Dredging and Reclamation of Berbera Port, Somaliland

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Abstract

Dredging is a very important activity in the construction and maintenance of ports and shipping navigation channels. However, the use of mechanical equipment in the dredging activity could pose significant social, environmental and economic drawbacks if it is not well managed. Furthermore, albeit this may vary from project to project, in general, dredging is expensive work, and in some cases small dredging projects can cost more than large dredging projects. The purpose of this paper is to provide a general overview about dredging and reclamation activities with a particular focus on the proposed redevelopment, and revitalization of Berbera port, Somaliland. In this context, the paper will discuss the unique landscape of Berbera port and its pristine environment including, but not limited to, the semi-enclosed lagoon and the natural breakwater, the Khoor, and the neighboring residential community.

The paper will also discuss the pressures that ongoing coastal development projects will have on this unique and sensitive coastal environment. In addition, the paper will review potential risks and challenges that changing bathymetric and hydrodynamic regimes would have on the coastal system. Finally, the paper will present some recommendations based on the international best practices that could be implemented to offset or mitigate these anticipated adverse impacts with respect to dredging and reclamation activities.

Keywords: Somaliland, Berbera, urbanization, integrated coastal zone management semi-enclosed lagoon, breakwater, dredging, reclamation, landfilling, hydrodynamic regime, flushing time, algal bloom, red tide.
Introduction

Berbera port is located in Somaliland along the Gulf of Aden at latitude of N10°26’16.97, and longitude of E044°55’45.89. Berbera Port is the main commercial port in Somaliland. Hence, it is the main platform for the international trade and transport of goods to and from Somaliland. Therefore, its economic stability is vitally important for the development of Somaliland. The government of Somaliland has signed a historic concession agreement with DP World to develop and manage the Berbera port for 30 years with an automatic 10 year extension. This concession is expected to boost the economic growth of the country. However, it is vitally important to recognize the associated risks and the value of the pristine surrounding environment that supports not only the port, but more importantly the livelihood of many of people. The port is surrounded by a unique marine ecosystem due to its semi-enclosed lagoon, extreme environmental conditions, natural breakwater and pristine intertidal areas (see Figure 1). The development and extension of the port will require both capital and maintenance dredging operations. The capital dredging is required to open up new shipping channels, berth pockets for the new container terminal and to deepen or widen the existing port. The maintenance dredging is required to improve the existing port and its waterways channel and berths.

Furthermore, since the DP World took control of the port, the Berbera city has experienced a rapid urbanization, particularly near the coastal areas. This has resulted in reclamation of intertidal areas by dumping massive sand materials in these areas that is putting enormous pressure on coastal areas. In particular, areas with a close proximity to the developed sites such as the semi-enclosed lagoon, breakwater and the small fishing port have been affected. Furthermore, reclamation of intertidal areas will change the natural physical structures of coastal areas and hence will lead to serious long term negative impacts not only on the marine ecosystem, but also the residential communities and the small fishery port. These coastal pressures are anticipated to be amplified due to the construction of the newly proposed container terminal and its access channel. Thus, urgent proactive measures are vitally needed to mitigate accompanied (environmental and socio-economics) adverse impacts. The purpose of
this paper is to raise awareness vis-à-vis of the potential social and environmental risks accompanied with dredging and reclamation activities. It will also highlight some common trade-offs used to mitigate environmental problems associated with dredging and reclamation while sustaining continued economic growth. Therefore, to address these challenges, one must first understand how these processes work and how they interact with the surrounding environment and vice versa.

In general, dredging activities involve mechanical and hydraulic equipment that by their virtue are linked with a number of significant social and environmental risks. Adverse impacts occur at different phases and stages of the project such as the construction (excavation of underwater, transportation and disposal of the dredged materials) and the operational phase. However, knowing the sensitivity of Berbera port and the fact that it is surrounded by sensitive coastal environment, both coastal reclamation and marine dredging, if unmanaged, will lead to subsequent losses of biodiversity, habitats, and ecosystems and potentially pose a threat to lifestyles, cultural heritage, property values, and resources. It is, therefore, essential to develop a proactive plan to select the most appropriate dredging equipment, suitable disposal site (i.e. if materials at the site have no beneficial use), and an environmentally friendly transportation method. In addition, an appropriate site for the new terminal and its access channel prior to commencing of the project must be determined and agreed based on environmental, social and economic justification and adequate mitigation measures put in place.

Dredging Equipment

Dredging involves excavation of material from the seabed and relocation of the materials elsewhere. What really matter is how dredging is conducted and how the dredged material is moved from one location to another location and how the process affects the community as a whole. Dredging is required for a range of reasons, including, but not limited to, improving of the depth and width of ports and shipping navigation channels or cleaning contaminated sites. The extent of dredging is usually determined by a range of factors, including the draught of vessels using the port and, the bathymetry of the site.

