging and dredge spoil disposal. • This section will have to be updated with the monitoring requirements as stipulated in the Dumping at Sea Permit.	Contractor	As specified in the Dumping at Sea Permit	• As specified in the Dumping at Sea Permit	• Compliance with the monitoring requirements specified in the Dumping at Sea Permit.

Appendices

Appendix A
Generic MMP

Western Cape Proclaimed Fishing Harbours

Generic Maintenance Management Plan

Report Prepared for

Coega Development Corporation

On behalf of

National Department of Public Works

Report Number 509310/01

Report Prepared by

srk consulting

July 2017

Western Cape Proclaimed Fishing Harbours Generic Maintenance Management Plan

Coega Development Corporation

On behalf of

National Department of Public Works

SRK Consulting (South Africa) (Pty) Ltd
The Administrative Building
Albion Spring
183 Main Rd
Rondebosch 7700
Cape Town
South Africa

e-mail: sjones@srk.co.za
website: www.srk.co.za

Tel: +27 (0) 21 659 3060
Fax: +27 (0) 21 685 7105

SRK Project Number 509310

July 2017

Compiled by:

Sharon Jones
Principal Environmental Consultant

Email: sjones@srk.co.za

Peer Reviewed by:

Chris Dalgliesh
Partner

Authors:

Sharon Jones

Profile and Expertise of EAPs

SRK Consulting (South Africa) (Pty) Ltd (SRK) has been appointed by Coega Development Corporation (CDC) on behalf of the National Department of Public Works (DPW) as the independent consultants to compile a Generic Maintenance Management Plan (MMP) applicable to all fishing harbours in the Western Cape.

SRK Consulting comprises over 1 300 professional staff worldwide, offering expertise in a wide range of environmental and engineering disciplines. SRK's Cape Town environmental department has a distinguished track record of managing large environmental and engineering projects and has been practising in the Western Cape since 1979. SRK has rigorous quality assurance standards and is ISO 9001 accredited.

As required by the National Environmental Management Act 107 of 1998 (NEMA), the qualifications and experience of the key individual practitioners responsible for this project are detailed below.

Project Director: Christopher Dalgliesh, BBusSc (Hons); MPhil (EnvSci)
Certified with the Interim Board for Environmental Assessment Practitioners South Africa (CEAPSA)
Chris Dalgliesh is a Partner at SRK Consulting and the Head of the Environmental Department in Cape Town. He has over 24 years of experience as an environmental consultant working on a broad range of EIA, auditing, environmental planning and management, public consultation and environmental management system projects. Chris's experience includes managing and co-ordinating major EIAs throughout Southern Africa and South America in the mining, energy, land-use planning and development, water and waste management, and industrial sectors.

Project Manager: Sharon Jones, BSc Hons (Env. Sci); MPhil (EnviroMan)
Certified with the Interim Board for Environmental Assessment Practitioners South Africa
Sharon Jones is a Principal Environmental Consultant with over 18 years' experience. Sharon has managed a broad range of projects in South Africa, Mozambique, Angola, Suriname, Namibia and the DRC, with particular experience in Port and marine-based projects, mining and large infrastructure projects (e.g. airports and dams). In addition to managing various ESIAs, her experience includes the development of Environmental Management Frameworks, Environmental Management Plans and due diligence reviews and gap analysis studies against IFC and World Bank Standards. Sharon holds a BSc (Hons) and MPhil (Env) and is a registered Professional Natural Scientist (Environmental Science) with SACNASP and a CEAPSA.

Statement of SRK Independence

Neither SRK nor any of the authors of this Report have any material present or contingent interest in the outcome of this Report, nor do they have any pecuniary or other interest that could be reasonably regarded as being capable of affecting their independence or that of SRK.

SRK has no beneficial interest in the outcome of the assessment which is capable of affecting its independence.

SRK's fee for completing this Report is based on its normal professional daily rates plus reimbursement of incidental expenses. The payment of that professional fee is not contingent upon the outcome of the Report.

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK by CDC and their consultants. The opinions in this Report are provided in response to a specific request from CDC to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not

necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

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Acronyms and Abbreviations

CDC	Coega Development Corporation
CER	Contractors Environmental Representative
DEA	Department of Environmental Affairs
DEA:O&C	Department of Environmental Affairs: Oceans and Coasts
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
GN	Government Notice
HWC	Heritage Western Cape
ICMA	Integrated Coastal Management Act 24 of 2008
MLRA	Marine Living Resources Act 18 of 1998
MMP	Maintenance Management Plan
MPA	Marine Protected Area
MSDS	Material Safety Data Sheets
NDPW	National Department of Public Works
NEMA	National Environmental Management Act 107 of 1998 as amended
NEM:ICMA	National Environmental Management; Integrated Coastal Management Act 24 of 2008
NEM:WA	National Environmental Management: Waste Act 59 of 2008
NHRA	National Heritage Resources Act 25 of 1999
RP	Responsible Person
SAHRA	South African Heritage Resources Agency
SRK	SRK Consulting (South Africa) (Pty) Ltd

Glossary

Contractor	Any company appointed by the Proponent to undertake construction or related activities on site, and will include the main Contractor for any aspect of the works, as well as any Sub-Contractors.
Contaminated water	Water contaminated by activities on site, e.g. concrete water and run-off from plant / personnel wash areas / quays.
Dredging	The removal of accumulated sediment and/or debris from the bottom of the ocean, generally to allow for better navigation.
Dumping at sea	In the context of this document, dumping at sea is limited to the disposal of dredged sediments at an approved location on the floor of the ocean, either inside or outside of the harbour boundaries.
Environment	The external circumstances, conditions and influences that surround and affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Environmental Authorisation	The authorisation by a competent authority of a listed activity or specified activity in terms of National Environmental Management Act 107 of 1998 as amended (NEMA).
Environmental Control Officer	A suitably qualified and independent individual appointed by the proponent to monitor compliance with the Maintenance Management Plan and general good environmental practice on site during the repair and maintenance activities at various fishing harbours.
Environmental Impact Assessment	A process of evaluating the environmental and socio-economic consequences of a proposed course of action or project.
Environmental incident	Environmental incident refers to an accident or unexpected occurrence related to the project, including fire, spills, pollution events, explosions, etc leading to negative environmental impacts.
Environmental Management Measures	Requirements or specifications for environmental management, as presented in the MMP.
Equivalent spherical diameter	The equivalent spherical diameter (or ESD) of an irregularly shaped object (in this case sand particle) is the diameter of a sphere of equivalent volume.
General waste	Waste that does not pose an immediate hazard or threat to health or to the environment, and includes domestic waste, building and demolition waste, business waste, inert waste and any waste classified as non-hazardous waste in terms of the regulations made under section 69 of the National Environmental Management: Waste Act 59 of 2008.
Generic MMP	The generic document applicable to environmental management at all the proclaimed fishing harbours. The generic MMP will be appended to, and form part of the Site Specific MMP for each of the individual fishing harbours.
Hazardous substance	A substance (including materials and waste) that can have a deleterious (harmful) effect on the environment and those substances declared hazardous substances in terms of the Hazardous Substances Act 15 of 1973.

Hazardous waste	Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within the business waste, residue deposits and residue stockpiles.
Maintenance dredging	The removal of accumulated sediment to the original depth of the harbour, but excluding any additional deepening or capital dredging. This excludes dredging for the upgrading of structures.
Method Statement	A mandatory written submission by the Contractor to the Environmental Control Officer (ECO) setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity.
Mitigation Measures	Actions identified to manage (avoid, minimise or optimise) potential environmental impacts which may result from the development.
Pollution	Pollution refers to the contamination of air, water, soil or the environment by a foreign substance or matter.
Proponent	The person or organisation implementing the project.
Resources	The personnel, financial, equipment and technical requirements necessary for the successful completion of mitigation measures and for monitoring activities.
Site Specific MMP	The Site Specific MMP is applicable to a single fishing harbour only and contains site specific information. The generic MMP will be appended to, and form part of the Site Specific MMP for each of the individual fishing harbours.
Solid waste	All solid waste including construction debris, chemical waste, broken / redundant equipment, oil filters, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).
Sub-Contractors	A Sub-Contractor is any individual or Contractor appointed by the main Contractor, to undertake a specific task on site.

1 Introduction

1.1 Background and Introduction

The National Department of Public Works (NDPW) has appointed the Coega Development Corporation (CDC) as Implementing Agent for the repair, maintenance and upgrade of the 13 proclaimed fishing harbours in the Western Cape. Repair of the 13 fishing harbours has been split into four discrete work packages as follows:

- **Work package 1**: Saldanha Bay and Pepper Bay;
- **Work package 2**: Hout Bay, Kalk Bay, Gordons Bay and Hermanus;
- **Work package 3:** Lamberts Bay, Laaiplek and St Helena Bay;
- **Work package 4:** Stilbaai, Struisbaai, Arniston and Gansbaai.

CDC has appointed SRK Consulting (South Africa) (Pty) Ltd (SRK) to compile a Generic Maintenance Management Plan (MMP) applicable to all 13 fishing harbours and based on which Site Specific MMPs can be compiled for each harbour. The Generic MMP (this report), together with the Site Specific MMP, (collectively referred to as "the MMP") aims to meet the requirements of the National Environmental Management Act 107 of 1998, as amended (NEMA) and the Environmental Impact Assessment (EIA) Regulations, 2014, for an approved MMP for maintenance activities.

1.2 Proponent Details

The NDPW will be responsible for the long-term maintenance of all fishing harbours and as such will be responsible for the implementation of the MMPs. Relevant proponent contact details are presented in Table 1-1 below.

Table 1-1: Proponent Details

Name of Company	National Department of Public Works
Contact Person	Vuyo Ngonyama
Position	Director: Property Management
Postal Address	Private Bag X9027, Cape Town, 8000
Telephone	0214022102
Email	vuyo.ngonyama@dpw.gov.za

1.3 Purpose and Structure of the MMP

The MMP aims to ensure that all future repairs and maintenance to the fishing harbours are undertaken in an environmentally responsible manner, in compliance with relevant environmental legislation. The MMP consists of two components:

- **The Site Specific MMP**: which contains only site specific information applicable to a single fishing harbour; and
- **The Generic MMP**: which contains information and requirements applicable to the management of all proclaimed fishing harbours and will allow for consistency in environmental management for all proclaimed fishing harbours in the Western Cape.

For each harbour, the Generic MMP will supplement (and be appended to) the Site Specific MMP.

1.3.1 Structure of the Site Specific MMPs

The Site Specific MMPs, which will be prepared for each harbour, will contain only information specific to the relevant fishing harbour and consists of the following sections:

Section 1: Background and Introduction

Provides an introduction and background to the project, outlines the purpose of the Site Specific MMP and how it relates to the Generic MMP.

Section 2: Site Description

Describes the location and characteristics of the harbour, provides property owner details and an overview of the receiving biophysical and socio-economic environment.

Section 3: Description of Proposed Works

Describes the maintenance and repair works currently proposed, noting that the MMP will also be applicable to future works, the details of which may not yet be available.

Section 4: Potential Impacts

Identifies and provides a qualitative assessment of the significance of the potential impacts of the proposed works on the receiving environment, assuming the specifications of the MMP are adequately implemented.

Section 5: Site Specific Environmental Management Requirements

Lists any additional environmental management requirements specific to the harbour in question, and which are **not** included in the Generic MMP.

1.3.2 Structure of the Generic MMP

The Generic MMP (**this document**) consists of the following sections, which would be applicable to all proclaimed fishing harbours:

Section 1: Background and Introduction

Provides an introduction and background to the project and outlines the purpose of this document, as well as the Site Specific MMPs.

Section 2: Governance Framework

Provides a brief summary and interpretation of relevant legislation.

Section 3: Potential Impacts

Provides a generic description of the potential environmental impacts associated with repair and maintenance works within harbour environments and identifies (high level) generic mitigation measures.

Section 4: Environmental Management Measures

Provides the management measures applicable during the long-term maintenance of the harbour including the roles and responsibilities for implementation of the MMP, compliance and monitoring requirements as well as detailed environmental management measures to be implemented.

1.4 Scope of the MMP

The scope of repair and maintenance activities addressed in the MMP includes:

- Placement of rock (more than 5 m^3) within the footprint of existing rock revetments;
- Maintenance dredging of a harbour basin; and
- Disposal or deposition of dredged material either below or within 100 m of the high-water mark of the sea (i.e. at a marine disposal site or for beach replenishment).

The following activities, if proposed in any of the fishing harbours, do not require an MMP in terms of NEMA and are excluded from the scope of this MMP. These activities should be undertaken in compliance with the Generic Environmental Management Plan (EMP) for the proclaimed fishing harbours (SRK Report Number 509310/02) to ensure compliance with the "*duty of care*" requirement in terms of Section 28(1) of NEMA. The activities are as follows:

- Removal of sunken fishing vessels;
- Repair and maintenance of existing marine structures including (but not limited to) breakwaters, quays, slipways, jetties, copings etc.;
- Maintenance and repair of quay furniture (bollards, fenders and access ladders);
- Repair and maintenance of harbour machinery and equipment e.g. cranes;
- Placement of rock (less than 5 m^3) within the footprint of existing rock revetments;
- Placement of armour units within the footprint of existing breakwaters; and
- Maintenance or replacement of fencing.

The following activities, if proposed in any of the fishing harbours, are not considered maintenance activities and are excluded from the scope of this MMP. Such activities may require more extensive authorisation procedures, which would require screening against relevant legislation:

- The construction of any new structures in the harbour, coastal public property or within 100 m of the high-water mark of the sea and any maintenance or repair works which increase the development footprint of the harbour; and
- The dredging, excavation, infilling or depositing of more than 5 m^3 of material either below or within 100 m of the high-water mark of the sea, which is not for maintenance purposes (e.g. capital dredging or construction of new rock revetments); and
- The removal of 300 m^2 or more of indigenous vegetation within 100 m of the high water mark of the sea.

1.5 Review of the MMP

The MMP will be reviewed and updated every five years particularly in response to changes in relevant legislation. Review of the MMP will be done in consultation with the competent authority (in this case the National Department of Environmental Affairs [DEA]) and will be subject to any public consultation required by the competent authority.

2 Governance Framework

This section provides the legislative framework that has informed the preparation of this (Generic) MMP. Local by-laws or strategic plans, regulated by each municipality that may be applicable are presented in Section 1.4 of the site specific MMP.

2.1 National Environmental Management Act 107 of 1998, as Amended

NEMA establishes a set of principles that all authorities have to consider when exercising their powers. 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 consequences of a policy, project, product or service applies throughout its life cycle.

Section 28(1) states that "*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.

Legal requirements for this project

The NDPW has a responsibility to ensure that the proposed activities conform to the principles of NEMA. NDPW is obliged to take actions to prevent pollution or degradation of the environment in terms of Section 28 of NEMA. This MMP will help the NDPW to conform with the principles of NEMA during the long-term maintenance of the fishing harbours.

2.2 EIA Regulations, 2014

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an Environmental Authorisation (EA) issued by the competent authority. In this context, Listing Notices 1[1], 2[2] and 3[3] of the EIA Regulations, 2014, list activities that require EA in terms of NEMA ("NEMA listed activities"). Certain listed activities are exempt from the requirement for EA if they are undertaken for maintenance purposes, and in accordance with an approved MMP.

Table 2-1 indicates the listed activity that is applicable to the proposed works (including dredging, disposal of dredge spoil and the movement or deposition of rock for any other maintenance purposes) and which is exempt from the requirement for EA on the approval of this MMP.

Table 2-1: NEMA listed activity applicable to the project

No.	Listed activity
Listing Notice 1	
19 A	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- (i) the seashore; or (ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater; or (iii) the sea - 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; or (i) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour...

Legal requirements for this project:

As the proposed works will involve the excavation and / or deposition of more than 5 m³ of material within a distance of 100 m of the high-water mark of the sea, NDPW requires the approval of this MMP to commence maintenance dredging activities and the excavation or deposition of dredge spoil or any other rock, sand etc., where such activities may increase the development footprint of the harbour or port.

It is the NDPW's responsibility to ensure that no other listed activities are triggered during ongoing maintenance works, or that, if they are, relevant processes are followed to obtain EA. Note that the approval of this MMP does not authorise any other listed activities that may be applicable.

2.3 National Environmental Management: Integrated Coastal Management Act 24 of 2008

The South African government is a signatory to the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972) (the London Convention) and to the 1996 Protocol to the London Convention (the London Protocol). The London Convention and London Protocol regulate the deliberate disposal of waste materials in the marine environment.

[1] GN R327 of 2017.
[2] GN R325 of 2017.
[3] GN R324 of 2017.

The London Protocol states that 'Each Contracting Party shall develop a national Action List to provide a mechanism for screening candidate wastes and their constituents on the basis of their potential effects on human health and the marine environment.' Annex II of the London Protocol provides guidance on the assessment of wastes or other material that may be considered for dumping at sea.

In South Africa, the National Environmental Management Integrated Coastal Management Act 24 of 2008 (NEM: ICMA) gives effect to the provisions of the London Convention and London Protocol.

The NEM: ICMA provides for the integrated management of the coastal zone, including the promotion of social equity and best economic use, while protecting the coastal environment.

Chapter 7 of the Act establishes integrated permitting procedures and other measures to ensure the protection and sustainable use of the coastal zone and its resources. This includes the requirement that adequate consideration be given to the objectives of this Act when considering applications for EA for any development within the coastal zone, and the consideration of impacts on coastal public property, the coastal protection zone and coastal access land.

In terms of the Section 71(1) of the NEM: ICMA, an application for a dumping at sea permit will be required for the offshore disposal of dredged material. Such an application requires the characterisation (analysis) of the sediment to be disposed of offshore against the National Action List (as required by the London Convention), details regarding the selection and characterisation of the dredge disposal site and an assessment of the potential impacts of the offshore disposal of dredged material.

Legal requirements for this project:

The MMP covers maintenance dredging and the disposal of dredged material associated with maintenance dredging. The disposal of dredged material below the high water mark of the sea will require a dumping at sea permit. Material to be dredged should be subject to sediment analysis to confirm contamination levels. If found to exceed the action levels in the National Action List for the Screening of Dredged Material, the material is not considered suitable for marine disposal, and must either be suitably diluted prior to disposal or disposed of at a licenced on-shore hazardous waste disposal site.

It is NDPW's responsibility to undertake the required sediment sampling and analysis, which should inform the identification of potential beneficial uses of the material or a suitable dredge disposal site.

2.4 National Environmental Management: Control of Use of Vehicles in the Coastal Zone GN Regulations 496 of 27 June 2014

In terms of Section 3 of the NEM: Control of Use of Vehicles in the Coastal Zone Regulation, the use of vehicles within the coastal area is permissible without a permit on (*inter alia*):

- A public road; and
- Private land, by the owner, or with the written permission of the owner or lawful occupier of that land.

In terms of Section 4 of the Regulations, a permit is required for the use of a vehicle in a coastal area for the purposes of the construction or maintenance of infrastructure authorised by any law. The competent authority is the DEA: O&C and the vehicle access permit for the construction or maintenance of infrastructure must be granted by the Minister.

Legal requirements for this project:

The construction or maintenance of infrastructure in the coastal zone which requires the use of vehicles in the coastal zone would require a permit for the use of vehicles in this zone (or exemption from the requirements of these regulations).

2.5 Marine Living Resources Act 18 of 1998

The Marine Living Resources Act 18 of 1998 (MLRA) governs Marine Protected Areas (MPAs) and states in section 43 that:

(2) No person shall in any marine protected area, without permission in terms of subsection (3)—

(b) take or destroy any fauna and flora other than fish;

(c) dredge, extract sand or gravel, discharge or deposit waste or any other polluting matter, or in any way disturb, alter or destroy the natural environment;

(e) carry on any activity which may adversely impact on the ecosystems of that area.

Legal requirements for this project:

A number of MPAs have been declared under the MLRA. The proximity of the proposed works to any MPAs must be determined and care must be taken to avoid any possible impact on these areas.

2.6 National Heritage Resources Act 25 of 1999

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act 25 of 1999 (NHRA). The enforcing authority for this act is the South African National Heritage Resources Agency (SAHRA). In the Western Cape, SAHRA has delegated this authority to Heritage Western Cape (HWC), however, SAHRA remains the custodian of heritage resources below the high-water mark of the sea. 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. Archaeological material is defined in the NHRA to include "*any vessel or aircraft, or any part thereof, which was wrecked in South Africa, as well as any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers worthy of conservation".*

In terms of Section 34 of the NHRA, "*no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site"*.

Section 38(1) of the NHRA specifies activities that trigger the need for the proponent to notify SAHRA of the proposed development, in order for SAHRA to determine the need for further Heritage Assessment. Relevant triggers which may be applicable to works undertaken within the fishing harbours include:

- Construction of any structure over 300 m in length; and
- Any development or activity that will change the character of a site (i) exceeding 5 000 m^2 in extent, (ii) involving three or more existing erven or subdivisions thereof.

Legal requirements for this project:

If the proposed works trigger any of the activities listed in Section 38 (1) of the NHRA (e.g. dredging and the disposal of dredge spoil in areas with a total extent exceeding 5 000 m^2), involve any structures older than 60 years, or have the potential to impact on any known heritage/archaeological

resources (including wrecks), the proponent is required to notify SAHRA of the proposed activities via the SAHRIS database and undertake any assessments deemed necessary by SAHRA.

2.7 National Environmental Management: Waste Act 59 of 2008

The National Environmental Management: Waste Act 59 of 2008 (NEM:WA) aims to (amongst other things) regulate waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development.

The Act makes provision for the listing of waste management activities that have, or are likely to have, a detrimental effect on the environment and may not be undertaken without a Waste Management Licence (WML) issued by the competent authority. The competent authority for WML applications is the DEA for applications involving hazardous waste.

A person wishing to undertake a waste management activity listed under Category C of GN R921 must comply with the Norms and Standards for Storage of Waste, 2013 (GN R926).

Legal requirements for this project:

The on-shore disposal of any waste at a location which is not a registered landfill site suitable for the relevant type of waste (as defined in the NEM:WA) will require a WML. The temporary storage of waste for a period exceeding 90 days will need to comply with the Norms and Standards for Storage of Waste.