There are general, three mechanisms by which dredging is actually accomplished of dredge techniques: suction and mechanical dredging (Figures 2 and 3). A combination of the two (suction and mechanical dredging) are also used.

Therefore, one of the main challenging issues concerning the dredging projects is linked with the selection of suitable dredging techniques. The choice is determined through a range of factors, including financial and social and environmental reasons. Project consideration such as the quantity and quality of material to be dredged, the depth and width to be dredged, disposal site, and the transportation mechanisms are some of the factors used in selecting an appropriate dredging technique.
Transporting the Dredged Material

Dredging activities entail removal of a huge quantity of sediment. Dredged materials are transported in a number of different ways, including but not limited to a trail rainbowing hydraulic or pipeline. One of the main challenging issue regarding the dredged activity is deciding where to relocate the dredging material. Therefore, if not improperly managed a dredging project could lead to a total loss of the semi-enclosed lagoon and the small fishing port. Therefore, a detailed pre-dredging plan, investigation, and site appraisal are vitally required to determine the nature and severity of sediment impact. Based on international best practices a comprehensive environmental, social and economic impact assessment should be prepared prior to dredging and reclamation activities to:

1. Predict and determine significant social, environmental and economic adverse impacts associated with these activities;
2. Identify and incorporate appropriate abatement and mitigation measures into the project; and
3. Identify and incorporate health and safety plans for all phases of the project.

As shown in Figure 1, Berbera port is located in a sensitive environment due to the presence of the semi-enclosed lagoon. Any changes to the coast, the port or the access channel could cause a change to the flushing capacity in this area. The lagoon is already under extreme pressure due to the land based activities. Thus, unless proactive action is taken, development of Berbera port will further increase the pressure on the semi-enclosed lagoon and the surrounding sensitive receptors. A small modification to the current coastal structure has the potential to alter the entire environmental conditions of the coastal area including, but not limited to, bathymetric formation, current pattern, water movement, marine water quality and the flushing capacity in the area.

Figure 4. trail rainbowing hydraulic fill

Impact of Rapid Coastal Development

The development activity along the coastal area poses a significant social and environmental threat. The activity has the potential to change the flushing capacity in the area, and may cause sedimentation and erosion elsewhere in the marine environment due to changes in marine water circulation. Therefore, unless effective measures are taken the coastal reclamation activities can have serious impacts not only on the semi-enclosed lagoon and the pristine surrounding environment, but also to the nearby residential area. The Berbera city council needs to regulate coastal development projects effectively to avoid further crises. If no action were taken to mitigate these adverse impacts, it may cost Somaliland millions if not billions of dollars to carry out frequent maintenance works, and this will undermine the economic stability of Somaliland. Thus, the Berbera city council should ban all coastal development activities, at least for the short term until a relevant coastal policy, legalization and plans, are established and executed. The coastal modifications will ultimately alter the flushing retention time, lead coastal erosion, stagnation at low attrition area, sea level rise and coastal flood risk. In addition, coastal filling may lead the sea water intrusion, to increase groundwater table of nearby areas, such as Daaroole and Barwaaqo, which potentially can result in property damage. Furthermore, the infilling material can lead to localized nutrient enrichment and oxygen depletion. Nutrient load fosters conditions amenable of the establishment of invasive species such as harmful algal bloom. This phenomenon has the potential to suck up vital oxygen,
particularly in shallow and warm waters like the semi-enclosed lagoon, resulting in massive fish kills and changing the plankton composition\(^3\).

**Marine Traffic Impacts**

Dredging works will involve dredging of the only shipping access channel. This is likely to add obstacles to marine traffic within the Berbera port. Thus, leading to a negative socio-economic impact, if smart marine traffic management is not taken into consideration. The dredging activity will disturb commercial ship traffic, marina operators and the operational activity of the small-scale fishermen. Therefore, since the channel will be directly affected the associated socio-economic consequences will be significantly high, given the fact that no other access channel is available.