3 Impacts on Receiving Environment

While the significance of impacts of the proposed works will largely depend on the receiving environment, the nature of the impacts associated with the work at all fishing harbours is likely to be fairly similar. A description of the types of impacts which may be anticipated as well as key mitigation requirements are provided in Table 3-1. The key mitigation measures have largely been converted into specific management requirements in Section 4.4, however, these should also be considered during planning of proposed maintenance and repair works.

The significance of relevant impacts at each of the fishing harbours is discussed in the Site Specific MMP for each harbour.

Table 3-1: Description of potential impacts and key mitigation measures

Impact	Description	Key mitigation measures
Higher noise levels adversely affecting surrounding communities	Increased noise levels may be generated by construction vehicles and equipment and dredging activities (depending on the dredging methodology). The level of disturbance experienced by surrounding communities will depend on emitted noise levels, ambient noise levels in the area, the nature of surrounding land uses as well as the proximity of sensitive receptors to the area in which works will be undertaken.	• Limit noisy activities to "normal working hours" or as otherwise required by local bylaws. • Notify surrounding land users of particularly noisy activities (e.g. blasting).
Increased emissions during construction adversely affecting air quality	Emissions from construction vehicles and, potentially, dust generated by vehicle movements or the handling of materials could affect the local air quality temporarily. The impact on surrounding communities will once again be determined by the proximity of sensitive receptors to the area in which works will be undertaken.	• Maintain vehicles and equipment to prevent excessive emissions. • Avoid activities that may generate dust (e.g. handling or stockpiling of material) during particularly windy conditions. • Cover stockpiles with shade cloth or similar material to prevent windblown dust.
Delays to other road users associated with increased traffic	While repair and maintenance activities are likely to be of short duration with limited need for large construction equipment/vehicles on site, the transport of materials to and from the site may lead to some localised increases in traffic.	• Avoid the movement of large construction vehicles/deliver of materials etc. to the site during peak traffic hours.
Loss or disturbance of terrestrial vegetation and habitat	Loss of terrestrial vegetation and habitat is considered extremely unlikely given the fact that works addressed in this MMP are limited to maintenance and repairs to existing harbour facilities. The loss or disturbance of terrestrial vegetation and habitats could occur due to the establishment of site camps or storage/laydown areas or infrastructure associated with e.g. handling of dredged sand used for beach replenishment.	• Confine all works, including the establishment of site camps and storage areas to hardened surfaces or previously disturbed areas as far as practically possible.
Disturbance of marine habitat within the footprint of proposed dredging.	Any benthic marine biota within the footprint of (or directly adjacent to) the proposed dredging activities will be removed, disturbed or smothered. Given that the scope of works covered by this MMP is limited to maintenance dredging it is expected that these habitats would previously have been significantly disturbed during harbour construction, previous maintenance activities and on ongoing use. As such marine biodiversity is expected to be low and unlikely to include sensitive marine habitats. It should also be noted that sandy marine habitats (such as beaches) are adapted to recover quickly from disturbance since these coastal systems naturally undergo regular erosion and accretion events.	• Limit the footprint of dredging as far as practically possible.
Disturbance of marine habitats by the disposal/deposition of dredged material.	Depending on the contaminants contained in the dredged material (if any), and the selected option for the disposal or deposition/re-use of dredged material, these operations could have a significant impact on undisturbed or sensitive marine or coastal	• Sample and analyse sediments to be dredged to confirm sediment type, particle size and levels of contamination. • Based on the outcomes of the sediment analysis, determine

Impact	Description	Key mitigation measures
	habitats.	the most suitable option for the disposal of dredge spoil / opportunities for reuse of the material and identify relevant mitigation measures applicable to the local conditions. • Apply for a dumping at sea permit if disposal of dredged material is proposed within the marine environment.
Elevated turbidity and sedimentation in surrounding habitat	Dredging and disposal of dredge spoil will result in the suspension of sediments in the water column, with potential impacts on marine ecology or other water users in the area (e.g. aquaculture activities). In an existing harbour environment, which is likely to be sheltered, the increased turbidity and sedimentation levels are likely to be contained inside the harbour boundaries, where marine life is likely to have been disturbed in the past, and unlikely to include sensitive marine habitats.	• Monitor turbidity or water quality if required, as determined on a case by case basis depending on the presence of sensitive marine habitats or water users occur (or if specified as a condition of the dumping at sea permit). • Select dredge methodologies that limit turbidity and sedimentation, where possible.
Nutrient release and associated algal blooms	Dredging and dredge disposal activities may release nutrients trapped in the dredged sediments, increasing nutrient levels in the water column and potentially leading to algal blooms. This may affect water quality and surrounding water users who may be sensitive to water quality. High nutrient levels in sediment are most likely to occur in existing fishing harbours where organic waste (e.g. fish waste) is dumped or discharged into the harbour.	• Sample and analyse sediments to be dredged to determine nutrient levels in the sediment and the risk of elevating nutrient levels in the water column significantly, where there is a likelihood of high nutrient levels. • If required, monitor nutrient levels in the water column during dredging.
Liberation of trace metals and other contaminants in dredged sediment, affecting marine life	Contaminants in sediments could be released into the water column during dredging and disposal of dredged material, potentially affecting marine biota and other water users in the area.	• Evaluate (analyse) trace metal / contaminant levels against the thresholds in the National Action List published by DEA in terms of the London Convention for guidance on acceptable threshold levels. • If toxicity levels are high, dispose of dredged material on land (at a suitable waste disposal site) and monitor toxicity levels in close proximity to sensitive marine aquatic habitats or water users.
Release/discharge of contaminants during construction, affecting marine life	Contaminants released into the water column during construction activities could affect marine biota and other water users in the area.	• Control run-off and discharge of any contaminated water into the marine environment. • Position potentially polluting activities so as to prevent spills into the marine environment.
Increased employment, income and skills development	Although the duration of repair and maintenance works is likely to be relatively short, opportunities exist for local employment, skills development and support of local industries with positive impacts on the local economy.	• Encourage the use of local contractors and staff and sourcing of materials form local suppliers where relevant skills and resources are available.
Visual impact of dredging	Dredge plumes (sediment suspended in the water column) will be visible on the surface and may have a visual impact, especially when viewed from an elevated location.	• Manage dredging and dredge disposal activities to limit dredge plumes where sensitive visual receptors exist (e.g.

Impact	Description	Key mitigation measures
activities	Assuming dredging and dredge disposal activities are relatively limited, dredge plumes are likely to be small and present for only a short period. The significance of the impact would depend on the presence of sensitive receptors.	through the use of silt screens if feasible).
Loss or disturbance of cultural heritage resources	Loss or disturbance of cultural heritage resources could occur due to disturbance of material (including wrecks) of archaeological or heritage value of structures older than 60 years. The terrestrial and marine portions of the site have been significantly disturbed by previous development, and dredging operations, and it is thus extremely unlikely that any material of archaeological value would be encountered. Most of the fishing harbours however include structures older than 60 years.	• Notify SAHRA of the proposed works on structures older than 60 years and undertake relevant heritage studies required by SAHRA. • Monitor dredging activities and report any archaeological material that may be uncovered to SAHRA, who will advise on further actions required.
Impact of constrained functionality of the harbour on other users	During maintenance and repair works, there may be constrained functionality of the harbour which could be disruptive to other users. This is however likely to be short-lived and the functionality would improve once the repairs and maintenance have been completed.	• Keep other harbour users informed of the proposed timing of potentially disruptive works and maintain open channels of communication with stakeholders.

4 Environmental Management Measures

4.1 Environmental Management Objectives

The environmental management objectives of the MMP include the following:

- Ensure that environmental management measures, structures or mechanisms are taken into account during the planning of harbour repairs and maintenance;
- Ensure that relevant environmental management measures are clearly documented and understood by all relevant parties;
- Ensure that all activities are undertaken in a way that will minimise potential negative effects on the surrounding environment and maximise possible benefits;
- Ensure that suitable organisational, record keeping and reporting structures are put in place to monitor implementation of environmental management measures during all future repairs and maintenance activities; and
- Ensure that the roles and responsibilities for management of various components are clearly defined.

4.2 Roles and Responsibilities

The key role players during maintenance and repairs of the fishing harbours are anticipated to be as follows:

- Proponent (NDPW), where relevant represented by their Implementing Agent;
- Engineer / Responsible Person[4] (RP), who will oversee the activities of the contractors on site;
- Environmental Control Officer (ECO);
- Contractors responsible for the maintenance and repair activities; and
- Any sub-contractors hired by the contractor.

The anticipated management structure (organogram) is presented in Figure 4-1 below and shows the proposed lines of communication for maintenance activities. NDPW retains overall responsibility for maintenance and the implementation of the MMP.

[4] Engineers may not be appointed for all maintenance activities. Should a Resident Engineer not be appointed, then this role will be fulfilled by a representative from the NDPW.

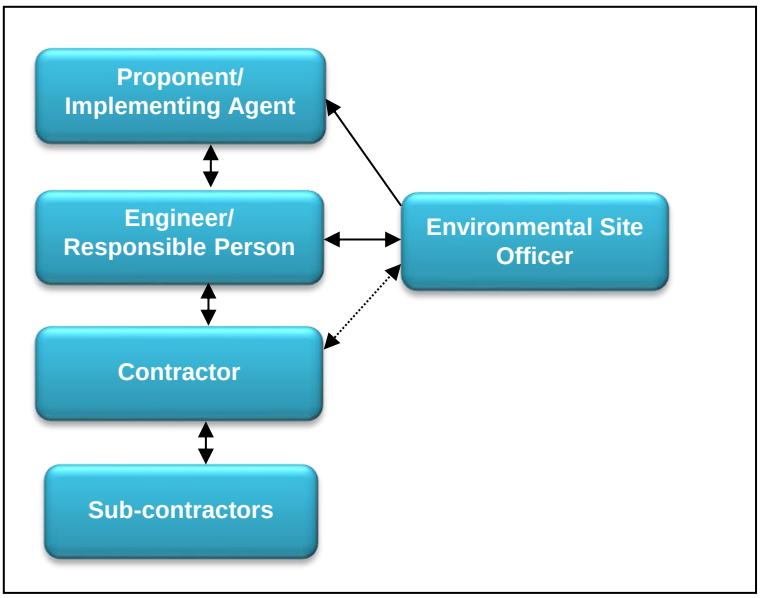

Figure 4-1: Reporting structure

Key roles and responsibilities with respect to the implementation of the MMP are outlined below.

Proponent (NDPW):

NDPW (through their Implementing Agent if applicable) has overall responsibility for management of maintenance activities. In terms of environmental management, the proponent will:

- Appoint suitably experienced Engineers, if required, who will be responsible for the overall management of activities on site;
- Identify any activities not covered by the scope of this MMP, and determine the need for, and where required, obtain relevant authorisations;
- Ensure that the Engineers are aware of the requirements of the MMP, implement the MMP and monitor the Contractor's activities on site;
- Ensure that the Contractor is aware of and contractually bound to the provisions of this MMP by including the relevant environmental management requirements in tender and contract documents, as appropriate;
- Appoint a suitably qualified and experienced ECO to oversee environmental management of the required works;
- Ensure that the Contractor remedies environmental problems timeously and to the satisfaction of the Engineer and authorities (when necessary); and
- Notify the authorities should problems not be remedied timeously.

Responsible Person:

NPDW will appoint suitably qualified Engineers (if necessary), who in turn will designate a responsible person (RP) to oversee activities of the Contractor. This role will be fulfilled either by the Resident Engineer or a suitably qualified representative of NDPW. The RP shall:

- Ensure that the Contractor is duly informed of the MMP and associated responsibilities and implications of this MMP prior to commencement of maintenance activities;
- Identify the need for, and request/provide Method Statements for future maintenance and repair works;
- Monitor the Contractor's activities with regard to the requirements outlined in the MMP;
- Report any environmental emergencies/concerns to the NDPW immediately; and
- Ensure that non-compliance is remedied timeously and to the satisfaction of the relevant authorities.

Environmental Control Officer:

The ECO shall be a suitably qualified/experienced environmental professional or professional firm, appointed by the proponent, for the duration of repair or maintenance works. The ECO shall:

- Request Method Statements from the Contractor prior to the start of relevant activities, where required, and approve these (as appropriate) without causing undue delay;
- Monitor, review and verify compliance with the MMP by the main Contractor, as well as any sub-contractors and specialist contractors;
- Undertake site inspections at least twice a month to determine compliance with the MMP;
- Identify areas of non-compliance and recommend corrective actions (measures) to rectify them in consultation with NDPW, the RP and the Contractor, as required;
- Compile a checklist highlighting areas of non-compliance following each ECO inspection;
- Ensure follow-up and resolution of all non-compliances;
- Provide feedback for continual improvement in environmental performance;
- Respond to changes in project implementation or unanticipated activities which are not addressed in the MMP, and which could potentially have environmental impacts, and advise NDPW, the RP and Contractor as required;
- Act as a point of contact for local residents and community members; and
- Undertake a site closure inspection, which may result in recommendations for additional clean-up and rehabilitation measures.

Contractor:

The Contractor will be required to appoint or designate a Contractor's Environmental Representative (CER) who will assume responsibility for the Contractor's environmental management requirements on site and be the point of contact between the Contractor, the ECO and the RP. The CER shall:

- Ensure that all activities on site are undertaken in accordance with the MMP and /or an approved Method Statement which applicable;
- Monitor the Contractor's activities with regard to the requirements outlined in the MMP;
- Ensure that all employees and Sub-contractors comply with the MMP;
- Immediately notify the RP and ECO of any non-compliance with the MMP, or any other issues of environmental concern; and
- Ensure that non-compliance is remedied timeously and to the satisfaction of the RP and ECO.

The Contractor has a duty to demonstrate respect and care for the environment. The Contractor will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the MMP, environmental regulations and relevant legislation.

Sub-contractors:

All Sub-contractors will be required to:

- Ensure that all employees are duly informed of the MMP and associated responsibilities and implications of this MMP prior to maintenance activities;
- Ensure that all activities on site are undertaken in accordance with the MMP;
- Monitor employees' activities with regard to the requirements outlined in the MMP;
- Immediately notify the RP and ECO of any non-compliance with the MMP, or any other issues of environmental concern; and
- Ensure that non-compliance is remedied timeously and to the satisfaction of the RP and ECO.

The Sub-contractor has a duty to demonstrate respect and care for the environment. The Sub-contractor will be responsible for the cost of rehabilitation of any environmental damage that may result from non-compliance with the MMP, environmental regulations and relevant legislation, resulting from their presence on site.

4.3 Compliance and Monitoring

4.3.1 Method Statements

A Method Statement is a document setting out specific details regarding the plant, materials, labour and method the Contractor proposes using to carry out certain activities, usually activities that may have a detrimental effect on the environment. It is submitted by the Contractor to the RP and ECO.

The purpose of a Method Statement is for the Contractor to provide additional details regarding the proposed methodology for certain activities, and for the RP and ECO to confirm that these meet the requirements of the MMP and acceptable environmental practice. This allows the MMP to be less prescriptive and affords the Contractor a certain amount of flexibility or to amend stipulations in the MMP, if approved by the ECO. It also provides a reference point to detect deviations from the agreed approach to an activity and allows for the proposed approach and methods for undertaking future maintenance and repair activities to be clearly documented and agreed on prior to commencement.

Each Method Statement will address environmental management aspects relevant to the activity and will typically provide detailed descriptions of items including, but not necessarily limited to:

- Nature, timing and location of activities;
- Procedural requirements and steps;
- Management responsibilities;
- Material and equipment requirements;
- Transportation of equipment to and from site;
- Method for moving equipment / material while on site;
- How and where material will be stored;
- Emergency response approaches, particularly related to spill containment and clean-up;
- Response to compliance / non-conformance with the requirements of the MMP; and
- Any other information deemed necessary by the RP.

Detailed method statements may also be requested by the ECO for certain aspects of the works proposed. The following list provides examples of Method Statements that may be requested from the Contractor:

- Dredging;
- Disposal of dredge spoil;
- Deposition of material for beach replenishment;
- Environmental awareness;
- Material and equipment storage and delivery;
- Fuel storage, dispensing and fuel spills;
- Waste management;
- Management of contaminated water;
- Erosion and stormwater control;
- Cement batching; and
- Any others considered relevant by the ECO or RP.

The Method Statements will be submitted by the Contractor to the RP and ECO not less than **14 days** prior to the intended date of commencement of an activity. The RP and ECO shall accept / reject the Method Statement within **4 days**. An activity covered by a Method Statement shall not commence until the RP and ECO have accepted such method and once accepted, the Contractor shall abide by the relevant Method Statement. A pro forma Method Statement is attached in

Appendix A, although a suitable Method Statement format can be agreed between the RP, ECO and Contractor.

4.3.2 Environmental Records and Reports

Environmental records and reports required during maintenance activities are listed in Table 4-1.

Table 4-1: Reports required during maintenance

Report	Frequency	From	To
Environmental Checklist	Daily (Weekly)	CER	RP (& ECO)
Environmental Compliance Report	Fortnightly	ECO	NDPW & RP
Site Closure Audit	End of Contract	ECO	NDPW

Environmental Checklist

The CR will undertake daily site inspections to check on the implementation of the MMP by the Contractor and complete a brief report/checklist after the inspection. The completed checklists shall be submitted to the RP at the end of each inspection. This checklist should be discussed between the CR and the RP during the initial site inspection, and agreement reached on the preferred format and content.

The checklists will be submitted to the ECO on a weekly basis, however any issues of environmental concern should be reported to the ECO immediately.

Environmental Compliance Report

The ECO will undertake regular site inspections (at least twice a month) to check on the implementation of the MMP by the Contractor and complete an Environmental Compliance/Progress Checklist Report after each inspection, detailing any environmental issues, non-compliance and actions to be implemented. Environmental Compliance Reports will be submitted to the RP and NDPW and a full record will be kept for submission to the Local Authority and/or DEA on request, or as stipulated in the Dumping at Sea Permit.

Site Closure Audit

The ECO will undertake a final site closure audit on completion of the maintenance activities. The purpose of this is to confirm compliance with all site closure requirements identified by the ECO, and that the site has been left in an environmentally suitable condition. If outstanding environmental requirements are observed during this inspection, a further inspection must be carried out to confirm compliance. The Site Closure Audit report must be submitted to NDPW and DEA (if required) for record purposes.

4.3.3 Corrective Action

Corrective action is a critical component of the implementation–review–corrective action–implementation cycle and it is through corrective action that continuous improvement can be achieved. Where repeated non-compliance is recorded, procedures may need to be altered accordingly to avoid the need for repeated corrective action.

If environmental compliance monitoring by the CR and ECO indicates non-conformance with the MMP or approved Method Statements, the RP will formally notify the Contractor through a Corrective Action Request. The Corrective Action Request documents:

- The nature of the non-conformance/environmental damage;
- The actions or outcomes required to correct the situation; and

- The date by which each corrective or preventive action must be completed.

Upon receipt of the Corrective Action Request, the Contractor will be required to produce a Corrective Action Plan, which will detail how the required actions will be implemented. The Corrective Action Plan must be submitted to the ECO for approval prior to implementation. Once it has been approved, the corrective action must be carried out within the time limits stipulated in the Corrective Action Request.

Additional monitoring by the CER, ECO and RP will then be required to confirm the success or failure of the corrective action.

4.4 Management Measures

The environmental management and mitigation measures that must be implemented during all maintenance activities, as well as responsibilities and timelines for the implementation of these measures and monitoring thereof, are presented in Table 4-2 (for all repair and maintenance works), and Table 4-3 (applicable to dredging and dredge disposal).

Table 4-2: Environmental management and mitigation measures that must be implemented for all maintenance and repair works

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
General environmental management	1.	Include the EMP in all tender documents to ensure that sufficient resources are allocated to environmental management by the Contractor.	NDPW/Engineer	Prior to call for tenders	• NDPW to check tender documents and contract	• Incorporated in tender documents
	2.	Screen all proposed works (method statements for future works) and confirm that no NEMA listed activities or the need for any other authorisations are triggered by the works proposed.	NDPW	Prior to approval of Method Statement(s)	• Method statement	• Approved method statement
	3.	Appoint/designate a suitable ECO prior to the start of maintenance and repair activities to monitor and ensure compliance with the EMP.	NDPW	Prior to the start of activities	• Appointment of ECO	• Appointment of ECO
	4.	Notify the local authority of the proposed works and confirm the applicability of any bylaws which may affect the works.	NDPW/ECO	Prior to the start of activities	• Communication with local authority	• Confirmation from local authority
	5.	Obtain permission from DEA:O&C in terms of the Control of Use of Vehicles in the Coastal Area Regulations for vehicles driving on the beach (if required).	NDPW/Contractor	Prior to commencement of maintenance activities	• Communication with DEA:O&C	• Permission from DEA:O&C
	6.	Limit all construction and repairs to the existing footprints of marine structures, unless relevant authorisations are in place	NDPW	During design	• Method statements and confirmation from Engineer	• No change in footprint of structures • Authorisation for changes in footprint of marine structures
Protection of Heritage Resources	7.	Notify SAHRA of any proposed works on structures old than 60 years and undertake relevant heritage assessments if required.	NDPW	Prior to commencement of maintenance activities	• Submission on SAHRIS portal	• Permit from SAHRA to commence with works
	8.	Report all exposed marine/terrestrial heritage resources to the HWC and/or SAHRA. Heritage resources uncovered/disturbed must not be disturbed further until advice has been obtained from the relevant heritage authority on how they should be dealt with.	Contractor and RP	When potential remains exposed	• Photographs of find. • Visual inspections of excavations.	• Records of correspondence.
	9.	Ensure that all Contractors and Sub-contractors are made aware of the potential existence of heritage resources (terrestrial and marine), and are instructed on the correct procedure for preserving the integrity thereof.	Contractor/ECO	Before construction activities commence	• Attendance registers of awareness sessions.	• Register of all workers that completed the awareness session
Records and Administration	10.	Ensure the Environmental Method Statements are approved and filed on site.	Contractor and ECO	Before relevant construction activities commence	• Internal Audit	• Approved Method Statements signed and filed.

[5] Unless otherwise indicated, monitoring will be undertaken by the ECO.

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
	11.	Maintain a copy of the EMP and any other environmental authorisations/permits/licences on site.	NDPW	Duration of maintenance activities	• Internal Audit	• Approved documents available on site.
	12.	Maintain a complaints register for all complaints. The register must list: • Complainant name and contact details; • Date complaint was lodged; • Person who recorded the complaint; • Nature of the complaint; • Actions taken to investigate the complaint and outcome of the investigation; • Action taken to remedy the situation; and Date on which feedback was provided to complainant.	ECO	Throughout activities	• Inspect complaints register	• Availability of register on site • Designated person to maintain register • Complaints logged • Complaints followed up and closed out
Environmental Awareness	13.	Provide environmental awareness training to all personnel on site. Training should include discussion of: • Potential impact of waste and effluent on the marine environment; • Suitable disposal of waste and effluent; • Key measures in the EMP relevant to workers' activities; and • How incidents and suggestions for improvement can be reported. Ensure that all attendees remain for the duration of the training and on completion sign an attendance register that clearly indicates participants' names.	Contractor and ESO	On site establishment and ongoing	• Check training attendance register • Observe whether activities are executed in line with EMP requirements during ECO site visits	• Register of workers that completed environmental training • Compliance of Contractor with the EMP
Site establishment	14.	Submit a method statement for site establishment for approval by the ESO at least two weeks prior to the start of activities.	Contractor	Prior to commencement of maintenance activities and ongoing	• Method statement • Visual inspections of site	• Approved method statement • Register of illegal entries • Site boundaries demarcated and demarcation maintained • Signage in place • No vegetation cleared or disturbed.
	15.	Demarcate site boundaries upon establishment and ensure that plant, labour and materials remain within site boundaries.				
	16.	Do not clear any vegetation and do not place any plant/materials on vegetation (excluding grassed areas).				
	17.	Designate any locally sensitive areas beyond the boundary of the site as "No go" areas for all personnel on site. No vehicles, machinery, materials or people shall be permitted in the "No go" area at any time without the express permission of the ECO.				
	18.	Place signage in suitable locations to warn members of the public of maintenance activities taking place and to limit access to work areas that may pose a safety risk.				

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
Waste management	19.	Ensure that no litter and debris reaches the marine environment during maintenance activities. Should this occur, remove such waste/litter from the marine environment immediately.	Contractor	Throughout activities	• Visual inspection of waste collection areas • Visual inspection of construction areas (litter) • Check waste disposal slips	• Presence of litter • Availability of rubbish bins • Frequency at which rubbish bins are emptied • Register of frequency of collection and volume of general and hazardous waste sent to final destination • Total volume of general and hazardous waste stored on site vs onsite storage capacity • Evidence of waste separation on site
	20.	Train all staff of the effects of debris and litter in the marine environment and appropriate disposal procedures.				
	21.	Ensure that waste material is not placed where it may be exposed to stormwater.				
	22.	Aim to minimise waste through reducing and re-using (packaging) material.				
	23.	Collect recyclables separately and deliver these to suitable facilities or arrange for collection.				
	24.	Prevent littering by staff at work sites by providing bins or waste bags in sufficient locations.				
	25.	Provide separate bins/waste bags for hazardous / polluting materials and mark these clearly. Remove hazardous / polluting materials from the site at regular intervals and dispose of these materials at a licensed waste disposal facility with a Class appropriate to the type of waste being disposed of.				
	26.	Prohibit any burning or burying of waste on site.				
Effluent and waste water management	27.	Prevent discharge of any pollutants, such as cements, concrete, lime, chemicals, and hydrocarbons into watercourses or the sea.	Contractor	Throughout activities	• Visual inspections	• Containment of all potentially polluted run-off • Register of suitable disposal of contaminated water from containment basins
	28.	Direct run-off from areas with a high risk of accidental releases of oil or hazardous materials (e.g. fuelling or fuel transfer locations, truck washing bays, concrete swills etc.) into containment basins or conservancy tanks and dispose of contaminated water at an approved site.				
	29.	Prevent illegal washing out of containers in water bodies.				
	30.	Do not dispose of any material of any kind in the sea at any time and under any circumstances. Any person that is deemed to have authorised, supervised, instructed, permitted or carried out such an act, shall be permanently removed from site.				
Concrete/Cement Work	31.	Batch cement (where unavoidable on site) in a bunded area on mortar boards and not directly on the ground (unless in a paved area and approved by the ECO).	Contractor	Throughout activities	• Visual inspection and approval by ECO.	• Number of incidents of batching outside bunded

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
	32.	Physically remove any remains of concrete, either solid, or liquid, immediately and dispose of as waste.				area • Contamination of water and soil • Visible litter / waste on site • Register of disposal of excess material.
	33.	Place cement bags in bins and dispose of bags as waste to a licensed waste disposal facility.				
	34.	Sweep / rake / stack excess aggregate / stone chip / gravel / pavers into piles and dispose at a licensed waste disposal facility.				
Hazardous materials	35.	Locate hazardous material storage facilities on an impermeable surface as far as practically possible from the water's edge.	Contractor	Throughout activities	• Visual inspection of hazardous materials handling and storage areas	• Number of incidents of non-compliance with safety procedures concerning hazardous materials, including waste materials • Number of spills of hazardous materials, including waste materials • Cost of cleaning up spills • Evidence of contamination and leaks
	36.	Ensure that contaminants (including cement) are not placed directly on the ground (e.g. mix cement on plastic sheeting) to prevent runoff reaching the marine environment.				
	37.	Develop (or adapt and implement) procedures for the safe transport, handling and storage of potential pollutants.				
	38.	Avoid unnecessary use and transport of hazardous substances.				
	39.	Keep Material Safety Data Sheets (MSDS) for all hazardous materials on site and ensure that they are available for reference by staff responsible for handling and storage of materials.				
Transportation and refuelling	40.	Undertake regular maintenance of vehicles and identify and repair minor leaks and prevent equipment failures.	Contractor	Throughout activities	• Visual inspection of vehicles, machinery and refuelling/maintenance areas	• Number of incidents of non-compliance • Number of leaks and spills • Cost of cleaning up spills • Availability of spill containment and clean up equipment on site.
	41.	Undertake any on-site refuelling of vehicles/machinery (only of essential) on a sealed surface.				
	42.	Use appropriately sized drip trays for all refuelling – ensure these are strategically placed to capture any spillage of fuel, oil, etc.				
	43.	Undertake maintenance and repair of vehicles off-site at an appropriate facility (unless unavoidable and with permission of the ESO).				
	44.	Clean up any spills immediately, through containment and removal of free product and appropriate disposal of contaminated soils/material.				
	45.	Keep spill containment and clean-up equipment on site and utilise as per product specification.				
Noise management	46.	Limit noisy activities to day-time from Monday to Friday or in accordance with relevant municipal bylaws, if applicable, where sensitive receptors are located close to the proposed works.	Contractor	Throughout activities	• Site inspections	• Number of registered complaints

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
	47.	Comply with the applicable municipal and / or industry noise regulations.				
	48.	Notify adjacent residents before particularly noisy activities will take place.				
	49.	Maintain (offsite) all generators, vehicles and other equipment in good working order to minimise exhaust fumes and excess noise.				
	50.	Control the use of radios, television sets and other such equipment by workers to maintain noise levels so as to avoid disturbance of neighbouring residents/tenants.				
	51.	Enclose diesel generators used for power supply on site to reduce unnecessary noise.				
	52.	If complaints regarding noise are received, investigate potential noise reduction measures such as mufflers on equipment.				
	53.	No unregulated blasting is permitted on site. Submit a Method Statement to the ESO if blasting is required.				
Dust Management	54.	Avoid activities that may generate dust (e.g. handling or stockpiling of material) during particularly windy conditions.	Contractor	Throughout activities	• Keep record of incidents and complaints • Observation of dust plumes	• Number of incidents and complaints
	55.	Cover stockpiles with shade cloth or similar material to prevent windblown dust.				
Traffic Management	56.	Manage activities so as to minimise impacts on road traffic as far as possible.	Contractor	Throughout activities	• Keep record of incidents and complaints • Visually inspect vehicles for any obvious faults or overloading	• Number of incidents and complaints • Condition of vehicles
	57.	Use appropriate road signage, in accordance with the South African Traffic Safety Manual, providing flagmen, barriers etc. at the various access points when necessary.				
	58.	Ensure that large vehicles are suitably marked to be visible to other road users and pedestrians.				
	59.	Ensure that all safety measures are observed and that drivers comply with the rules of the road.				
	60.	Investigate and respond to complaints about traffic.				
	61.	Avoid the delivery of construction equipment and materials to the site during local peak traffic hours.				
Housekeeping	62.	Clean up any spills immediately.	Contractor	Throughout activities	• Visually inspect areas inside and outside the	• Number of contaminations noted on
	63.	Regularly inspect all equipment and machinery for leaks or damage.				

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
	64.	Repair any defects as soon as possible. In the case of leaks, ensure that the leaking water or effluent is captured and not released into the environment.			plant for pollution	site
	65.	Keep the site clean, especially during the rainy season when pollutants can wash into the sea with the stormwater.				
Fire Management	66.	Ensure that no fires are permitted on or adjacent to site.	Contractor	Throughout activities	• Inspect fire extinguishers and certificates	• Number of fire incidents • Certified extinguishers in appropriate locations
	67.	Ensure that no smoking is permitted on the site.				
	68.	Ensure that sufficient fire-fighting equipment is available on site.				
	69.	Ensure that all personnel on site are aware of the location of firefighting equipment on the site and how the equipment is operated.				
	70.	Suitably maintain firefighting equipment.				
Ablution facilities	71.	Provide ablution facilities (i.e. chemical toilets unless suitable toilet facilities are available) further than 100 m from the high-water mark for all site staff at a ratio of 1 toilet per 15 workers.	Contractor	Throughout activities	• Visual inspections • Records of waste disposal	• Number of incidents of staff not using facilities • Number of pollution incidents
	72.	Secure all temporary / portable toilets to the ground to the satisfaction of the RP to prevent them toppling due to wind or any other cause.				
	73.	Maintain toilets in a hygienic state (i.e. toilet dispensers to be provided, toilets to be cleaned and serviced regularly).				
	74.	Ensure that no spillages occur when the toilets are cleaned or emptied.				
Response to environmental pollution	75.	In the event of environmental pollution, e.g. through spillages, immediately stop the activity causing the problem.	Contractor	Throughout activities	• Maintain register of pollution events and response • Following resumption of activities, frequently inspect repaired equipment to ensure proper functioning	• Number of incidents • Time activities stopped • Number of recurring incidents • Availability and completeness of register
	76.	Only resume activity once the problem has been stopped or (in the case of spillages) the pollutant can be captured without reaching the marine environment.				
	77.	Repair faulty equipment as soon as possible.				
	78.	Treat hydrocarbon spills, e.g. during refuelling, with adequate absorbent material, which then needs to be disposed of at a suitable landfill.				
	79.	In the event of equipment, litter and debris entering the sea, remove these immediately.				
	80.	Notify the relevant authorities within one day of an environmental pollution event. Inform at least the following parties: • NDPW, • ECO; and • DEA.				

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods[5]**	**Performance Indicators**
Closure and Rehabilitation	81.	Remove all equipment, vehicles, equipment, waste and surplus materials, site office facilities, temporary fencing and other items from the site.	Contractor	Once activities are complete	• Visual inspection of site • Keep record of rehabilitation measures	• Records of waste disposal • State of areas on and surrounding the site • Site Closure Audit report
	82.	Spread excavated (uncontaminated) soil in areas adjacent to the site and not removed as spoil.				
	83.	Clean up and remove any spills and contaminated soil in the appropriate manner.				
	84.	Do no bury discarded materials on site or on any other land not designated for this purpose.				
	85.	Rehabilitate all areas affected by the works to at least the same condition as was present prior to activities commencing.				
	86.	Compile and submit the Site Closure Audit report to NDPW and DEA.				

Table 4-3: Environmental management and mitigation measures for dredging and dredge disposal

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods (where applicable)[6]**	**Performance Indicators**
Define dredge volumes and determine dredging frequencies	1.	Define / estimate the limits for maintenance dredging volume /time interval for the harbour to determine dredge frequency. This should ensure that dredge volumes do not become excessive and to constrain accumulation of contaminants. Time interval can be calculated according to the rates at which the fishing harbour 'captures' sediments.	NDPW/Consultant	Prior to dredging or determining suitable dredge disposal options	-	• Estimate of dredge volume limits/time interval
Sampling and characterisation of sediments	2.	Consult DEA: Oceans and Coasts before any maintenance dredging is undertaken to determine any sampling requirements.	NDPW/Consultant	Prior to dredging or sediment sampling	-	• Confirmation of sampling requirements from DEA: O&C
	3.	For small dredge volumes (below 30 000 m^3) in low traffic ports[7] if sediment is predominantly fine sand or coarser (i.e.>80% of sediment is > 63 µm [equivalent spherical diameter]) the probability of the sediment containing elevated trace metal concentrations or other sediment bound toxins is low, and it is unlikely that sediment sampling and analysis will be required. Where these conditions are not met, sample and characterise sediments to be dredged.		Prior to dredging or determining suitable dredge disposal options	• Sampling and laboratory analysis of sediments	• Sediment analysis report with recommendation regarding sediment disposal and management during dredging
	4.	Compile a sediment analysis report to gauge compliance with relevant contamination thresholds in the National Action List (NAL – see Appendix B) published by DEA in terms of the London Convention 1972 (or other relevant standards published by DEA) and making recommendations regarding the need for further testing and the suitability for unconfined open water disposal, based on the following general principles (see Annexure B for more detailed classifications): • Sediments with trace metal concentrations below Level 1 (as specified in the NAL) are suitable for unconfined open water disposal and require no further testing. • Sediments with trace metal concentrations above Level 1 but below Level 2 may require further testing before disposal at sea. • Sediments with trace metal concentrations exceeding Level 2 should not be disposed of at sea without suitable dilution or				

[6] Unless otherwise indicated, monitoring will be undertaken by the RP.

[7] Where ship traffic is largely limited to fishing vessels and exclude deep sea demersal trawl, tuna bait boats, and ocean long liners.

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods (where applicable)[6]**	**Performance Indicators**
		treatment.				
Identification of suitable dredge spoil disposal options	5.	Determine suitable dredge spoil disposal options based on outcomes of sediment analysis and recommendations of qualified specialist, taking into account the following options and collate into a brief dredge disposal report: • Beneficial use e.g. beach replenishment or use as building material. (This should be considered the preferred option) • Offshore disposal at a site that will allow for dispersion of sediments • Offshore disposal at a site that will limit the dispersion of sediments • Disposal on shore at a hazardous (Class A) waste disposal site (if contaminated) • On shore bioremediation and use/ disposal at a general (Class B) waste disposal site	NDPW/Consultant	Prior to disposal of dredge spoil	-	• Consideration of dredge disposal options • Motivation for disposal rather than beneficial use
	6.	Determine the need for authorisations or permits for the selected disposal solution and where required proceed with the relevant permitting process.			-	• Confirmation of need for permits and authorisations
	7.	Determine whether there is an approved marine dump site in close proximity to the harbour, and consult DEA: O&C regarding the possibility of disposing additional dredge spoil at the existing dump site.			-	• Confirmation of existing marine dumping sites
Use of sediment for beach replenishment	8.	If beach replenishment is identified as a suitable option for the beneficial use of dredged material, consult the local and/or provincial authorities responsible for management of the relevant beach and identify site specific management requirements (see site specific MMP).	NDPW/Consultant	Prior to undertaking beach replenishment	-	• Confirmation from relevant authority responsible for beach management that beach replenishment is an acceptable option. • Site specific management requirements.
Identification of suitable offshore dredge disposal sites (where there is no existing marine dump site)	9.	Where offshore disposal is proposed, identify ideally two suitable candidate dredge spoil disposal sites, taking into account: • Long term dredge disposal requirements • Costs of disposal and associated infrastructure requirements • Proximity of disposal sites to dredge sites (harbours) • Seafloor space required to accommodate the dredge spoil volume • Characteristics of the proposed dredge disposal site	NDPW/Consultant	Prior to disposal of dredge spoil	-	• Dump site selection report

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods (where applicable)[6]**	**Performance Indicators**
		(bathymetry, topography, uniformity etc.) • Location in proximity to known important biodiversity features or sensitive (natural or human receptors) Identify dredge disposal sites with the following characteristics: • Similar sediment granulometry to the dredge spoil • Where wave and/or current driven turbulence is sufficient to facilitate incorporation of dumped sediments back into the local sediment dynamics and avoid the creation of large mounds of dredge spoil A uniform sedimentary area (with no reefs or other features) large enough to accommodate the dredge spoil volume See Dump Site Selection Protocol (Appendix C) for further guidance.				
	10.	When identifying the extent of seafloor space required to accommodate the dredge spoil volume: • Dumped sediment should not reduce water depth at the disposal site by more than 10% for offshore disposal sites. (This is not applicable inside the harbour where sediment will not influence wave dynamics) • Take into account wave action and migration ability of benthos at the dredge disposal site			-	• Details included in dump site selection report
Characterisation of candidate dredge disposal sites (where there is no existing marine dump site)	11.	Undertake sediment sampling and a high level environmental survey to characterise the dredge disposal sites including: • Coarse bathymetry • Absence/presence of reefs • Sediment granulometry • Levels of trace metals in the sediment • Oceanographic circulation patterns • Biodiversity assessment (if required by DEA: Oceans and Coasts, depending on the dump site location and size) The number of samples required should be informed by the size of the proposed dredge disposal site, the condition of the site as well as the location of the site.	NDPW/Consultant	Prior to disposal of dredge spoil	-	• Details included in dump site selection report
Dumping at Sea Permit	12.	If a valid Dumping at Sea Permit has not been granted, apply for and obtain a Dumping at Sea Permit in terms of the NEM:ICMA prior to the disposal of dredge spoil at sea (either within or outside of harbour boundaries). See Guidance on applying for Dumping as Sea Permit attached as Appendix D.	NDPW/Consultant	Prior to disposal of dredge spoil	-	• Application for Dumping at Sea Permit

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods (where applicable)[6]**	**Performance Indicators**
	13.	Include the following information in the submission of the Dumping at Sea Permit application to DEA:O&C: • Sediment analysis report (see item 4 above) • Dump site selection report (see item 9 - 11 above), ideally proposing more than one potential disposal site • Maps depicting proposed dump site location • An estimate of future dredge disposal requirements • An estimate of annual volumes of dredge material to be disposed of • Required/proposed validity of dumping at sea permit				
	14.	Provide DEA: O&C with the name of the dredging contractor prior to the commencement of dredging to allow for the Dumping at Sea Permit to be updated to include this information.			-	• Dumping at Sea permit with correct dredge contractors details
Dredging and dredge disposal	15.	Determine and implement site specific dredging and dredge disposal mitigation and monitoring measures taking into account: • Contamination levels in sediments • Proximity to sensitive environments or water users • Proposed dredge methodology • Proposed dredge volumes • Selected dredge disposal methodology and (where application) location of dredge disposal site	NDPW/Consultant	Prior to commencement of and during dredging or dredge disposal	-	• Site specific dredging and dredge disposal mitigation measures
	16.	Ensure that the dredging contractor is aware of the MMP, the Dumping at Sea Permit and any other relevant authorisations prior to the commencement of dredging activities, and that they are aware of their relevant environmental management obligations in terms of these documents.	NDPW/Consultant	On appointment of dredge contractor	-	• Copies of relevant documents issued to dredge contractor • Compliance with MMP and dumping at sea permit conditions
	17.	Implement all relevant conditions of the Dumping at Sea Permit during dredging activities	Contractor	Duration of dredging and dredge disposal	-	• Compliance with MMP and dumping at sea permit conditions
Monitoring during dredging and dredge spoil disposal	18.	Implement monitoring requirements (if any) specified in the Dumping at Sea Permit issued by the DEA: O&C during dredging and dredge spoil disposal.	Contractor	As specified in the Dumping at Sea Permit	• As specified in the Dumping at Sea Permit	• Compliance with the monitoring requirements specified in the Dumping at Sea Permit.
Long term monitoring of dredge spoil disposal site	19.	If sediments in the dredge spoil and dredge spoil disposal site are similar, no long term monitoring of the dredge spoil disposal site is required, unless otherwise specified in the Dumping at Sea permit.	NDPW/Consultant	1 year after disposal	• Sediment sampling and analysis	• Monitoring report

Maintenance Management Measures						
Aspect	**ID**	**Mitigation measure / Procedure**	**Responsible**	**Implementation Timeframe**	**Monitoring Methods (where applicable)[6]**	**Performance Indicators**
	20.	If sediments in the dredge spoil and dredge spoil disposal site are not similar, sample sediments at the dredge disposal site and analyse contaminant levels 1 year after disposal to demonstrate whether the dredge spoil has been mixed into the overall sediment body (simple statistical analysis of variance approach). This would provide insight on the suitability of the site for future disposal.				
Safety	21.	Maintain a marine exclusion zone around the dredge areas to prevent unauthorised access and injury to third parties.	Contractor	Designate exclusion zone before dredging activities commence	• Visual inspection.	• Clearly delineated exclusion zone.
	22.	Inform other users of the harbour about the exact timing and location of construction/dredging activities through the issuing of notices to surrounding land users		Before dredging activities commence	• Internal Audit.	• Record of communication.
	23.	Conduct visual inspection of area to be dredged for marine fauna/mammals immediately before commencing with dredging activities, to avoid injury.		Before dredging activities commence	• Visual inspections.	• Records of sightings.
	24.	Avoid dredging at night.		Ongoing	• Visual inspections at night.	• No dredging at night.
Oil Spill Contingency Plan	25.	Update any relevant oil spill contingency plan or develop a new oil spill contingency plan to be implemented in the event of an oil spill during dredging, dredge disposal and vessel salvaging activities. (See Appendix E)	Contractor	Prior to dredging activities	• Submission of oil spill contingency plan to ECO for approval	• Approved oil spill contingency plan
	26.	Include the use of physical containment or recovery equipment including a variety of booms, barriers, and skimmers, as well as natural and synthetic sorbent materials in the case of a spill, as well as the use of sorbent materials in the final stages of clean up.				
Heritage Resources	27.	Report all exposed marine/terrestrial heritage resources to the HWC and/or SAHRA. Heritage resources uncovered/disturbed must not be disturbed further until advice has been obtained from the relevant heritage authority on how they should be dealt with.	Contractor and RP	When potential remains exposed	• Photographs of find. • Visual inspections of excavations.	• Records of correspondence.
	28.	Ensure that all Contractors and Sub-contractors are made aware of the potential existence of heritage resources (terrestrial and marine), and instructed on the correct procedure for preserving the integrity thereof.	ECO	Before construction activities commence	• Attendance registers of awareness sessions.	• Occurrence of awareness sessions.