**Table 1: Potential Significant Impacts on Marine Environment**

<table>
<thead>
<tr>
<th>Activity / Source of Impact</th>
<th>Significant Potential Impacts</th>
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<tbody>
<tr>
<td>Dredging activity</td>
<td>Increase of the total suspended solids concentration and turbidity level; and decrease dissolved oxygen concentration in marine water and in turn impact on the respiration system of the aquatic living organisms and the photosynthesis of marine flora. Some of the contaminants in the sediment may be released in the water column due to the stirring of sediment or pH change in the aquatic environment. Change to hydrodynamics.</td>
</tr>
<tr>
<td>Dredging and reclamation work (stirring up of sediment and resuspension of sediment particles).</td>
<td>Marine structure (providing via dredging and reclamation (e.g. man-made beach of the iconic hotel)). Change to hydrodynamics. Reducing the flushing capacity in the semi-closed lagoon.</td>
</tr>
<tr>
<td>Coastal reclamation (e.g. man-made land for buildings)).</td>
<td>Change to hydrodynamics. Reducing the flushing capacity in the semi-closed area. Direct drawback to fishing community Reducing the size</td>
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### Activity / Source of Impact

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<tr>
<td>Coastal reclamation</td>
<td>Drawback on fisheries and fishing port and the shipping channel (e.g. poor circulation of water), environment). The deterioration is mainly associated with the decrease of dissolved oxygen, increase of nutrients and potential occurrence of algae bloom. Threat to the lives of the fauna at the fisheries and fishing port and marine ecology in the wider area. Threat to adjacent residential area, due to potential sea flood and seawater intrusion. and dimension of the lagoon</td>
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**Conclusions and Recommendations**

The expansion of the Berbera port and deepening of the shipping navigation channel will have a positive economic contribution to Somaliland. However, as discussed in this paper, the expansion is also associated with some adverse social, environmental and to some degree economic drawbacks. Therefore, the ultimate objective is to find a balanced method to achieve economic development without sacrificing the health and environmental values. Therefore, a proactive approach is needed to establish marine and coastal planning. Some of the major concerns are due to the lack of a national coastal policy, legislation and marine special plan. In addition, adequate alternative design options are essential as early as possible to accommodate or eliminate long term adverse impacts through the planning, design and construction stages.

The burgeoning urbanization that is currently taking place in Berbera city is another major issue that is altering the natural physical structure of the coastal areas. Unfortunately, coastal urbanization is taking place without the presence of any coastal plan. Coastal reclamation together with the proposed marine activities such as the new container terminal and its navigation channel may cause long term consequences to the semi enclosed lagoon area. Therefore, an immediate action is required to ban coastal urbanization at least for the short term or restricting developments 300 m away from the coastal boundaries.

Regarding the redevelopment and revitalization of the Berbera port, the proponent (DP World) should prepare a comprehensive social and environmental impact assessment to address both construction and operational related impacts. DP World should in coordination with Somaliland Ministry of Environment and Rural Development and Berbera Marine University undertake a comprehensive marine assessment to characterize and describe the marine current status or baseline to assure that the fragile coastal areas can be protected. This is prudent because any coastal damage will be evaluated against the established baseline information. To respond to the rapidly changing environmental conditions in the Berbera port and surrounding environment, decision-makers should develop an integrated coastal zone management plan (ICZMP) to maintain the quality of marine and coastal ecosystems, while meeting
economic and social needs. This will require proactive program to identify sensitive receptors that should be protected while at the same time allow the development to proceed in non-sensitive areas.

The dredging and reclamation in and around the Berbera port can cause dreadful long-term consequences, particularly in the semi-closed lagoon area and natural physical structure of the coastal system. Therefore, a tradeoff approach between the economic benefits of these activities and the associated adverse impacts on marine and coastal ecosystems can be achieved through number of ways including:

1. Ban coastal urbanization at least for the short term or restrict developments 300 m away from the coastline boundaries.
2. Develop smart policies to promote a healthy, resilient and productive coastal environment, as well as build resilient infrastructure.
3. Strengthen the national legal framework to better coordinate and monitor coastal and ocean and coastal activities.
4. Develop an integrated coastal zone management plan (ICZMP). This will offer an operational framework to maintain the value of marine and coastal environment while at the same time allowing sustainable use of the economic potential of the coastal environment.
5. Request the proponent (DP World) and the contractor to develop a comprehensive social and environmental impact assessment to address all threats.
6. Request the proponent (DP World) to carry out a detail hydrodynamic model to determine the most appropriate site and design for the new terminal and access channels and to predict and manage future impacts and identify potentially impacted areas based on proposed activities.
7. Proponent (DP World) to coordinate with Somaliland Ministry of Environment and Rural Development and Berbera Marine University to characterize the marine environment by conducting monitoring programs before, during and after the dredging.
9. Restrict dredging activities during windy seasons.
10. Develop marine traffic management plan before starting the dredging activities to inform all marine uses.
11. Develop a detail site appraisal for the new container terminal, access channel and dumping sites to justify selected options based on social and environmental and economic reasons.
12. Performing hydrodynamic model to technically support selected sites and design options.

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