Prepared by

Sharon Jones Pr.Sci.Nat, CEAPSA

Principal Environmental Consultant

Reviewed by

Chris Dalgliesh

Partner

Appendices

Appendix A:

Method Statement Pro Forma

METHOD STATEMENT PRO FORMA

CONTRACT:……..……... **DATE:**……

PROPOSED ACTIVITY (give title of method statement):

WHAT WORK IS TO BE UNDERTAKEN (give a brief description of the works):

WHERE ARE THE WORKS TO BE UNDERTAKEN (where possible, provide an annotated plan and a full description of the extent of the works):

START AND END DATE OF WORKS FOR WHICH METHOD STATEMENT IS REQUIRED:

Start Date:	End Date:

HOW ARE THE WORKS TO BE UNDERTAKEN (provide as much detail as possible, including annotated maps and plans where possible):

Note: please attach extra pages if more space is required

Appendix B:

National Action List

The National Action List is currently being revised and DEA:O&C should be consulted for the most up-to-date version.

Appendix C:

Dump Site Selection Protocol

DUMP-SITE SELECTION

Site selection considerations

1. Proper selection of a dump-site at sea for the reception of waste is of paramount importance. Information required to select a dump-site shall include:

   1. Physical, chemical and biological characteristics of the water column and the sea-bed;

   2. Location of amenities, values and other uses of the sea in the area under consideration;

   3. Assessment of the constituent fluxes associated with dumping in relation to existing fluxes of substances in the marine environment; and

   4. Economic and operational feasibility.

2. Guidance for procedures to be followed in dump-site selection can be found in a report of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP Reports and Studies No. 16 - Scientific Criteria for the Selection of Waste Disposal Sites at Sea). Prior to selecting a dump-site, it is essential that data be available on the oceanographic characteristics of the general area in which the site is to be located. This information can be obtained from the literature but field work should be undertaken to fill the gaps.

Required information includes:

1. The nature of the seabed, including its topography, geochemical and geological characteristics, its biological composition and activity, and prior dumping activities affecting the area;

2. the physical nature of the water column, including temperature, depth, possible existence of a thermocline/pycnocline and how it varies in depth with season and

weather conditions, tidal period and orientation of the tidal ellipse, mean direction and velocity of the surface and bottom drifts, velocities of storm-wave induced bottom currents, general wind and wave characteristics, and the average number of storm days per year, suspended matter; and

3. The chemical and biological nature of the water column, including pH, salinity, dissolved oxygen at surface and bottom, chemical and 8 biochemical oxygen demand, nutrients and their various forms and primary productivity.

3. Some of the important amenities, biological features and uses of the sea to be considered in determining the specific location of the dumpsite are:

1. The shoreline and bathing beaches;

2. Areas of beauty or significant cultural or historical importance;

3. Areas of special scientific or biological importance, such as sanctuaries;

4. Fishing areas;

5. Spawning, nursery and recruitment areas;

6. Migration routes;

7. Seasonal and critical habitats;

8. Shipping lanes;

9. Military exclusion zones; and

10. Engineering uses of the seafloor, including mining, undersea cables, desalination or energy conversion sites.

Size of the dump-site

4. Size of the dump-site is an important consideration for the following reasons:

1. It should be large enough, unless it is an approved dispersion site, to have the bulk of the material remain either within the site limits or within a predicted area of impact after dumping;

2. It should be large enough to accommodate anticipated volumes of solid waste and/or liquid wastes to be diluted to near background levels before or upon reaching site boundaries;

3. It should be large enough in relation to anticipated volumes for dumping so that it would serve its function for many years; and

4. It should not be so large that monitoring would require undue expenditure of time and money.

Site capacity

5. In order to assess the capacity of a site, especially for solid wastes, the following should be taken into consideration:

1. The anticipated loading rates per day, week, month or year;

2. Whether or not it is a dispersive site; and

3. The allowable reduction in water depth over the site because of mounding of material.

Evaluation of potential impacts

6. An important consideration in determining the suitability of a waste for dumping at a specific site is the degree to which this results in increased exposures of organisms to substances that may cause adverse effects.

7. The extent of adverse effects of a substance is a function of the exposures of organisms (including humans). Exposure, in turn, is a function, inter alia, of input flux and the physical, chemical and biological processes that control the transport, behaviour, fate and distribution of a substance.

8. The presence of natural substances and the ubiquitous occurrence of contaminants means that there will always be some pre-existing exposures of organisms to all substances contained in any waste that might be dumped. Concerns about exposures to hazardous substances thus relate to additional exposures as a consequence of dumping. This, in turn, can be translated back to the relative magnitude of the input fluxes of substances from dumping compared with existing input fluxes from other sources.

9. Accordingly, due consideration needs to be given to the relative magnitude of the substance fluxes associated with dumping in the local and regional area surrounding the dump-site. In cases where it is predicted that dumping will substantially augment existing fluxes associated with natural processes, dumping at the site under consideration should be deemed inadvisable.

10. In the case of synthetic substances, the relationship between fluxes associated with dumping and pre-existing fluxes in the vicinity of the site may not provide a suitable basis for decisions.

11. Temporal characteristics should be considered to identify potentially critical times of the year (e.g., for marine life) when dumping should not take place. This consideration leaves periods when it is expected that dumping operations will have less impact than at other times. If these restrictions become too burdensome and costly, there should be some opportunity for compromise in which priorities may have to be established concerning species to be left wholly undisturbed. Examples of such biological considerations are:

1. Periods when marine organisms are migrating from one part of the ecosystem to another (e.g., from an estuary to open sea or vice versa) and growing and breeding periods;

2. Periods when marine organisms are hibernating on or are buried in the sediments; and

3. Periods when particularly sensitive and possibly endangered species are exposed.

Contaminant mobility

12. Contaminant mobility is dependent upon several factors, among which are:

1. Type of matrix;

2. Form of contaminant;

3. Contaminant partitioning;

4. Physical state of the system, e.g., temperature, water flow, suspended matter;

5. Physio-chemical state of the system;

6. Length of diffusion and advection pathways; and

7. Biological activities e.g., bioturbation.

Appendix D:

Guidance on Applying for Dumping at Sea Permit

Guidance on applying for a Dumping at Sea Permit under the Integrated Coastal Management Act 2008 (Act No. 24 of 2008).

1. Introduction

This document provides some guidance on the methods and requirements when applying for a Dumping at Sea Permit in terms of Chapter 8 (71) of the Integrated Coastal Management Act 2008 (Act No. 24 of 2008) (ICM Act). The focus of the guide is specifically on the disposal of dredged material into designated open water disposal sites.

Section 71(1)(a) of the ICM Act provides that "A person who wishes to dump at sea any waste or other material must apply in writing to the Minister in the form stipulated by the Minister for a dumping permit that authorises the waste or other material to be loaded aboard a vessel, aircraft, platform or other structure and to be dumped at sea".
In ……. 2012, the Minister's authority to issue dumping permits was officially delegated to the Chief Director: Integrated Coastal Management, in the Branch: Oceans and Coasts.

2. Documents required

All requests to dispose of waste and other matter into the marine environment must be submitted on an official application. "Annex 4 contains a summary of supporting documents required as part of that application".

The supporting documentation required will largely depend on the type of application submitted for evaluation. Failure to provide the listed/required documentation may result in an unsuccessful application.

Documentation:

- Scientific report (sediment analysis)
- Maps depicting proposed dumpsite location
- Application fee payment receipt
- Completed and signed application form
- Approved Environmental Authorisation in accordance with the Environmental Impact Assessment process in the case of capital dredging projects.

3. Maintenance Dredging

Maintenance dredging is routinely undertaken to maintain port depths and to further supply beach nourishment schemes with clean sediment from sand trap areas (Sand Bypass Systems). Maintenance Dredging does not require the completion of an Environmental Impact Assessment. National Environmental Management Act, EIA regulations, Listed Item 1 Activity 16 (c) "Construction or earth moving activities in the sea, an estuary, or within the littoral active zone or a distance of 10 meters inland of high water mark of the sea or an estuary, whichever is the greater in respect of but excluding such construction or earth moving activities is undertaken for purposes of maintenance of the facilities. However, the following supporting documentation is required as part of the application:

a. Sediment Heavy Metal Assessments – Assessments of contaminants must be completed in line with the National Action List for the assessment of dredged material requiring unconfined open water disposal (Annex 2). In addition, the test result should not be older than 3 years from the date at which the samples were collected. The assessment for contamination in sediment is not limited to heavy metals. The Department may require additional Persistent Organic Pollution (POPs) testing, at the expense of the applicant, if reasonable concern suggests a high presence of POPs in the sediment proposed for disposal. Furthermore, the

Department may request a biological testing of the sediment if initial chemical analyses suggest a significant probability of biological effects.

With reference to the new Action List (Annex 2), a decision on whether or not to require biological testing, or to prohibit disposal of the sediment at sea, is determined as followed:

I. If none of the metals measures exceed the Action Levels, then no biological testing is required, and the material can be dumped;
II. If Action Levels for both Annex I metals (Cd and Hg) are exceeded, or the combined level of Cd and Hg is >5ug/g, then biological testing is required;
III. If Action Level for either of the Annex I metal, and two or more of the Annex II metals are exceed, then biological testing is required;
IV. If the Action Levels of three or more Annex II metal are exceeded, and the total of Annex II metals is >500 ug/g, then biological testing is required;
V. If the combined level of Annex II is >100 ug/g, then biological testing is required;
VI. If either of the Prohibition Levels for the Annex I metals is exceeded, or if the prohibition Level of two or more of the Annex II is exceeded, dumping will not be allowed.

b. **Disposal Site Map and Co-ordinates** – A detailed diagram of the disposal site and areas proposed for disposal must be (Annex 3). It is preferred that a side-scan sonar or bathymetric survey of the proposed disposal area, not older than 12 months, be attached to the application. These maps will assist the Department with managing the level of mounting in the disposal site as well as current trends of sediment movement over time. The co-ordinates submitted should preferably be in the following format:

I. Degrees, Minutes, seconds
II. Decimal Degrees

4. Capital Dredging Projects

Disposal of dredged spoil would require further assessment and approvals as opposed to maintenance operations. The application procedure and requirements would follow that of maintenance operation as indicated earlier. However, the following additional documentation is required:

a. **An approved Environmental Authorisation** – The Department requires a completed Environmental Impact Assessment report and subsequent approved Environmental Authorisation to undertake the activity. Specialist marine studies may be required as part of the EIA process before a permit may be considered.

5. Sand By-Pass

Currently, authorised sand by-pass operations fall outside the scope of the Section 71 of the ICM Act. Such activities are not considered dumping because by definition it involves the lawful depositing of a substance for a purpose other than mere disposal of it (see the ICM Act definition of 'dumping'). Sand by-pass schemes nevertheless require an Environmental Authorisation under the National Environmental Management Act. Listed Item 1, Activity 18 (ii) "The infilling or depositing of any material of more than 5 cubic metre into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from the sea.

6. Compliance Monitoring

The Department reserves the right to undertake site inspections in order to assess the permit holder's compliance with the permit conditions stipulated.

7. Payment Procedure and Administration

Once the Department has received all relevant documentation which would include a signed application form, a payment of R 300 (which is subject to change at the Departments discretion) would be required. The details of the payment process will be communicated to the applicant by an Official of the Department. No assessment of the received application(s) will take place proof of payment has been provided. Please note that the application fee is non-refundable, regardless of the application outcome.

Applicants are required to pay the prescribed fee within 30 days of invoice date, or interest may be levied upon the application.

8. Processing time

45 working days for the review (this has been repealed by new ICM Act as from May 2015).

9. Completed application forms should be sent to:

The Director: Coastal Pollution Management
Tel: (021) 819 2439

Contact Person:
Ms Nokuzola Sukwana
Tel: (021) 819 2446
Email: nsukwana@environment.gov.za

Appendix E:

Guidelines for Development of an Oil Spill Contingency Plan

Guidelines for development of an Oil Spill Contingency Plan

A plan for action needs to be prepared in anticipation of a spill of a marine contaminant, such as oil. Contingency plans are essential because they establish practical plans of action for all types of spills so that, when spills do occur, a quick response can minimize the damage. Site or project specific oil spill contingency plans must be aligned with any local oil spill contingency plans and must be submitted to Coastal Pollution Management for approval.

The first step in developing a plan is to learn as much about the area as possible.

- Contingency plans normally include the following:
    - Identification of authority and a chain of command in the case of a spill;
    - A list of persons and organizations that must be immediately informed of a spill;
    - An inventory of available trained spill personnel and spill response equipment;
    - A list of actions that must be taken (in order of priority);
    - A communication network to coordinate response;
    - Probable oil movement patterns under different weather conditions; and
    - Sensitivity maps and other technical data.
- In developing the contingency plan, the following must be taken into consideration:
    - Important or sensitive physical and biological resources within or near the area, such as marshes, unusual flora (plant life) and wildlife resources such as fish, shellfish, marine mammals and birds;
    - Important habitat areas required by particular species for spawning, feeding or migration;
    - Tides, currents and local climatic conditions, such as wind and severe weather patterns;
    - Shoreline characteristics; and
    - Proximity to roads, trained response personnel, oil spill clean-up equipment, etc

SRK Report Distribution Record

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S Jones	SRK	CD		

Approval Signature:

Appendix B
SAHRA NID Response

Coastal Engineering Infrastructure Activities – Proclaimed Fishing Harbours
Work Package 3: West Coast – Laaiplek (Velddrift)

Our Ref:

an agency of the
Department of Arts and Culture

T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Briege Williams
Tel: 021 462 4502
Email: bwilliams@sahra.org.za
CaseID: 10756

Date: Thursday April 13, 2017

Response to NID (Notification of Intent to Develop)

In terms of Section 38 of the National Heritage Resources Act (Act 25 of 1999)

Attention: National Department of Public Works
Maintenance and Repair of Infrastructure Elements at Laaiplek Harbour, Erf number 807, Velddrift, Bergrivier Local Municipality, West Coast District Municipality, Western Cape

Aurecon South Africa Pty Ltd was requested by the Coega Development Corporation (CDC) on the behalf of the Department of Public Works to undertake the coastal engineering infrastructure activities Work Package 3 of the Proclaimed Fishing Harbours Western Cape Development Programme, also known as the small harbours programme. This work package includes the harbour at Laaiplek.

Although there was a settlement at Laaiplek from the mid 19th century, the development of Laaiplek harbour started in earnest in 1968 when a channel was blasted to link the Berg River with St Helena bay. Laaiplek Harbour contains a main wooden wharf with a quay approximately 330m in length and a number of smaller jetties as well as two slipways. The proposed works will entail the repair and maintenance of existing harbour structures, no expansion of the existing footprint will occur as a result of these works.

The project involves the following aspects:

- repairs to concrete structures;
- replacement of the wooden quay;
- replacement of the shore crane;
- dredging of the harbour basin;
- the removal of 2 sunken vessels.

The South African Heritage Resources Agency would like to thank you for submitting the Notification of Intent to Develop and accompanying documents for the Maintenance and Repair of Infrastructure Elements at Laaiplek Harbour, Velddrift, Bergrivier Local Municipality, Western Cape.

SAHRA has reviewed the submitted documents and would like to advise that no work is required under the National Heritage Resources Act (No 25 of 1999) as:

The harbour infrastructure was developed in 1968 and is therefore less than 60 years of age. It therefore currently falls outside of the remit of the NHRA.

an agency of the
Department of Arts and Culture

T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

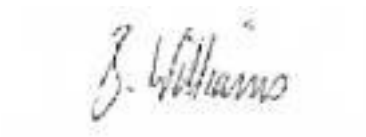
- While the proposed dredging activity in the harbour basin exceeds an area of 5000m^2 and thus requires input from SAHRA in terms of Section 38(1) of the NHRA, it does not extending beyond the area or depth that has been previously dredged; and
- The information provided regarding the sunken vessels shows that they are modern fishing vessels that have all sunk within the last 14 years. They are thus also outside of the remit of the NHRA which protects any wreck older than 60 years of age.

That said, SAHRA would like to advise that should any structures or shipwreck remains older than 60 years be uncovered during the proposed works, we must be notified immediately so that further advise can be given regarding complying with heritage legislation.

With regard to the dredging activity, the documents provided state that the disposal site for the dredged material has not yet been established, SAHRA would like to advise that the disposal site must not be on or within 200m of any known shipwreck or underwater cultural heritage site.

Should you have any further queries, please contact the designated official using the case number quoted above in the case header.

Yours faithfully



Briege Williams
Heritage Officer
South African Heritage Resources Agency

John Gribble
Manager: Maritime and Underwater Cultural Heritage Unit / Acting Manager: Archaeology, Palaeontology and Meteorites Unit

an agency of the
Department of Arts and Culture

T: +27 21 462 4502 | F: +27 21 462 4509 | E: info@sahra.org.za
South African Heritage Resources Agency | 111 Harrington Street | Cape Town
P.O. Box 4637 | Cape Town | 8001
www.sahra.org.za

Enquiries: Briege Williams
Tel: 021 462 4502
Email: bwilliams@sahra.org.za
CaseID: 10756

Date: Thursday April 13, 2017

South African Heritage Resources Agency

ADMIN:
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Appendix C
Specialist Studies

SEDIMENT SPECIALIST STUDY

FINAL REPORT

AURECON PROCLAIMED FISHING HARBOURS

DISPOSAL SITE CHARACTERISATION

PREPARED FOR:

REPORT REF.: LT-460 W2 V-2

JULY 2017

+27 (0)21 705 0819 +27 (0)21 705 6652 info@lwandle.co.za

Old Warehouse, Black River park, Fir Road, Observatory, Cape Town
PostNet Suite 50, Private Bag X3, Plumstead, Cape Town, 7801, South Africa

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Report Version and Quality Control:

Date	Report No. and Revision No.	Created	Reviewed	Released
14/06/2017	LT-16-460 W2: V1.0 Final report: Aurecon disposal site characterisation	Lisa Holton, Gemma Rashley, Kate Dodds	Lisa Holton	Robin Carter
10/07/2017	LT-16-460 W2: V2.0 Final report: revised disposal options included.	Kate Dodds	Robin Carter	Robin Carter

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1 INTRODUCTION

The Coega Development Corporation is responsible for the implementation of the National Department of Public Works (NDPW) Small Harbours Programme. The aim of this programme is to accelerate projects pertaining to the improvement of infrastructure, day-to-day operations, and aesthetics at 13 proclaimed harbours in the Western Cape. These projects include the repairs of existing infrastructure, dredging of harbour basins, characterisation of basin sediments and identification of suitable disposal locations for the dredged material.

The 13 proclaimed harbours were divided into several work packages and the contracts for services in each work package awarded separately. Aurecon has been awarded the work package covering the proclaimed west coast fishing harbours at St Helena Bay, Laaiplek and Lambert's Bay.

Dredging is proposed to take place within all three of the harbours in Aurecon's work package. As such, the sediment composition has been characterised in order to determine whether dredged material is fit for disposal at sea (LT-16-460 W1: V3). The results show that Laaiplek and Lambert's Bay sediments are uncontaminated by trace metals and/or total organic carbon (TOC) and would therefore qualify for unconfined open ocean disposal. At St Helena Bay, although the sediments contained elevated levels of metals, further investigations (through elutriation) showed that these were unlikely to pose a toxicity risk, and these sediments also qualify for unconfined open ocean disposal. According to the regulations set out in the National Action List (DEA, 2012), which adhere to those of the London Convention, dredge spoil disposal locations need to be characterised before dumping is authorised. Aurecon have identified disposal site options and have requested Lwandle to provide the disposal site field investigations and sensitivity assessments for the preferred disposal sites (receiving environment) at each of the three harbours in order to inform the dredge disposal permit application. This document characterises and provides recommendations on the proposed disposal sites at Laaiplek, Lambert's Bay and St Helena Bay from the results of the field investigations completed at each small harbour on the 23rd and 24th May 2017 and compares these results to those collected in the dredge spoil assessment. A detailed description of the field survey methods can be found in the field report (LT-460 W2 Field Report V1). The results of which are set out below.

2 LAAIPLEK

Laaiplek harbour is situated at the mouth of the Berg River and to the north east of the harbour there is a long stretch of beach. Beneficial use of the dredge spoil is favoured over disposal in the ocean, and at Laaiplek, Aurecon has identified beach nourishment as the most appropriate disposal option for the proposed 9,300 m^3 of dredged sediment. The need for beach nourishment was evident during field investigations where extensive erosion of the existing beach was observed (Figure 2-2). Additionally, the beach exhibited a steep profile (Figure 2-) and anti-

erosion rock armouring was present in some areas. Sand appears to be moving away from the investigated beach in a north easterly direction. Cross shore and down shore beach sediment transects were carried out to determine whether the targeted dredge material was similar in nature to the beach sediment and thus suitable for disposal on the beach. Sediment samples were collected at five sites for particle size analysis for fractions >75 microns (Figure 2-2).

Figure 2-1: Photos taken of the sediment receiving beach (north east of the harbour) just after spring low tide (8 am) on the 23rd May 2017. A) View from the top of the eroded cliffs towards the shore armouring; B) View from site LH 5 looking south west towards the harbour; C & D) Two views of the steeply sloping beach profile, alongshore towards the north east.

Figure 2-2: Sediment sampling sites in Laaiplek Harbour at the proposed beach nourishment location as well as the proposed dredging sites originally sampled in the November 2016 field survey

2.1 PSA

Ideally, the dredged material should be similar in grain size distribution to the receiving beach. This is seen to be true for Laaiplek and the results of the grain size analysis for all sites as summarised in Table 2-1 Sediment texture classes are defined as **clay** (< 0.002 mm), **silt** (0.002 - 0.075 mm), grouped as mud in this analysis, **sand** (0.075 – 4.75 mm) and **gravel** (>4.75 mm) (Wentworth 1922). The particle size analysis results show that the median particle size (D_{50}) of the beach sediment samples ranged between 0.36 mm and 1.18 mm, classifying all the sediments as medium to coarse sand (Table 2-1). Sediment samples from the targeted dredge areas showed D_{50} values which ranged from 0.30 mm to 1.0 mm, also classifying these as medium to coarse sand.

Table 2-1: Sampling data for all sites sampled at Laaiplek during the dredge characteristics and the beach sampling campaign. The medium particle size (D_{50}), sediment class and observed beach profile are included.

Name	Lat (deg S)	Lon (deg E)	D_{50} (mm)	Class	Beach Profile
LP 1	-32.7687	18.14748	0.36	Medium Sand	On steep slope between high water and low water, nearest eroded diff behind beach protection
LP 2	-32.7684	18.14772	0.36	Medium Sand	On steep slope between high water and low water
LP 3	-32.7682	18.14801	0.36	Medium Sand	On steep slope between high water and low water
LP 4	-32.7684	18.14763	1.18	Coarse Sand	On edge of low water before wave cut notch (steep slope)
LP 5	-32.7685	18.1478	0.36	Medium Sand	On steep slope at the high water mark just before the diffs
LH 1	-32.7723	18.15073	0.33	Medium Sand	Harbour
LH 2	-32.7715	18.15003	1	Coarse Sand	Harbour
LH 3	-32.771	18.14915	0.5	Coarse Sand	Harbour
LH 4	-32.7706	18.14819	0.47	Medium Sand	Harbour
LH 5	-32.7705	18.14705	0.4	Medium Sand	Harbour
LH 6	-32.7705	18.14591	0.3	Medium Sand	Harbour
LH 7	-32.7694	18.14408	0.8	Coarse Sand	Harbour

Sand size classes varied in the cross-shore direction (Figure 2-1). Grain size and distribution is relative to the cumulative energy of the coastal processes (wind, wave and currents) acting on the beach, in general resulting in steep beaches having coarser grain sizes (Stauble, 2005). This is evident at Laaiplek, where the beach has a steep profile characterised by medium to coarse grain material and the coarsest sediment were found at the base of the beach. As both the harbour and beach sediments comprise predominately sand, the donor sediments are seen as a good match for nourishment of the beach.

Figure 2-1: Grain size distribution at the dredge sites and the receiving beach north east of the harbour.

3 LAMBERT'S BAY

At Lambert's Bay marine disposal is the most economical and practical option to discard of dredge material as no beneficial use has been identified for this sediment. Aurecon have proposed two disposal site options for the disposal of the targeted 48,000 m^3 of dredged material, both of which were investigated in the May 2017 field campaign. The disposal areas (location 1 and 2) require a an area of 5,6471 m^2 and 40,000 m^2 respectively to ensure water depth is not reduced by more than 10% of the surveyed depth (a regulatory threshold). These sites were investigated using a van Veen grab, deployed at eight sites at each disposal location to identify the particle size, trace metal content and total organic carbon of the sediments (Figure 3-1). In addition, drop camera transects were carried out at each disposal location to characterise the seafloor habitats.

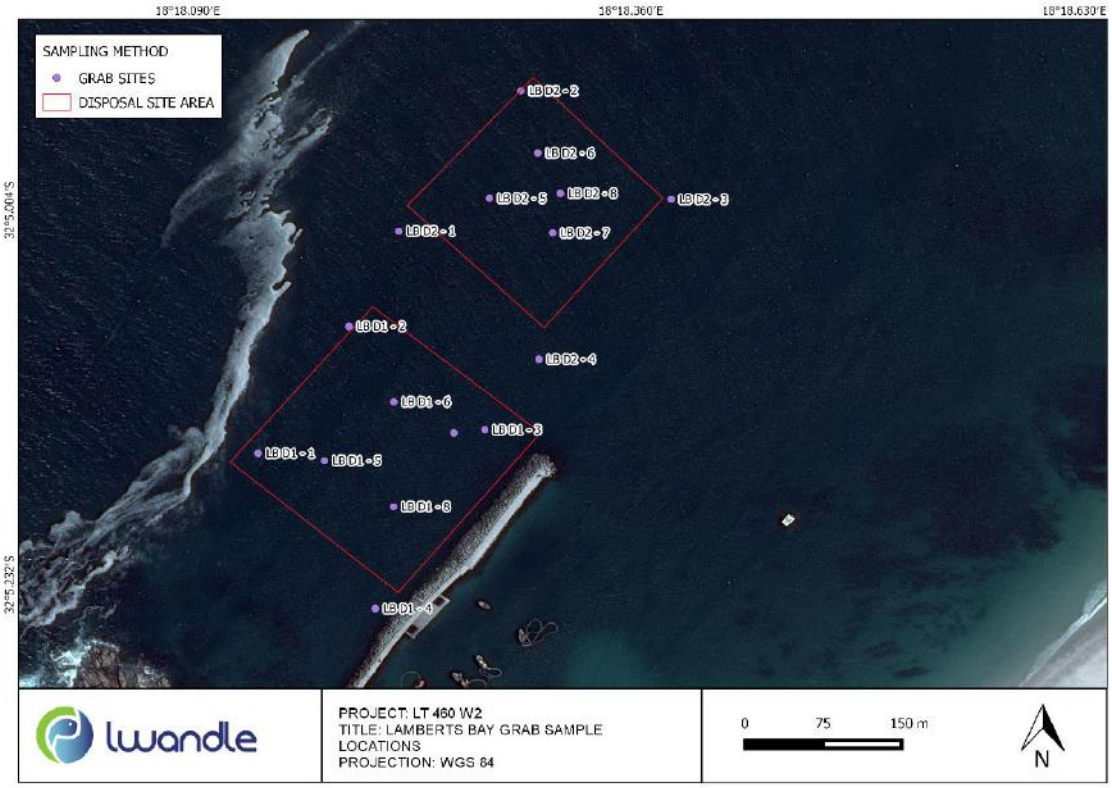

Figure 3-1: Sediment grab sample sites within the two proposed disposal locations for dredge sediments from Lambert's Bay Harbour.

3.1 PSA

Sediment samples obtained during the May 2017 disposal site survey in Lamberts Bay harbour consisted mainly of sand (Table 3.1). The median particle size (D_{50}) of the samples ranged between 0.1 mm and 0.7 mm, classifying the sediment as fine to medium sands. The highest percentage of muds were recorded at sample sites LBD1-6, LBD2-5, LBD2-6, and LBD2-8 where flow velocity is less and fine sediment deposition can occur. No sediment was collected at sites LBD1-1 and LBD2-7 as these sites appeared to have rocky substrate, as confirmed by drop camera images and the presence of urchins and mussels in the grab.

These findings were very similar to the sediment texture classifications of the targeted dredge material as reported in Lwandle (2017), where a range of 0.1 mm to 0.7 mm was also identified (Figure 3-2).

Table 3-1: Sediment texture classification of sediment for Lambert's Bay Harbour, results include those obtained during the May 2017 disposal site characterisation survey as well as those collected in November 2016 during the target dredge material characterisation survey. LBD1 and LBD2, refer to Lamberts Bay disposal locations 1 and 2 respectively.

Site	Latitude (°S)	Longitude (°E)	Percentage Gravel	Percentage Sand	Percentage Silt	Percentage Clay	D_{50} (mm)
Survey 2: May 2017: Disposal site characteristics							
LBD1 - 2	-32.08458	18.30313	0	94	0	6	0.200
LBD1 - 3	-32.08563	18.30451	0	90	3	6	0.200
LBD1 - 4	-32.08744	18.3034	16	76	3	5	0.700
LBD1 - 5	-32.08594	18.30289	0	94	0	6	0.160
LBD1 - 6	-32.08534	18.30359	0	90	4	6	0.200
LBD1 - 7	-32.08566	18.3042	0	91	3	6	0.150
LBD1 - 8	-32.08641	18.30359	0	91	3	5	0.160
LBD2 - 1	-32.08361	18.30364	0	94	0	6	0.180
LBD2 - 2	-32.08219	18.30488	0	92	2	6	0.150
LBD2 - 3	-32.08329	18.30641	0	92	2	6	0.130
LBD2 - 4	-32.08491	18.30506	0	91	3	6	0.300
LBD2 - 5	-32.08327	18.304562	0	90	4	6	0.140
LBD2 - 6	-32.08282	18.30505	0	90	4	6	0.130
LBD2 - 8	-32.08323	18.30528	0	90	4	6	0.150

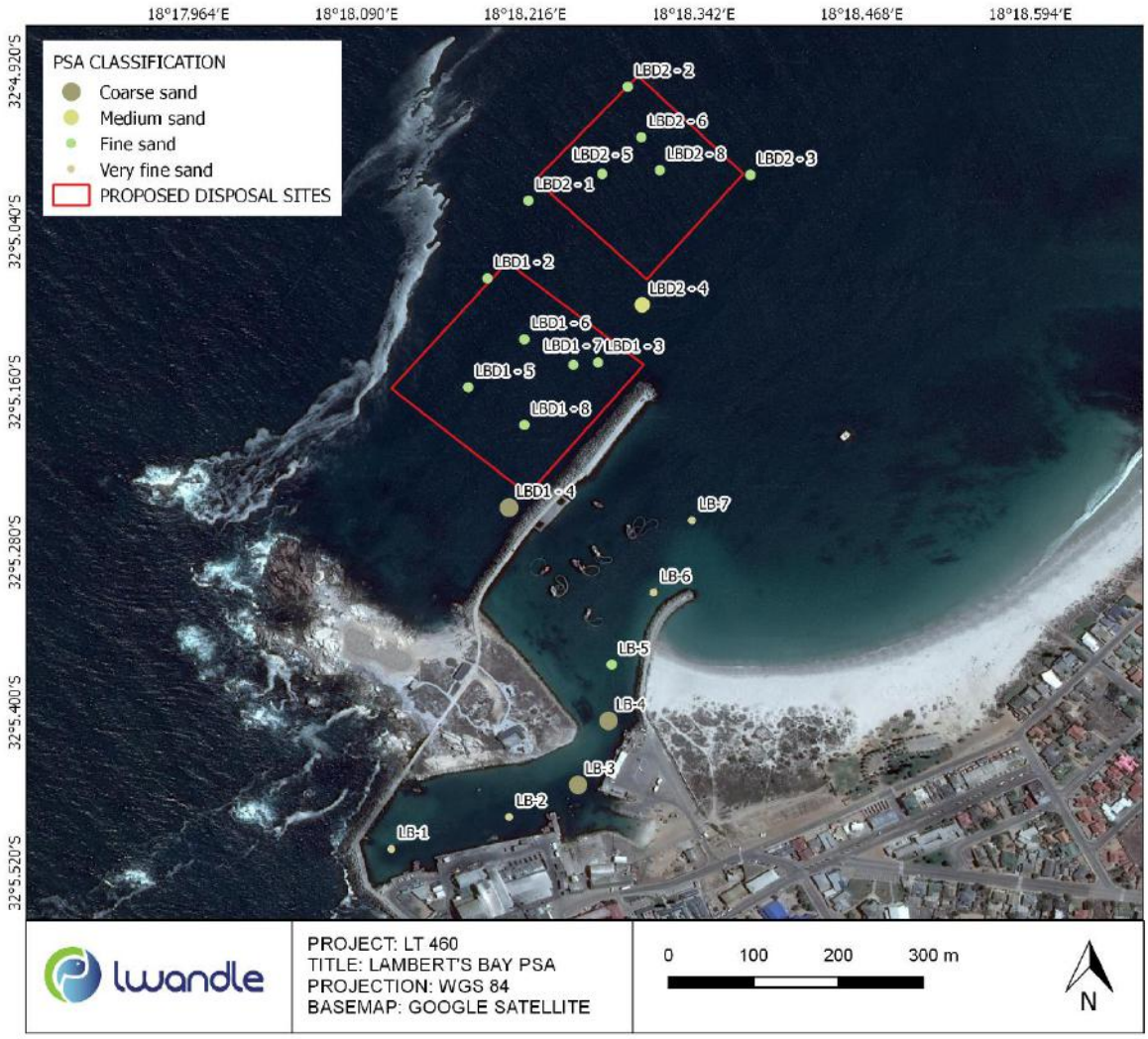

Figure 3-2: Sediment texture results from both the target dredge material locations and the two proposed disposal site locations at Lamberts Bay.

3.2 TRACE METAL CONCENTRATIONS

Trace metal analyses were conducted from material collected at 14 sites within the disposal locations and the mean of the measured metal concentrations were compared against the National Action List values (Table 3.2). The concentrations of the measured trace metals in the sediment samples from both of Lamberts Bay disposal sites did not exceed the recommended National Action List values. This is consistent with the findings of the dredge material characterisation (Lwandle 2017) where metal concentrations did not exceed any of the National Action List values for any of the sampled locations.

Table 3-2: Trace metal concentrations (mg/kg) measured in sediments at 14 sites in Location 1 and 2 in Lambert's Bay harbour. The low action level (LAL) and upper action level (UAL) (National Action List) are also shown.

	LBD1-2	LBD1-3	LBD1-4	LBD1-5	LBD1-6	LBD1-7	LBD1-8	D1 mean	LBD2-1	LBD2-2	LBD2-3	LBD2-4	LBD2-5	LBD2-6	LBD2-8	D2 mean	Total mean	PEC	LAL	UAL
Aluminum	4291	7790	4420	4860	4340	5010	4670	5054	4570	4910	4400	3790	4300	4420	5300	4527	4790	-	-	-
Arsenic	2.30	1.50	1.60	2.00	1.50	1.40	2.00	1.76	2.80	2.10	2.30	1.90	3.10	2.30	2.90	2.49	2.12	41.60	30.00	150.00
Cadmium	0.20	0.20	<0.1	0.10	0.20	0.20	0.20	0.18	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19	4.21	1.50	10.00
Chromium	10.40	12.00	8.19	11.60	12.50	12.00	12.10	11.26	11.80	14.10	14.90	8.40	13.00	14.00	15.10	13.04	12.15	160.00	50.00	500.00
Copper	2.00	<1	1.00	2.00	<1	2.00	1.00	1.60	<1	1.00	<1	<1	<1	1.00	<1	1.00	1.43	108.00	50.00	500.00
Lead	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	112.00	100.00	500.00
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	0.10	0.10	0.70	0.50	5.00
Nickel	4.40	3.10	2.67	3.89	8.25	4.99	4.11	4.49	3.36	2.47	4.12	3.40	3.36	3.67	4.00	3.48	3.99	42.80	50.00	500.00
Zinc	4.80	8.60	13.80	13.40	8.33	10.90	11.20	10.15	10.90	11.00	6.82	12.20	5.73	7.08	9.43	9.02	9.59	271.00	150.00	750.00

Table 3-3: Total Organic Carbon percentage by weight concentrations for 14 sites in Lambert's Bay Harbour.

	LBD1-2	LBD1-3	LBD1-4	LBD1-5	LBD1-6	LBD1-7	LBD1-8	D1 mean	LBD2-1	LBD2-2	LBD2-3	LBD2-4	LBD2-5	LBD2-6	LBD2-8	Mean	Total mean
Total Organic Carbon (%)	0.06	0.05	0.08	0.06	0.04	0.05	0.05	0.06	0.18	0.07	<0.02	0.15	0.21	0.07	0.2	0.15	0.09

3.3 ORGANICS

The total organic carbon percentages by weight ranged from <0.02 to 0.21% (Table 3-3). These very low values are indicative of low accumulation of organic compounds in the disposal site sediments. Slightly higher TOC values were identified during the dredge material characterisation survey where a range in TOC of 0.11 to 1.78 % was identified, however these values are considered low compared to regional background levels (1-7%, Monteiro and Roychoudhury 2005) (Lwandle 2017). At dredge spoil location 2 three sites were found to have slightly elevated TOC values D2-1 (0.18%), D2-4 (0.15%), and D2-5 (0.21), there appeared to be a layer of organic material above the sediment in this location, which could be related to the influence of local rivers.

3.4 BIOLOGICAL FEATURES

Disposal Location 1 has a relatively uniform bathymetry and is approximately 8-12 m deep. Rocky reef was observed at site LB D1-1 which extended towards Bird Island. The remainder of the sites consisted of sand with large ripples which provides evidence of a dynamic flow area. The substrate became rocky again at site D1-8 nearest to the breakwater (Figure 3-3).

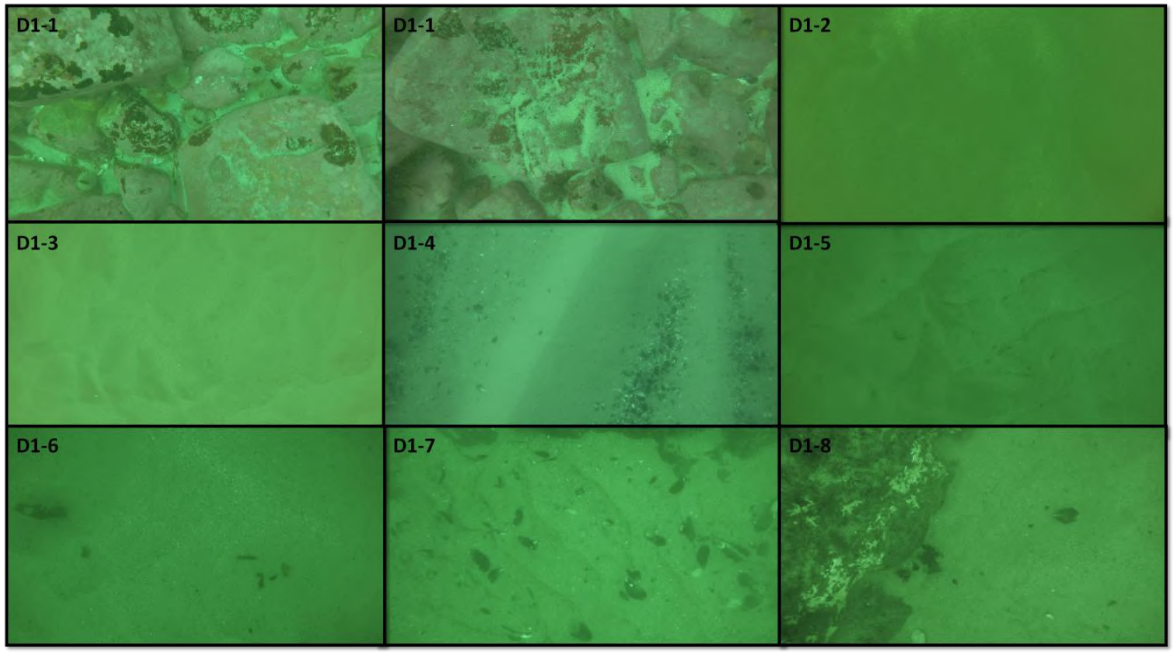

Figure 3-3: Drop camera images of the seafloor at disposal location 1 sites D1-1 to D1-8 taken in Lambert's Bay on the 24th May 2017.

The disposal area of Location 2 has a gently sloping bathymetry and depth of 11-14 m. The depth and poor visibility prevented clear images being recorded by the drop camera. The only recoverable drop camera images were recorded at site LB D2-4 and LB D2-7 which shows sand ripples at LB D2-4 and some small rocks in the vicinity of the site LB D2-7, surrounded by sand (Figure 3-4). The sediment retrieved in the grabs consisted predominantly of sand apart from at

site LB D2-7 (Figure 3-4) where no sediment was retrieved and urchins were present again suggesting a rocky outcrop in this area.

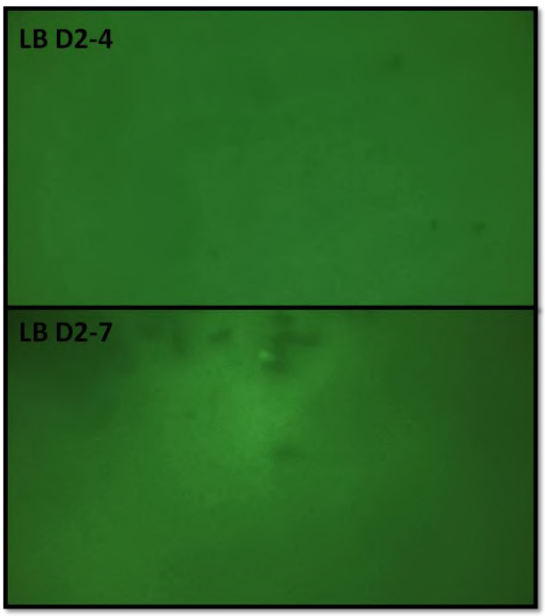

Figure 3-4: Drop camera images of the seafloor at disposal location 2 sites D2-4 and D2-7 8 taken in Lambert's Bay on the 24th May 2017.

4 ST HELENA BAY

At the two possible disposal locations in St Helena Bay sediment sampling was carried out as described for the disposal locations in Lambert's Bay and a drop camera was deployed to record the seafloor habitats at each disposal site. In reference to the surveyed bathymetry, for a dredge volume of 13,000 m^3, Location 1 to the north of the breakwater required an area of 16,250 m^2 and Location 2 within outer reaches of the harbour an area of 17,333 m^2 both of which were investigated in this study (Figure 4-1).

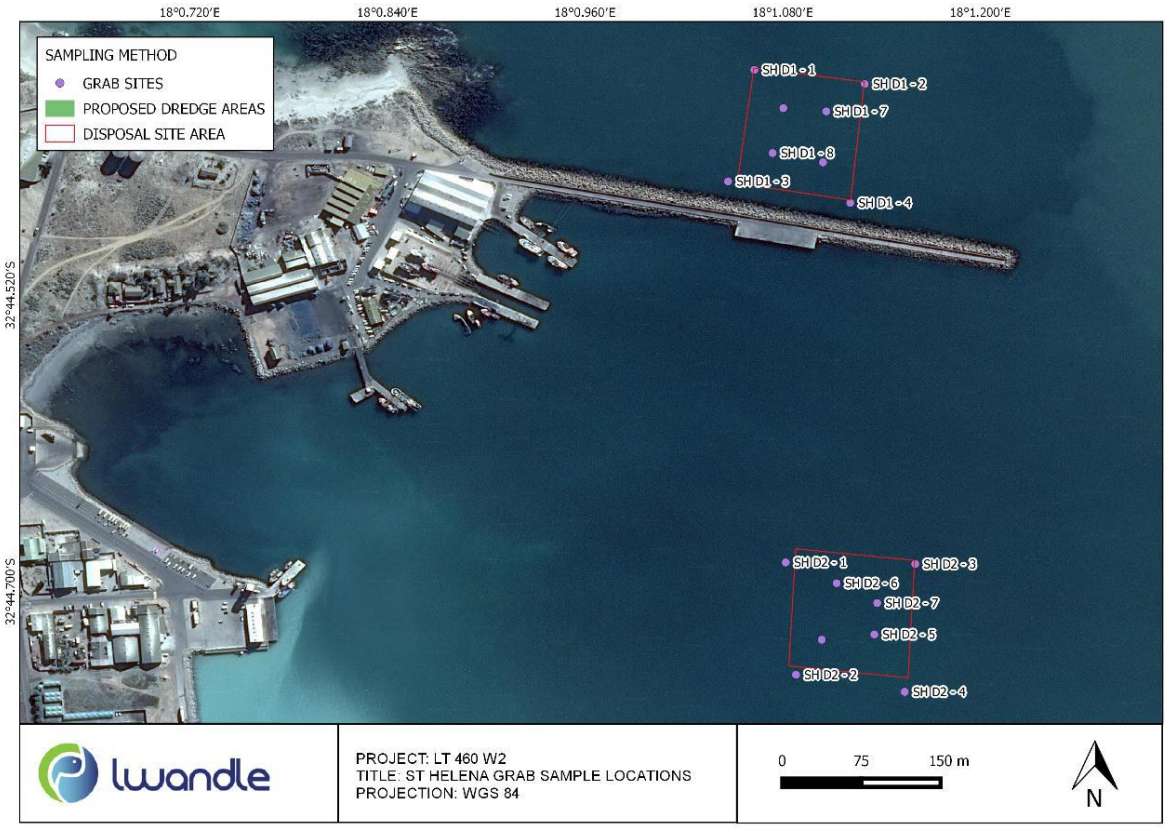

Figure 4-1: Sediment grab sample sites within the two proposed disposal locations for dredge sediments from St Helena Harbour. Sampling was carried out in May 2017.

4.1 PSA

The particle size analysis results for both disposal sites show that the median particle size (D_{50}) of the sediment samples ranged between 0.1 mm and 0.6 mm, classifying the sediment as fine to coarse sands (Table 4-1). Material sampled from Location 2 was generally coarser than that sampled from Location 1, although sediment texture was found to vary at both locations (Figure 4-2).

These results differ slightly from those related to the target dredge areas, where a D_{50} range of 0.075 mm to 0.25 mm for sediment texture was reported, indicative of finer sediment (Lwandle 2017). The generally larger proportion of coarse sediment at the disposal site locations could indicate increased water column energy at these sites, as both of these locations are situated on the boundaries or outside of the shelter of the harbour, this is expected.

Table 4-1: Sediment texture classification for St Helena Bay Harbour.

Site	Latitude (°S)	Longitude (°E)	Percentage Gravel	Percentage Sand	Percentage Silt	Percentage Clay	D_{50} (mm)
SHD1 - 1	-32.73972	18.01771	5	77	6	12	0.130
SHD1 - 2	-32.73986	18.01883	35	51	6	8	0.300
SHD1 - 3	-32.74085	18.01745	0	94	0	6	0.200
SHD1 - 4	-32.74107	18.01868	1	93	0	6	0.200
SHD1 - 5	-32.0859	18.30289	0	83	7	10	0.120
SHD1 - 6	-32.74066	18.01841	0	76	11	13	0.120
SHD1 - 7	-32.74014	18.01844	4	74	10	12	0.100
SHD1 - 8	-32.74056	18.0179	6	65	12	17	0.150
SHD2 - 2	-32.74584	18.01813	3	57	22	18	0.500
SHD2 - 3	-32.74472	18.01934	6	57	22	18	0.500
SHD2 - 4	-32.74601	18.01923	3	68	14	15	0.200
SHD2 - 5	-32.74543	18.01893	7	53	21	19	0.300
SHD2 - 6	-32.74491	18.01854	2	62	16	20	0.600
SHD2 - 7	-32.74511	18.01896	8	50	24	18	0.300
SHD2 - 8	-32.74548	18.01839	15	42	24	21	0.200

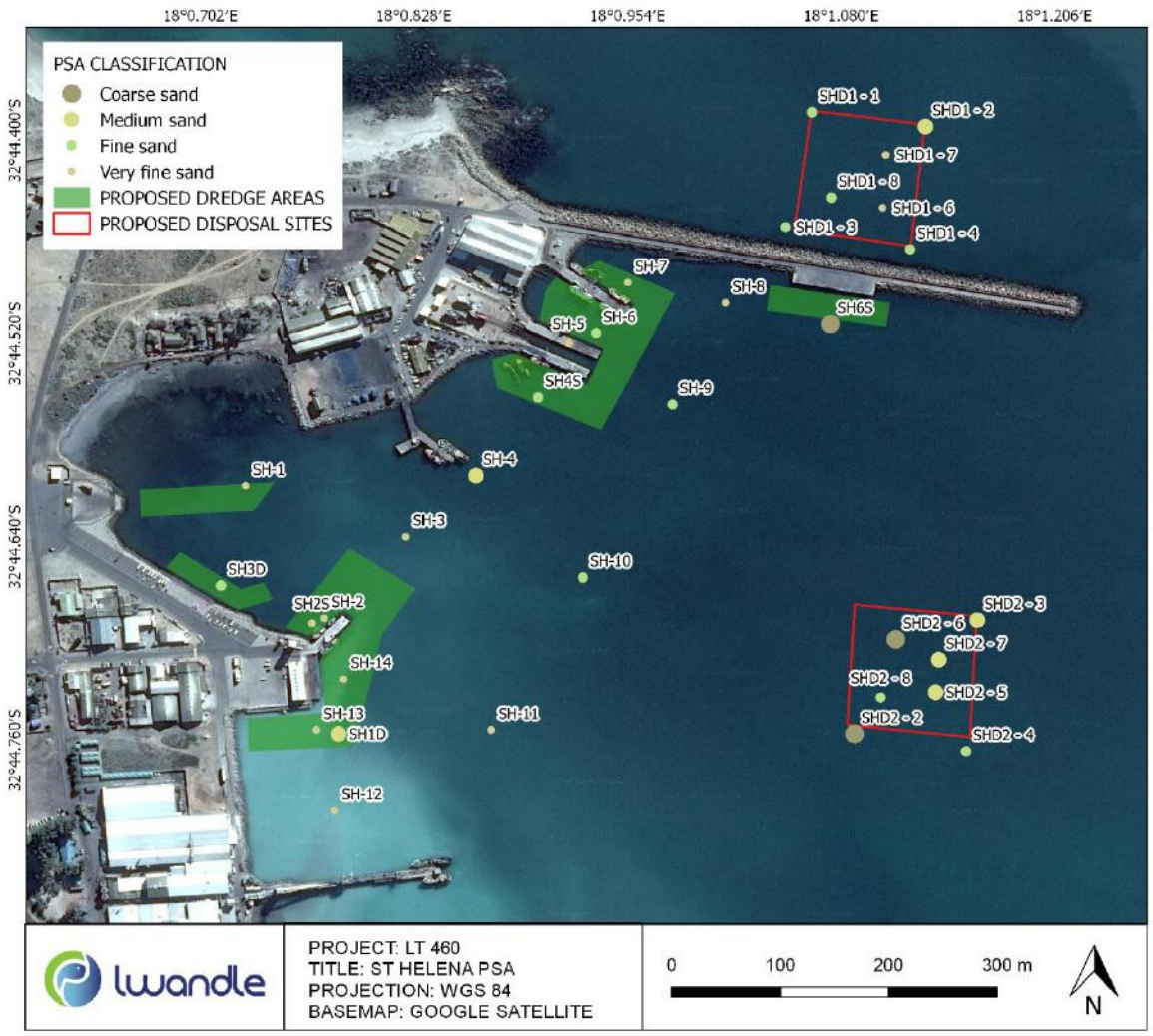

Figure 4-2: Sediment texture results from all samples collected at St Helena Bay from both the dredge material and disposal location characterisation surveys in November 2016 and May 2017.

4.2 TRACE METAL CONCENTRATIONS

Trace metal concentrations were investigated from all eight sites in both of the proposed disposal locations. The results show elevated levels of some metals above the National Action List's lower action level, and some that exceed the BCLME sediment guidelines for the region (Table 4-2). At disposal Location 1, cadmium concentrations were found to exceed the lower action level at most sites, while at Location 2 cadmium as well as chromium are found at elevated levels. At Location 2 cadmium exceeds the lower action level threshold and the recommended BCLME sediment guideline value for the region at all sampled locations. This data shows that both sites are contaminated by cadmium and that Location 2 is contaminated by both cadmium and chromium. As described in Lwandle (2017), the sediments in the region are known to be enriched by both cadmium and chromium. The target dredge material was also identified as being contaminated but it was further explained that this contamination did not pose a toxicity threat due to it not

being available in the dissolved phase (Lwandle 2017). Location 2 shows a higher level of contamination than that of Location 1.

Table 4-2: Trace metal concentrations (mg/kg) measured in sediments at the two possible disposal locations in St Helena Bay harbour. Values between the described National Action List lower action level and upper action level are highlighted in blue. The low action level (LAL) and upper action level (UAL) (National Action List) are also shown. Values above the described National Action List lower action level are highlighted in blue, those above the upper action level are highlighted in orange and BCLME probable effect concentration are highlighted in bold font.

	SHD1-1	SHD1-2	SHD1-3	SHD1-4	SHD1-5	SHD1-6	SHD1-7	SHD1-8	D1 mean	SHD2-1	SHD2-2	SHD2-3	SHD2-4	SHD2-5	SHD2-6	SHD2-7	SHD2-8	D2 mean	Total Mean	PEC	LAL	UAL
Aluminum	27600	22200	35000	30500	24700	24900	25100	28420	27303	45255	58905	54009	51956	54445	56099	60200	55967	55940	40954	-	-	-
Arsenic	9.3	7.6	3.4	3.1	6.7	6.4	7.7	6.3	6.31	15	10.7	6.9	10.3	6.4	9.9	8.5	12.9	9.37	8.19	41.6	30	150
Cadmium	**2**	**1.6**	0.7	1.1	**1.8**	**2**	**1.7**	**2.6**	1.69	**3.9**	**4.1**	**2.8**	**2.8**	**3**	**3.7**	**3.5**	**3.8**	3.39	2.57	4.21	1.5	10
Chromium	35.6	35.4	11.7	11.7	26.7	31.3	32.7	18.7	25.48	78.9	102.7	90.4	80.3	90.8	104.6	106.2	98.4	96.20	59.76	160	50	500
Copper	8	7	2	2	6	7	7	10	6.13	28	25	19	17	21	25	24	25	22.29	14.56	108	50	500
Lead	<5	6	<5	<5	<5	<5	<5	5	5.50	8	9	<5	<5	7	8	10	8	8.40	7.63	112	100	500
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.7**	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			0.7	0.5	5
Nickel	8.45	8.23	5.84	2.16	6.45	7.34	7.85	4.4	6.34	21.3	26.8	22.6	21.2	23.2	30	28.4	26.1	25.47	15.65	42.8	50	500
Zinc	28.8	28.6	10.6	12.6	21.8	22.8	29.6	16.9	21.46	93.7	83.2	64.4	58.4	67.4	164	109.5	175.9	103.26	61.76	271	150	750

Table 4-3: Total Organic Carbon (TOC) percentage by weight concentrations for all sites in St Helena Bay harbour.

	SHD1-1	SHD1-2	SHD1-3	SHD1-4	SHD1-5	SHD1-6	SHD1-7	SHD1-8	D1 mean	SHD2-1	SHD2-2	SHD2-3	SHD2-4	SHD2-5	SHD2-6	SHD2-7	SHD2-8	D2 Mean	Total Mean
TOC (%)	1.61	1.36	0.1	0.26	0.83	1.57	0.97	1.43	1.02	3.82	3.6	2.91	2.8	3.08	4.14	3.34	3.58	3.4	2.21

4.3 ORGANICS

Total organic carbon (TOC) was found in similar amounts at the two disposal locations (2.21%) compared to those identified in the dredge material characterisation survey (3.64%). Disposal Location 1 is shown to have a lower TOC level with a mean of 1.02%, compared to Location 2 where a mean of 3.40% was identified (Table 4-3). The increased level of organic material at Location 2 is consistent with the finer material found in this location and potentially its proximity to localised sites of organic enrichment, such as those identified in Lwandle (2017).

4.4 BIOLOGICAL FEATURES

The drop camera images from Location 1 in St Helena Bay show a diverse and thriving habitat comprising brittle stars; white mussels; whelks; puffadder sharks; crayfish; urchins; anemones and polychaetes as identified from the field survey images (Table 4-2). Kelp and other algae were also identified in the survey. The habitat appears to be representative of the west coast rocky shores and is in a healthy and established state.

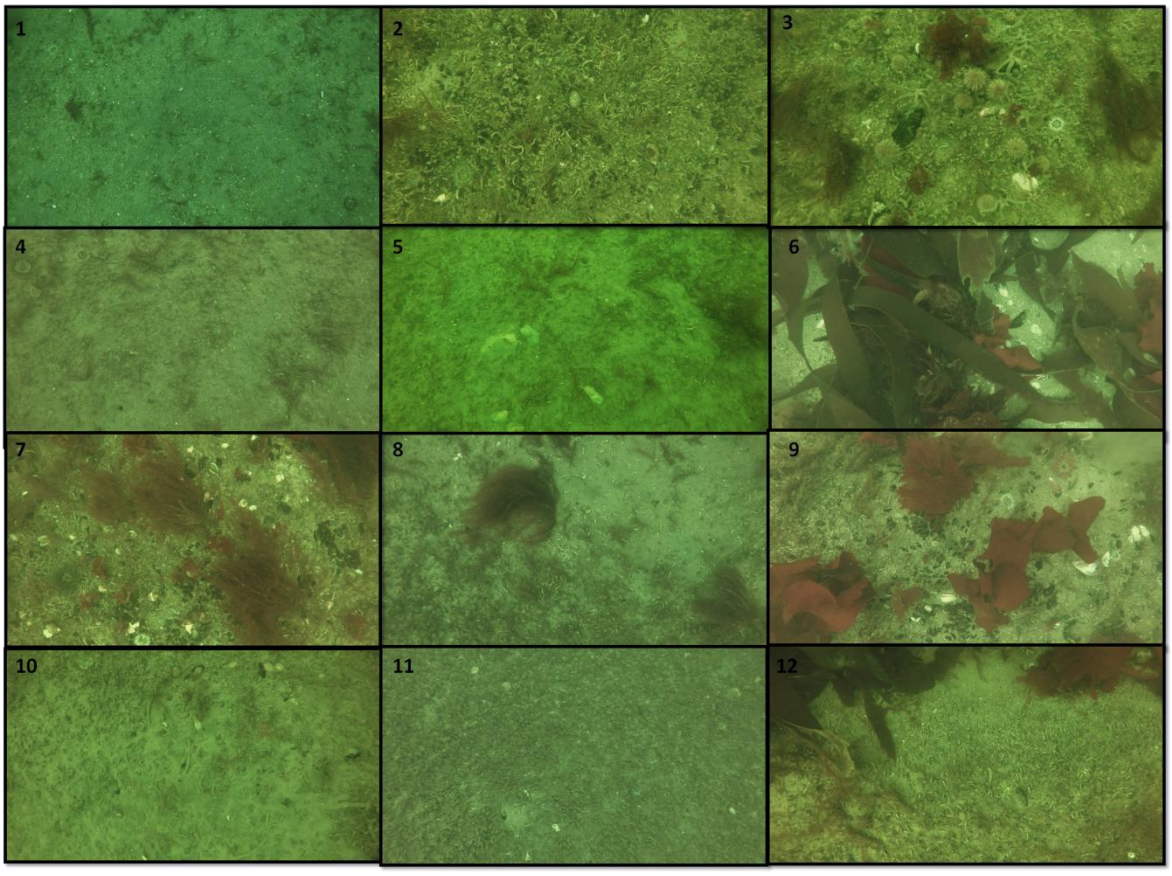

Figure 4-3: Drop camera images of the seafloor at disposal location 1 in St Helena Bay taken on the 23rd May 2017.

In contrast, the drop camera images and grab sample results from Location 2 show that the benthic fauna are dominated by homogenous worm (polychaete) beds, which may feed on the elevated organic carbon of the sediment in the area (Figure 4-4). Figure 4-5 depicts the typical benthic community observed at disposal Location 2, one which is dominated by polychaetes and their casings, interspersed with mollusc species.

These 'polychaete beds' are associated with fine sediment, which appears to cover the entire area of disposal Location 2. Polychaetes are known to be associated with fine sediment and elevated organic loading. As organic material and fine sediment partides scavenge trace metals from the water column, high trace metal concentrations are often associated with these areas. In other contaminated areas it has been shown that some worm species have evolved a high tolerance to trace metal carbon and can become dominant in such environments where other species cannot exist, which may be the case here (Dafforn et al., 2013). The worm beds were also observed outside of the disposal area and are not uncommon in harbours and modified estuaries with measurable levels of contamination.

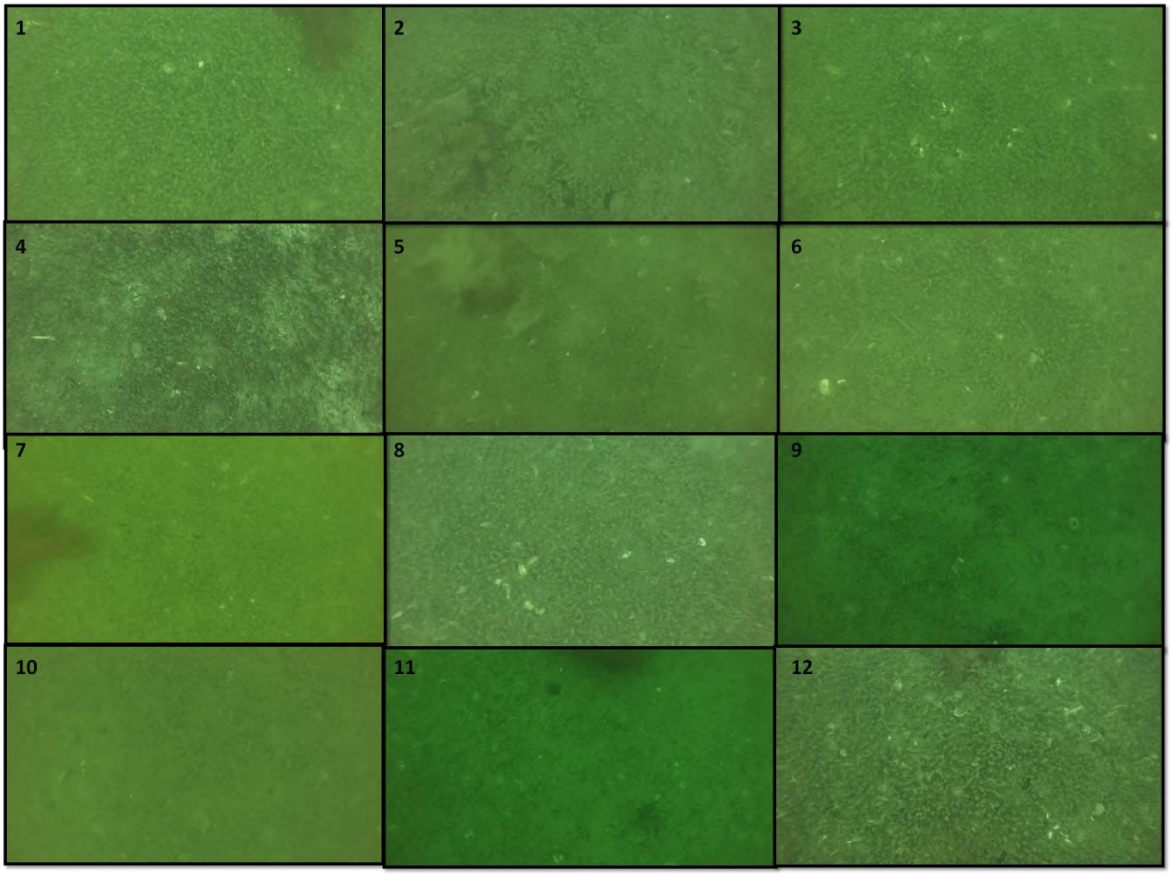

Figure 4-4: Drop camera images of the seafloor at disposal location 2 in St Helena Bay taken on the 23rd May 2017.

Figure 4-5: Polychaete tubes, polychaetes and molluscs retrieved from the Van Veen grab during sampling at disposal location 2 (site D2-8) in St Helena Bay.

5 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions are made based on the results reported above:

5.1 LAAIPLEK

The target disposal beach at Laaiplek is eroded and would benefit from beach nourishment in the form of dredge material from the adjacent harbour. The analysis of grain size distributions at the receiving and extraction sites at Laaiplek has shown that the grain size and distribution is relatively similar at both the targeted extraction and nourishment sites and that nourishment is therefore a suitable disposal option for this location. Nourishment on the beach should provide a wider upper beach during high tide for recreational use; protection from erosion; and the supply of sediment to adjacent beaches, downstream of the nourishment location through long-shore drift.

5.2 LAMBERT'S BAY

A summary comparative table for Lamberts Bay is presented below (Table 5-1).

Table 5-1: Comparison of defining characteristics of the targeted dredge material and the two proposed disposal locations at Lambert Bay. Site description taken from Aurecon report 113148.

Option	Dredge Material	Location 1	Location 2
Disposal Method	n/a	Offshore (near breakwater)	Offshore (deeper water location)
Site Description	Within harbour	Seaward side of breakwater, north of Coaster Berth.	Around breakwater, approximately 100m northwest in deep waters.
Spatial requirement/dredge volume	48,000 m^3	Water depth: 8.5 m CD	Water depth: 12 m CD
		Estimated area required: 56,471 m^2	Estimated area required: 40,000 m^2
PSA -Mean D_{50}	0.286 mm	0.253 mm	0.169 mm
Trace metals (mg/kg)			
Aluminium	6890	5054	4527
Arsenic	1.475	1.76	2.49
Cadmium	0.6	0.18	0.2
Chromium	17.6	11.26	13.04
Copper	4	1.6	1
Lead	<5	<5	<5
Mercury	<0.1	<0.1	<0.1
Nickel	5.56	4.49	3.48
Zinc	28.23	10.15	9.02
Total Organic Carbon (%)	0.85	0.06	0.15

Biological features		Rocky reef structure towards bird island and the breakwater and sand rippled beds.	Rippled sand beds.

5.2.1 Recommended Disposal Option

From the investigations carried out at disposal site one and two in Lambert's Bay, Location 2 is the more suitable disposal location due to its similar sediment characteristics and absence of important biological structures. Disposal in this location is likely to have a low impact on the benthic environment. If possible the boundaries of Location 2 should be positioned to avoid the one area of rocky reef which was identified at site D2-7.

5.3 St Helena Bay

A summary of the comparison between the two investigated disposal locations and the target dredge material for St Helena Bay is provided below (Table 5-2).

Table 5-2: Comparison of defining characteristics of the targeted dredge material and the two proposed disposal locations at St Helena. Site description taken from Aurecon report 113148.Site description taken from Aurecon report 113148. Blue shading identifies trace metals above the UAL of the National Action List BCLME probable effect concentration are highlighted in bold font.

Option	Dredge Material	Location 1	Location 2
Disposal Method	n/a	Offshore	Offshore
Site Description	Various sites within the harbour, some contamination.	Alongside main breakwater, exposed to open ocean wave conditions.	Approximately 500m offshore (southeast) in Sandy Bay in relatively protected waters due to the main breakwater.
Spatial requirement/dredge volume	13,000 m^3	Water depth: 8 m CD	Water depth: 7.5 m CD
		Estimated area required: 16,250 m^2	Estimated area required: 17,333 m^2
PSA - Mean D50	0.187 mm	0.165 mm	0.371 mm
Trace metals (mg/kg)			
Aluminium	37718	27303	55940
Arsenic	11.73	6.31	9.37
Cadmium	**8.5**	1.69	3.39
Chromium	63.78	25.48	96.2
Copper	59.25	6.13	22.29
Lead	19.13	5.50	8.4
Mercury	<0.1	0.18	<0.1
Nickel	16.43	6.34	25.47
Zinc	179.13	21.46	103.26

Total Organic Carbon (%)	3.64%	1.02%	2.21%
Biological features	High organic loading	Diverse benthic habitats and species.	Homogenous worm beds cover the entire area of Location 1.

5.3.1 Recommended Disposal Option

Based on the above results, and particularly the low fraction of metals recorded as being available to the water column after elutriation testing, Lwandle recommends that both of the proposed disposal sites be used; but each under different disposal conditions. Location 1 should be used for the slow release of dredged material, ideally that which is pumped from the dredge site over the harbour wall in relatively small volumes; while Location 2 should be used for the disposal of larger volumes of sediment in discrete events (such disposing of sediment from a dredger's hopper).

These recommendations are based on the fact that Location 1 exhibited a diverse benthic environment with a limited amount of accumulated fine material, classifying it as a dispersive zone. Because of this, sediment released onto this environment in small quantities will be dispersed into the nearshore zone, and eventually move further afield having little effect on the existing habitat. Location 2, displays the opposite characteristics, and is thought to be a retentive zone. As this area exhibits elevated levels of trace metal contamination already, the addition of large volumes of dredged sediment with elevated metal concentrations and TOC values, will cause less of an impact than would be the case at Location 1. The fact that little to none of the sampled metals associated with the dredge material will be available to the water column (Lwandle 2017), means that the wider polychaete and associated benthic community should not be severely affected by the addition of these sediments at this location. Furthermore, the polychaete community does not appear to be unique to the area within the boundaries of Location 2 and a loss of the organisms in this area (through smothering) should not result in population level disturbances.

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SEDIMENT SPECIALIST STUDY

WEST COAST SMALL HARBOURS

Dredge Material - Data Report

PREPARED FOR:

REPORT REF.: LT-JOB-460 W1: V- 4.0

July 2017

+27 (0)21 705 0819 +27 (0)21 705 6652 info@lwandle.co.za

Old Warehouse, Black River park, Fir Road, Observatory, Cape Town
PostNet Suite 50, Private Bag X3, Plumstead, Cape Town, 7801, South Africa

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EXECUTIVE SUMMARY

As part of the National Department of Public Works (NDPW) Small Harbours Programme Aurecon has been awarded the work package covering the proclaimed west coast fishing harbours at St Helena Bay, Laaiplek and Lambert's Bay. Sediment properties were measured in each of the three harbours and then compared against National Action List (DEA 2012) and the BCLME (2006) sediment quality guidelines to determine their suitability for disposal at sea.

The comparisons show that **Laaiplek** and **Lambert's Bay** sediments are uncontaminated by trace metals or the measured organic compounds and would qualify for unconfined open ocean disposal. **St Helena Bay** sediments however were non-compliant in terms of the trace metal loads at the National Action List low action target threshold and the upper action level threshold for cadmium for some sites. In some cases, the trace metal concentrations exceeded the probable effect thresholds recommended for the BCLME (CSIR 2006). Sources of the offending trace metals may be natural as St Helena Bay sediments naturally sequester these (e.g. CSIR 2008) leading to the observed high concentrations, however local enrichment sources were not confirmed. Additional testing of samples from the target dredge pockets showed that sediment contamination was not limited to the top 15 cm of the sediment pile and in some cases extended to 30 cm sediment depth. The potential for the elevated metals to reach the dissolved phase was tested through elutriation however, and the results indicate that negligible amounts would enter this phase when agitated. The dredge material is therefore not considered to pose a toxicity risk to human and or ecological receptors. Nevertheless, should harbour dredging be required, the dredge spoil disposal site(s) will need to be carefully selected.

Contents

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1 INTRODUCTION

The Coega Development Corporation is responsible for the implementation of the National Department of Public Works (NDPW) Small Harbours Programme. The aim of this programme is to accelerate projects pertaining to the improvement of infrastructure, day-to-day operations and aesthetics at 13 proclaimed harbours in the Western Cape. These projects include repairs of existing infrastructure, dredging of harbour basins, characterisation of basin sediments and identification of suitable disposal locations for the dredged material. The 13 proclaimed harbours were divided into several work packages and the contracts for services in each work package awarded separately. Aurecon has been awarded the work package covering the proclaimed west coast fishing harbours at St Helena Bay, Laaiplek and Lambert's Bay.

Aurecon envisages the need for dredging at their assigned proclaimed fishing harbours. As such, Aurecon has contracted Lwandle to investigate the sediment composition and levels of contaminants within the targeted dredge sediments, at each of the three harbours, in order to determine whether the dredge material can be safely disposed of at sea.

2 BACKGROUND

Sediment is an important sink for many contaminants that are anthropogenically introduced into the water column, and settle on the seafloor. Any form of disturbance to this sediment may have ecological effects through re-suspension, hence sediments removed from one area and disposed of elsewhere can lead to detrimental environmental impacts. The London Protocol, to which South Africa is a signatory, regulates the disposal of dredged sediments and other waste materials in the marine environment. This protocol requires the screening of target dredge sediments for contaminants of concern, to determine their suitability for offshore disposal. The screening process investigates the sediment constituents and their potential effects on the environment.

Using the London Protocol as a framework, South Africa has produced a National framework that outlines a set of protocols relating to the screening of sediments for disposal tailored to the expected natural levels of chemicals in sediments along the South African coastline. The National Action List includes guidelines (APPENDIX A) for concentrations of trace metals such as arsenic, chromium, copper and cadmium; and organic pollutants such as polyaromatic hydrocarbons (PAH) and residual pesticides in target sediments. On the West Coast of South Africa, cadmium levels are naturally high and appropriate guidelines (all three harbours fall under the Benguela Current Large Marine Ecosystem (BCLME) guidelines) should be used to evaluate the environmental risks associated with measured cadmium levels prior to disposing these sediments. The particle size distribution of the sediments as well as the total organic carbon are also

measured as these can provide normalising factors qualifying toxicity risks of sediment constituents.

Following these protocols sediment measurement campaigns were carried out in Laaiplek, Lambert's Bay and St Helena Bay harbours during November 2016 and a follow up survey was conducted at St Helena Bay harbour in May 2017. Particle size distribution (PSA) was measured at all sampled locations at each harbour. Trace metals and total organic content (TOC) were only measured at a subset of locations in each harbour as these analyses are restrictively expensive and the distributions of these parameters are expected to be relatively homogenous in close proximity to each other. It was assumed that the selected subset of sites would be sufficiently representative of the general distributions of trace metals and TOC in that particular area. Additionally, four sites at the Laaiplek harbour were analysed for the presence of pesticides due to the estuarine nature of this harbour and the potential for pesticides from upriver of the estuary to affect the harbour sediment.

This document presents and discusses the results of the sediment surveys conducted at the three harbours and concludes whether or not the sediments present at each harbour comply with the requirements for unconfined open ocean disposal of dredge material.

3 LAAIPLEK

Laaiplek harbour is situated at the mouth of the Berg River. In total, sediments from seven sampling sites were obtained (Figure 3-1) during the November 2016 field trip. The collected samples were analysed for sediment particle size distribution (PSA) (all sites), and trace metals, total organic carbon content (TOC), and the presence of pesticides (four sites). Results are set out below.

Figure 3-1: Laaiplek Harbour sediment sampling sites for the November 2016 field trip.

3.1 PSA

Sediment texture classes are defined as **clay** (< 0.002 mm), **silt** (0.002 - 0.075 mm), **sand** (0.075 – 4.75 mm) and **gravel** (>4.75 mm) (Wentworth 1922). Sediment samples obtained during the survey in Laaiplek harbour consisted mainly of sand (Table 3-1). The median particle size (D_{50}) of the samples ranged between 0.3 mm and 1.0 mm, classifying the sediment as medium to coarse sand. Sites LH1, LH2, LH3 and LH7 presented the highest gravel percentage which is likely due to local flow dynamics preventing deposition of finer particles at these sites.

Table 3-1: Sediment texture classification (% by weight) for Laaiplek Harbour.

Site	Percentage Gravel	Percentage Sand	Percentage Silt	Percentage Clay	D_{50} (mm)
LH-1	17	73	3	7	0.330
LH-2	34	57	3	6	1.000
LH-3	16	78	1	5	0.500
LH-4	0	94	0	6	0.470
LH-5	7	84	3	6	0.400
LH-6	4	87	3	6	0.300
LH-7	10	85	0	5	0.800

3.2 TRACE METAL CONCENTRATIONS

Trace metal analyses were conducted on samples obtained from sites LH2, LH3, LH5 and LH7. Concentrations of the following metals were investigated: aluminium, arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. The four sample sites were treated as replicates and the mean of the measured metal concentrations were compared against the recommended environmental quality guidelines for the BCLME region and the National Action List values (Table 3-2). It is evident that measured trace metal concentrations from Laaiplek harbour did not exceed the probable effect concentration (BCLME) or the low action level (National Action List) thresholds.

Table 3-2: Trace metal concentrations (mg/kg) measured in sediments at the four harbour sites at Laaiplek harbour during the November 2016 field survey. The probable effect concentration (BCLME) and the low action level (LAL) and upper action level (UAL) (National Action List) are also shown. All of the results fall below the guideline environmental quality values.

	LH2	LH3	LH5	LH7	Mean	PEC	LAL	UAL
Aluminium	30600	13300	12800	11900	17150	-	-	-
Arsenic	1.8	1.6	2	2	1.9	41.6	30	150
Cadmium	0.3	0.1	0.1	<0.1	0.2	4.21	1.5	10
Chromium	40.6	15.5	9.9	12.1	19.5	160	50	500
Copper	18	32	2	<1	17.3	108	100	500
Lead	<5	<5	<5	<5	<5	112	100	500
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	0.5	5
Nickel	16.5	4.6	3.7	3.8	7.2	42.8	50	500
Zinc	89.8	28.2	18.2	22.1	39.6	271	150	750

3.3 ORGANIC COMPOUNDS

Sediment samples from each site were analysed for their weight percentage of total organic carbon (TOC). LH2 had the highest ratio of 0.17% with LH3 and LH5 both having the lowest ratios of 0.04% (Table 3-3). Such low values would suggest that there is minimal organic matter present in the sediment.

Table 3-3: Total Organic Carbon percentage concentrations for all sites in Laaiplek Harbour.

	LH2	LH3	LH5	LH7	Mean
Total Organic Carbon (%)	0.17	0.04	0.04	0.07	0.08

3.4 PESTICIDE CONCENTRATIONS

Agricultural activities along the banks of the Berg River have the potential to produce pesticide run off. Because of this the sediment samples from Laaiplek harbour were analysed for the presence of a suite of chemicals related to pesticides. At no sites were concentrations of these

chemicals above the detection levels of the analysis methods used. It can be concluded that pesticide contamination was not evident at the time of the survey.

4 LAMBERT'S BAY

Lamberts Bay Harbour is situated at the north-west side of Lamberts Bay, opposite the Bird Island Reserve. Seven sites were sampled within the harbour during the November 2016 field survey (Figure 4-1). As with Laaiplek, samples for PSA and trace metals and organic content analyses were collected. Pesticides were neglected in this case, as the harbour is not estuarine in nature.

Figure 4-1: Lambert's Bay sediment sampling sites for the November 2016 field trip.

4.1 PSA

Sediment samples obtained during the survey in Lamberts Bay harbour consisted mainly of sand (Table 4-1). The median partide size (D_{50}) of the samples ranged between 0.1 mm and 0.7 mm, classifying the sediment as fine to coarse sands. The highest percentages of silts and clays were recorded at sample sites LB1, LB2, LB5 and LB7 where flow velocity may be less allowing the deposition of fine sediment.

Table 4-1: Sediment texture classification of sediment for Lambert's Bay Harbour.

Site	Percentage Gravel	Percentage Sand	Percentage Silt	Percentage Clay	D_{50} (mm)
LB-1	0	72	17	11	0.100
LB-2	0	81	9	10	0.110
LB-3	2	89	3	6	0.700
LB-4	0	90	3	6	0.700
LB-5	0	87	5	8	0.150
LB-6	0	91	2	7	0.120
LB-7	0	87	5	8	0.120

4.2 TRACE METAL CONCENTRATIONS

Trace metal analyses were conducted on samples obtained from sites LB1, LB3, LB5 and LB7. As with Laaiplek, the four sample sites were treated as replicates and the mean of the measured metal concentrations were compared against recommended environmental quality guidelines for the BCLME region and the National Action List values (Table 4-2). The concentrations of the measured trace metals in the sediment samples from Lamberts Bay did not exceed the recommended values (BCLME and National Action List).

Table 4-2: Trace metal concentrations (mg/kg) measured in sediments at the four sites in Lambert's Bay harbour during the November 2016 field survey. The probable effect concentration (BCLME) and the low action level (LAL) and upper action level (UAL) (National Action List) are also shown.

	LB1	LB3	LB5	LB7	Mean	PEC	LAL	UAL
Aluminium	12100	4560	5250	5650	6890	-	-	-
Arsenic	1.1	1.2	2	1.6	1.5	41.6	30	150
Cadmium	1.3	0.3	0.5	0.3	0.6	4.21	1.5	10
Chromium	20.1	13.6	18.1	18.6	17.6	160	50	500
Copper	6	3	6	1	4.0	108	100	500
Lead	<5	5	<5	<5	<5	112	100	500
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	0.5	5
Nickel	6.6	7.1	4.8	3.8	5.6	42.8	50	500
Zinc	23.9	43.3	29.8	15.9	28.2	271	150	750

4.3 ORGANIC COMPOUNDS

The total organic carbon percentages by weight ranged from 0.11 to 1.78% (Table 4-3). These low values are indicative of low accumulation of organic compounds in the harbour sediments.

Table 4-3: Total Organic Carbon percentage by weight concentrations for all sites in Lambert's Bay Harbour.

	LB1	LB3	LB5	LB7	Mean
Total Organic Carbon (%)	1.78	0.11	0.79	0.72	0.85

5 ST HELENA BAY

St Helena Bay harbour is situated in the south west corner of St Helena Bay, 13 km south of Laaiplek harbour. Eleven sites were sampled (Figure 5-1) during the November 2016 field campaign, with PSA analysed at all sites and trace metals and total organic carbon analysis carried out at seven of these. The results of this survey showed contamination at many of the sites and a follow up survey was conducted in May 2017 to investigate the severity of this contamination. Only sites identified as being contaminated in the original study, and falling within the targeted dredge areas (provided by Aurecon prior to the May 2017 survey) were sampled during the follow up survey.

During the follow up survey six sites within the identified dredge pockets were sampled (Figure 5.1) using diver deployed 30 cm plastic cores, as opposed to a Van Veen grab which was used in the November 2016 survey. This sampling technique does not disturb the sediment pile and thus allows investigation into the vertical distribution of grain size and contaminants. Two cores were collected at each site. From one of the cores, a surface (top 10 cm) and deep (bottom 20 cm) sub-sample was obtained. These surface and deep sub-samples were each analysed for PSA, trace metals, and total organic carbon. From the second core, a sub-sample from the surface of the core was collected for elutriation testing, to determine the bioavailability of any trace metals within the sub-sample. Insufficient material was collected from site 5 in the May 2017 survey as the sediment was hard packed and impenetrable using the core.

The results of both field campaigns are presented below, with the results focussing on characterising the sediment within the identified dredge pockets.

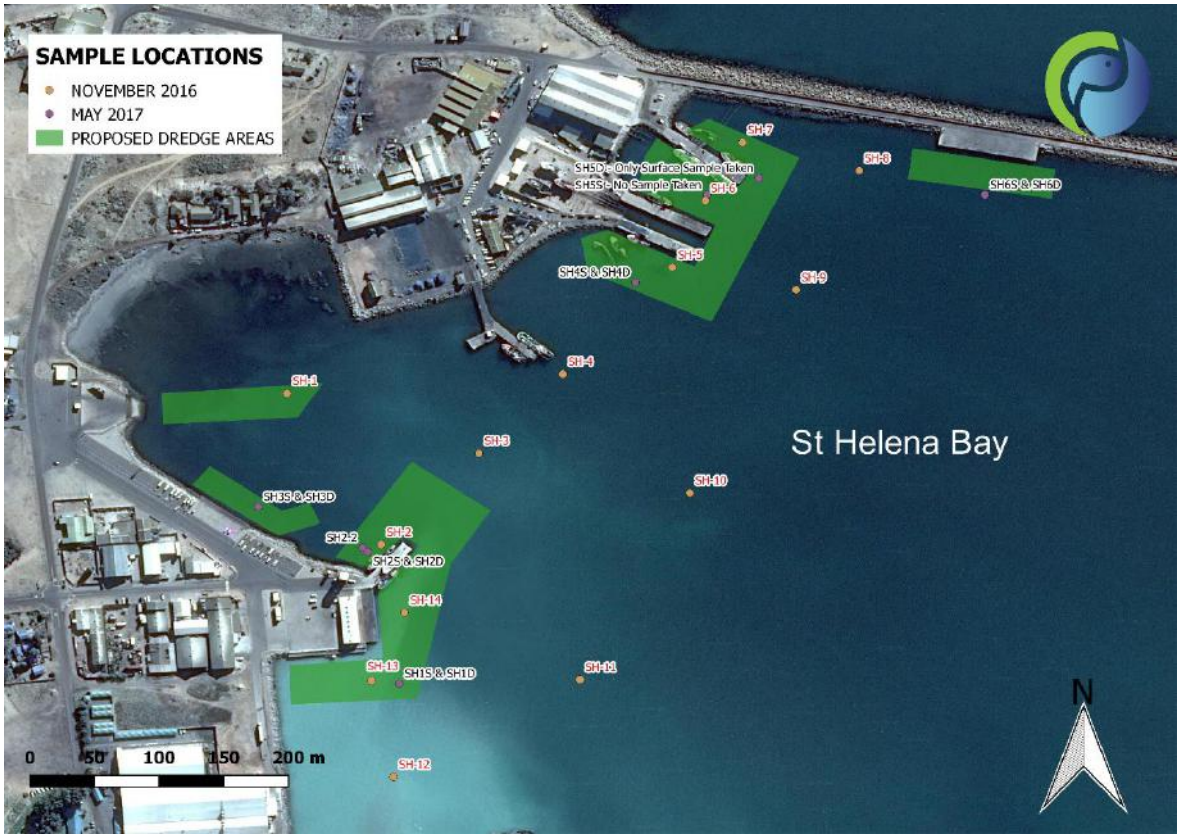

Figure 5.1: St Helena sampling sites from both the November 2016 and May 2017 field campaigns. The location of the targeted dredge pockets is also shown.

5.1 PSA

The particle size analysis results show that the median particle size (D_{50}) of the sediment samples from within the target dredge areas ranged between 0.075 mm and 0.25 mm (with the exception of site SH6S & 6D), classifying the sediment as fine to medium sands (Table 5.1). The presence of fine sediments in the area suggests a low energy system that allows for the settlement of small particles. This is consistent with findings of previous studies carried out in the bay (St Helena SOB 2012; Monteiro and Roychoudhury 2005). The fine material is thought to originate from river run-off into the bay, and possibly from entrained run-off from further afield rivers, such as the Orange River. At site SH6S &6D, the sediment can be classed as coarse-gravely sand. This site was situated along the break water and contained mussels and shell material which could account for the different texture identified here.

Table 5-1: Sediment texture classification for St Helena Bay Harbour, from both the November 2016 and May 2017 field campaigns.

Site	Percentage Gravel	Percentage Sand	Percentage Silt	Percentage Clay	D_{50} (mm)
Survey 1: November 2016					
SH-1	0	84	6	10	0.11
SH-2	1	55	24	20	0.1
SH-5	0	67	21	12	0.12
SH-6	15	52	18	15	0.25
SH-7	0	50	30	20	0.075
SH-13	3	46	22	29	0.075
SH-14	3	55	23	19	0.1
Survey 2: May 2017					
SH1D	3	72	10	15	0.300
SH2S	0	52	28	20	0.075
SH2D	5	63	20	12	0.120
SH3D	4	78	9	9	0.150
SH4S	0	84	7	9	0.200
SH4D	0	84	6	10	0.200
SH6S	22	54	11	13	0.800
SH6D	4	68	16	13	0.500

5.2 TRACE METAL CONCENTRATIONS

St Helena Bay has a greater percentage of fine sands, silts and clays than the other two harbours surveyed. Silts and clays are typically associated with a higher trace metal content than coarser sands as there is a larger binding surface (high surface to volume ratio). The mean values for cadmium, chromium, copper, and zinc are above the low action level target values on the National Action List for dredge disposal (Table 5-2) with mean cadmium values exceeding the probable effect concentration for the BCLME region and the upper action limit at some sites (November 2016: SH2 and May 2017: SH1+2+3). Regressions of the concentrations of each of the trace metals against that of aluminium are often used to identify metal sources (natural or anthropogenic). This is due to aluminium being a proxy for clay minerals and strong relationships of trace metals with this element being indicative of terrigenous geochemical sources of the metals. When plotted against aluminium cadmium, chromium, nickel and zinc showed positive correlations suggesting that the high levels measured were of natural origin (APPENDIX B). The regression between aluminium and cadmium showed a weakly positive result (R^2 = 0.2) which suggests that cadmium is not necessarily linked to the presence of clays. In St Helena Bay this could be explained by cadmium scavenging from the water column during hypoxic/anoxic events. When comparing these results with the CSIR (2008) findings, it is clear that the cadmium levels recorded in both the November 2016 and May 2017 surveys exceed those measured by the CSIR

(CSIR mean: 2.16 mg/kg, Lwandle mean: 8.7 mg/kg). Although the Lwandle surveys were focussed on sites within the harbour, compared to the bay wide approach for the CSIR study, the difference in results is interesting and the source of cadmium enrichment may need to be investigated further. It has been shown that the majority of trace metals that are transported into the sediments in St Helena Bay form stable insoluble sulphide minerals which persist and accumulate in the sediments, but are not bio-available to organisms and hence display limited toxicity (CSIR, 2008).

As recommended by the Technical report on the National Action list and to determine whether these metals do indeed form insoluble metal sulphides, further tests regarding the potential for the elevated metals to enter the dissolved phase were carried out. This was done through the elutriation test (sediment is mixed with water and continually agitated) of sediment sampled from the sites targeted in the May 2017 survey.

Table 5-2: Trace metal concentrations (mg/kg) measured in sediments at sites within the dredge pockets in St Helena Bay harbour during the November 2016 field survey, as well as those measured in the upper and lower sections of the sediment pile at four of the sites sampled in May 2017. Values above the described National Action List lower action level are highlighted in blue, those above the upper action level are highlighted in orange and BCLME probable effect concentration are highlighted in bold font. The probable effect concentration (BCLME) and the low action level (LAL) and upper action level (UAL) (National Action List) are also shown.

	November 2016			May 2017													
	SH1	**SH2**	**SH5**	**SH1S**	**SH1D**	**SH2S**	**SH2D**	**SH3S**	**SH3D**	**SH4S**	**SH4D**	**SH6S**	**SH6D**	**Mean**	**PEC**	**LAL**	**UAL**
Aluminium	32000	42300	37300	41500	49000	36300	22600	37400	34500	34600	28300	45100	51000	37718.7			
Arsenic	6.5	18.1	6.4	15.3	9.9	23.9	17.7	20.1	8.4	5.9	2.3	13.7	8.4	11.7	41.6	30	150
Cadmium	3.4	**13.2**	**4.8**	**16.2**	**15**	**16.2**	**10.9**	**10.3**	3.3	**4.8**	1.7	**9**	**5.8**	**8.5**	4.21	1.5	10
Chromium	22.1	128	50.9	81.2	87.9	73.6	46.8	58.9	32.3	46.7	26.7	83.9	80.5	63.8	160	50	500
Copper	17	90	51	87	74	89	86	61	28	74	37	56	40	59.3	108	50	500
Lead	6	24	10	18	18	16	84	17	16	9	6	15	27	19.1	112	100	500
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.7	0.5	5
Nickel	5.7	14	28.9	23.1	23.6	19.4	10.5	15.3	9.68	11.9	8.46	22	21.7	16.4	42.8	50	500
Zinc	72.6	186	208	**297**	**331**	**327**	173	215	110	142	73.8	154	110	179.1	271	150	750

Elutriation tests were performed for cadmium, chromium, copper, nickel and zinc at all of the sites sampled in the May 2017 field campaign as these metals were found to exceed at least the lower action level at most of the originally sampled locations. The tests for bioavailability of the elevated metals in the water column showed that a very limited amount of metal would enter the dissolved phase and hence become available (Table 5-3). Cadmium, the only metal measured at concentrations which exceeded the upper action level as well as the recommended BCLME guideline, was not found to be available above the detection limits of the laboratory, and was therefore not identified as bioavailable. This is probably due to its affinity for forming insoluble metal sulphides which remain inert in the sediment, even when agitated, and is in agreement with regionally elevated levels of cadmium in seafloor sediments, but not in the overlying water column.

The low release of these metals into the dissolved phase indicates that although their natural concentrations exceeded the sediment quality guidelines for the region they do not represent a toxicity risk either *in situ* or following physical disturbance.

Table 5-3: Results from the elutriation of sediment collected from five sites during the May 2017 field campaign at St Helena bay.

	Site	Cadmium	Chromium	Copper	Nickel	Zinc
30 cm Cores	SH1S	0	0.003	0	0.033	0
	SH1D	0	0.003	0	0.033	0
	SH2S	0	0.002	0.020	0.009	0
	SH2D	0	0.003	0.021	0.017	0
	SH3S	0	0.003	0.015	0.039	0.008
	SH3D	0	0.006	0.032	0.062	0.016
	SH4S	0	0.001	0.010	0.021	0.036
	SH4D	0	0.002	0.020	0.030	0.068
	SH6S	0	0.003	0.016	0.036	0.041
	SH6D	0	0.003	0.023	0.037	0.057
Mean per site	SH1	0	0.003	0	0.033	0
	SH2	0	0.002	0.021	0.012	0
	SH3	0	0.004	0.020	0.048	0.011
	SH4	0	0.001	0.013	0.025	0.047
	SH6	0	0.003	0.019	0.036	0.048
Mean		**0**	**0.003**	**0.016**	**0.032**	**0.023**

5.3 ORGANIC COMPOUNDS

The percentage total organic carbon concentrations at St Helena Bay (between 0.64% and 7.58%) are higher than those at Laaiplek and Lamberts Bay, however they are still similar to previously

recorded values for the area which were found to range between 1 and 7 % (Monteiro and Roychoudhury 2005) (Table 5-4). In general, the major input of organic carbon into the ocean is likely from primary productivity in the surface waters. Local sources of organic material have however, been identified in previous studies where elevated TOC levels have been identified within 100 m of fish factory outfalls in St Helena Bay. The below figure shows that this may be the case here too (Figure 5-2).

Table 5-4 Total Organic Carbon percentage by weight concentrations for all sites in St Helena Bay Harbour.

	November 2016			May 2017										
	SH1	SH2	SH5	SH1S	SH1D	SH2S	SH2D	SH3S	SH3D	SH4S	SH4D	SH6S	SH6D	mean
TOC (%)	1.07	5.11	2.00	6.99	6.18	7.58	5.55	4.81	1.17	1.67	0.64	5.16	2.31	3.64

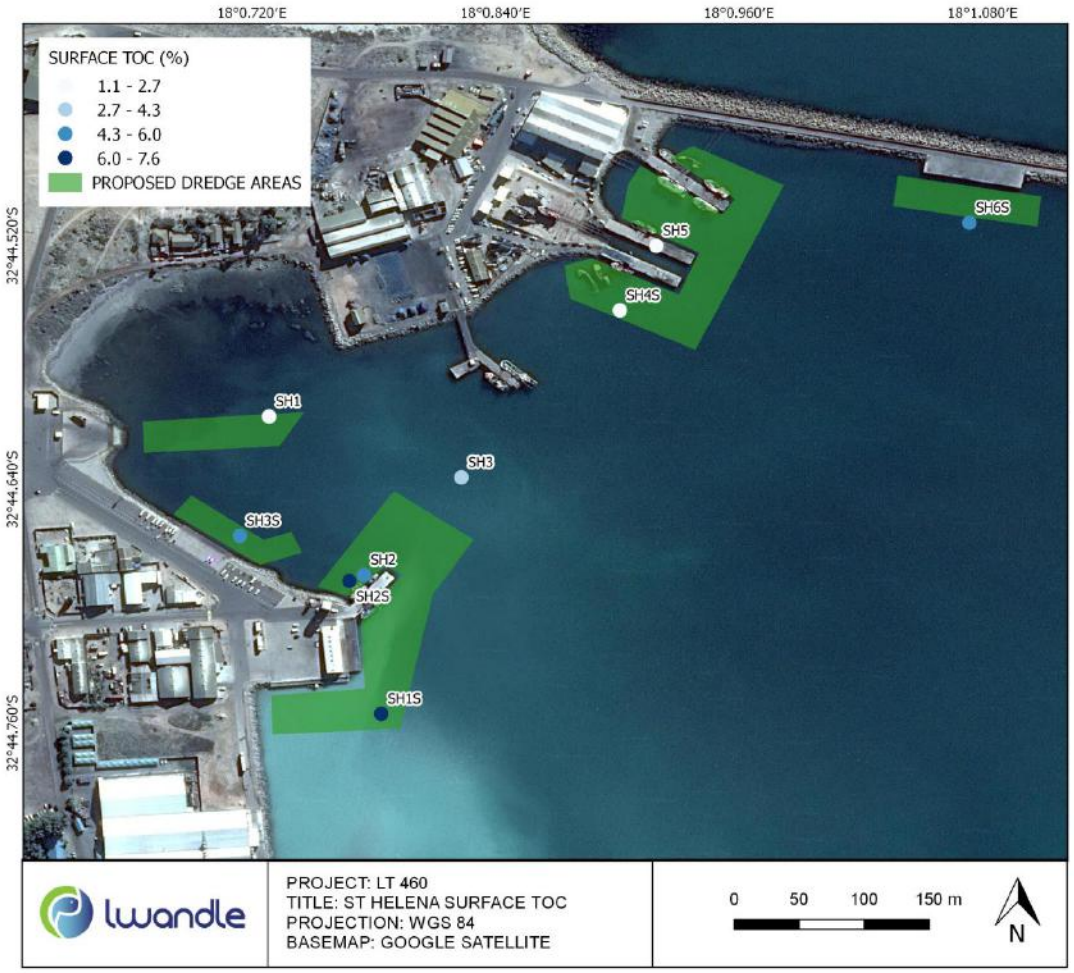

Figure 5-2: Local distribution of TOC measurements from both the November 2016 and May 2017 field campaigns at St Helena Bay.

6 CONCLUSIONS

According to the South African National Action List for the screening of dredged sediment disposal at the values reported above, sediments from both **Laaiplek** and **Lambert's Bay** harbour can be safely disposed of at an authorised location with low probability of associated contaminants generating negative effects on the receiving sediment body. At these sites, no chemical substances are present at higher than 'normal' concentrations. Although these sediments are safe to be disposed of, a suitable dredge disposal location needs to be identified and disposal should only occur at an authorised site. Potential disposal sites should be inspected to assess whether they are suitable for disposal and that there will be limited, mainly physical, detrimental impacts caused by the dumping of sediments.

Targeted dredge sediment at **St Helena Bay** does however, contain some trace metals at concentrations exceeding the National Action List values. Although cadmium, chromium, copper and zinc were found at concentrations higher than the lower action level in some cases, and in exceedance of the upper action level (for cadmium only) at four of the sites; none of the mean values (across all sampled, dredge pocket locations) exceeded the National Action List upper action or prohibition levels. Furthermore, elutriation testing carried out on samples collected in the follow up (May 2017) survey found that minimal to no metal entered the dissolved phase when the sediment was agitated. This test concluded that the investigated metals, from within the targeted dredge areas, do not present a toxicity risk. A previous sediment study carried out within the greater St Helena Bay area (CSIR, 2008) also indicated elevated levels of chromium and copper within the harbour and greater bay area. These metals were seen to accumulate in the central zone of the bay. This suggests that the levels recorded in this report are not localised to the harbour and it is likely that the wider bay area displays naturally elevated levels of these metals. The high cadmium level appears to be a natural phenomenon and as a result of this, the sediment quality guideline of the National Action List allows cadmium in the region of St Helena Bay to be excluded from decision-making. Based on the above results, the sediment within the target dredge areas at St Helena Bay is considered suitable for disposal at sea following an in-depth investigation of the proposed disposal location. It should be noted that sediments outside of the targeted dredge zones displayed elevated levels of nickel, and have not been subjected to elutriation testing. Should the proposed dredging go ahead, the dredging contractor is advised to dredge only from within the demarcated areas, or, if it becomes necessary to widen the dredge area toxicity risks associated with nickel will need to be assessed.

7 REFERENCES

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APPENDIX A. NATIONAL ACTION LIST GUIDANCE

Appendix 4

Modified National Action List for South Africa (the original National Action list is presented in Appendix 3)

Range(ppm)	Action level	Prohibition level
Cadmium	1.5-10.0	>10.0
Mercury	0.5-5.0	>5.0
or for a combined level of these two	1.0-5.0	>5.0
Arsenic	30-150	>150 (1000)
Chromium	50-500	>500
Copper	50-500	>500 (1000)
Lead	100-500	>500 (500)
Nickel	50-500	>500
Zinc	150-750	>750 (1000)
or a combined level of these substances:	50-500	>500 (1000)

Explanatory notes on application:

1. Once the levels of contamination in the sediments have been determined through chemical analysis, these are compared with the Action Levels contained in the above List (presented as $\mu g.g^{-1}$ dry weight sediment).
2. A decision on whether or not to require biological testing, or to prohibit disposal of the sediment at sea, is determined as follows:

a) If none of the metals measured exceed the Action Levels, then no biological testing is required, and the material can be dumped.

b) If the Action Levels for both Annex I metals (Cd and Hg) are exceeded, or the combined level of Cd and Hg is >5 $\mu g.g^{-1}$, then biological testing is required.

c) If the Action Level for either of the Annex I metals, and two or more of the Annex II metals are exceeded, then biological testing is required.

d) If the Action Levels of three or more Annex II metals are exceeded, and the total of Annex II metals is >500 $\mu g.g^{-1}$, then biological testing is required.

e) If the combined level of Annex II metals is >1 000 $\mu g.g^{-1}$, then biological testing is required.

f) If either of the Prohibition Levels for the Annex I metals is exceeded, or if the Prohibition Level of two or more of the Annex II metals is exceeded, dumping will not be allowed.

APPENDIX B. ALUMINIUM REGRESSIONS

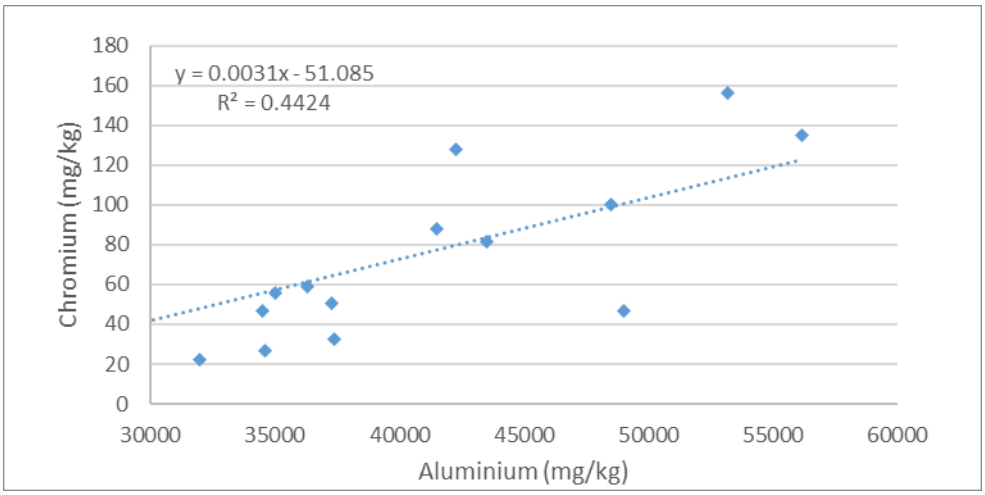

Figure 7.1 Aluminium vs Chromium concentrations in St Helena Bay Harbour, sampled during the November 2016 and May 2017 field campaigns.

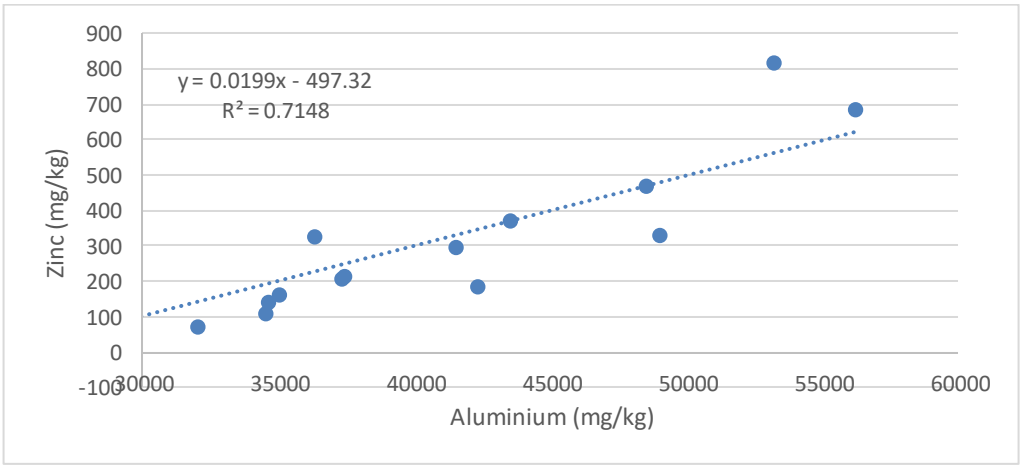

Figure 7.2 Aluminium vs Zinc concentrations in St Helena Bay Harbour, sampled during the November 2016 and May 2017 field campaigns.

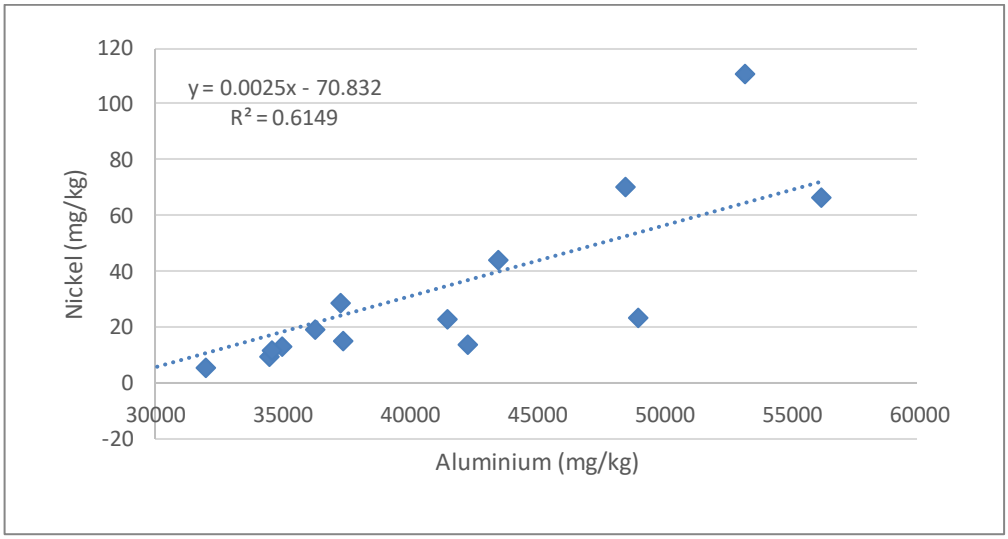

Figure 7.3 Aluminium vs Nickel concentrations in St Helena Bay Harbour, sampled during the November 2016 and May 2017 field campaigns.

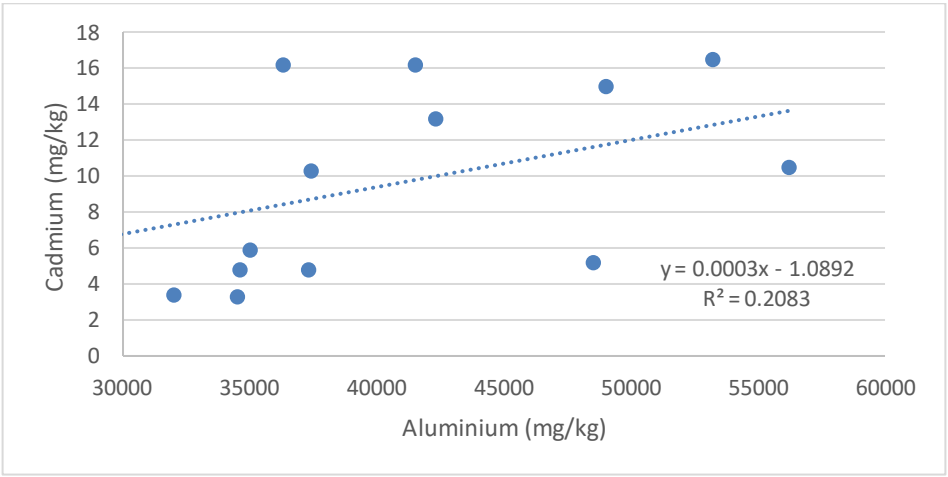

Figure 7.4: Aluminium vs Cadmium concentrations in St Helena Bay Harbour, sampled during the November 2016 and May 2017 field campaigns.

Aurecon South Africa (Pty) Ltd
Reg No 1977/003711/07

Aurecon Centre
1 Century City Drive
Waterford Precinct
Century City
Cape Town 7441

PO Box 494
Cape Town 8000
South Africa

T +27 21 526 9400
F +27 21 526 9500
E capetown@aurecongroup.com
W aurecongroup.com