2 PRINCES CHANNEL DEVELOPMENT

2.1 Navigational Need

Southern access to the Port of London has, for many years, been provided by the North Edinburgh Channel, Princes Channel and, more recently, the Fisherman's Gat. The seabed of the Thames Estuary in these areas is in constant flux, and water depths and channel centrelines are continually changing. Historically, there has always been a southern access route to the main entrance channel of the Thames with a minimum channel depth in the region of -7.0 to -8.0m. Currently, this is provided by the Fisherman's Gat, but there are signs that this access route is unstable, and recent traffic risk assessment studies (Marico, 2002) have highlighted the added risk inherent in having to cross busy shipping lanes when entering from this channel. To address this issue, it has been recommended, on safety grounds, that alternative routes are developed which remove the double-crossing situation that exists at the lower end of the Knock John Channel and Black Deep at its confluence with Fisherman's Gat.

2.2 The Dredging Operation

Phase II of the Princes Channel Development will develop part of Princes Channel to provide a 300m channel with maintenance dredging zones of 75m to either side (see Figure 3). The maintenance dredging zones will facilitate maintenance requirements by providing uninterrupted passage to ships. Approximately 2.5Mm^3 of predominantly fine sand will be dredged. An environmental assessment of the dredging operation has been undertaken and is reported separately.

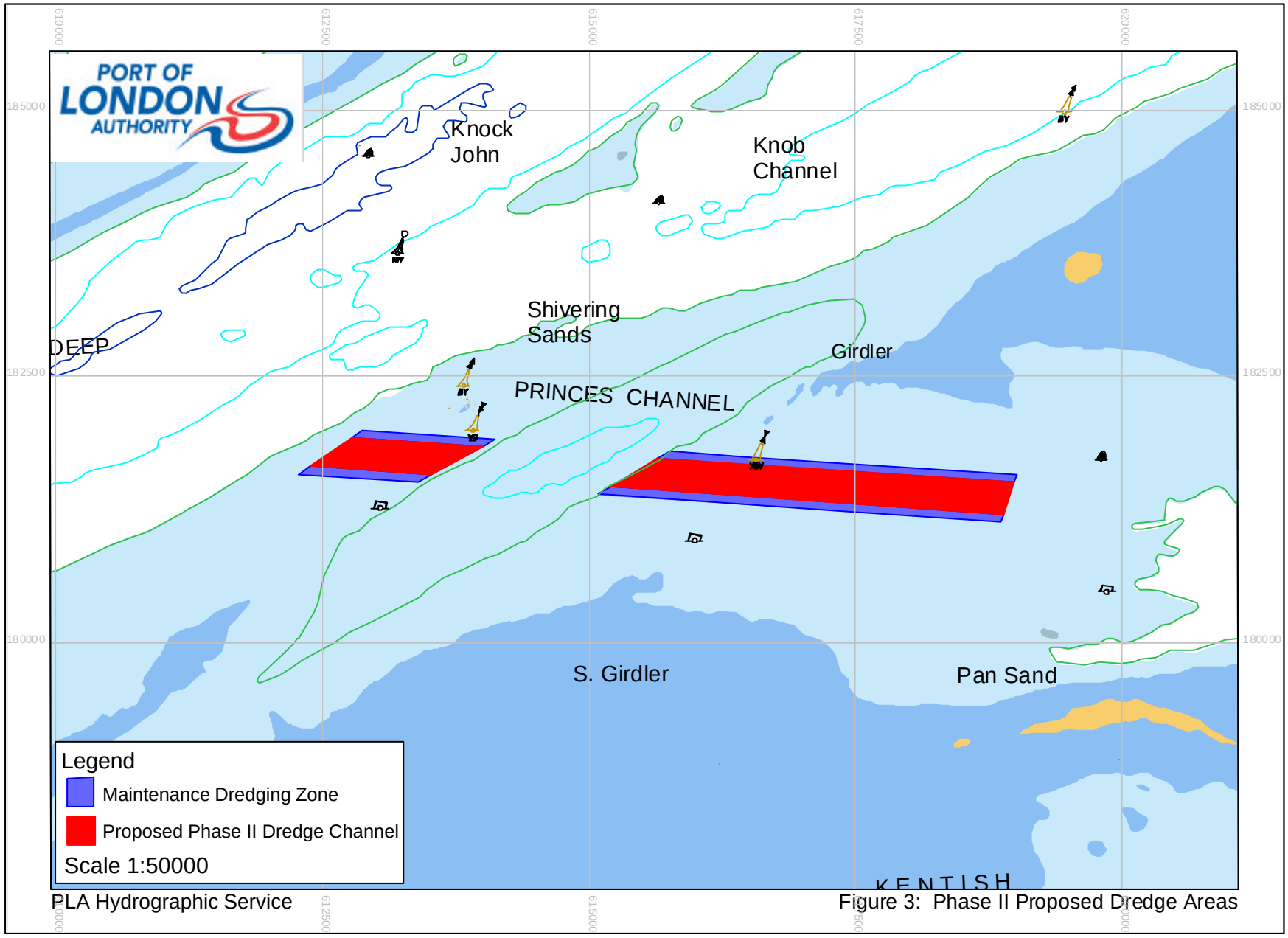

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Figure 3: Phase II Proposed Dredge Areas

2.2.1 Material Composition

A vibrocore survey has been undertaken to provide information on the composition of the seabed in the Phase II dredge area. Figure 4 shows the average particle size distribution in one metre slices to –8.00mCD and for the slice between –8.00 and –10.00mCD. A summary of the composition is provided in Table 1.

Table 1 Summary of Dredged Material Composition

MATERIAL TYPE	APPROXIMATE QUANTITIES (M^3)		
	-6m to –7mCD	-7m to –8mCD	-8m to –10mCD
Clay (stiff)	0	0	350,000
Silts and weak clays	97,500	272,000	1,100,000
Sand	526,500	1,292,000	4,176,000
Gravel	26,000	136,000	174,000
Total	650,000	1,700,000	5,800,000

From Table 1 it can be seen that the total quantity of material in the vibrocore survey area amounts to some 8.15 Mm^3 at -10mCD depth and comprises a silty fine sand inter-bedded with thin layers of soft sandy clays with bands of fine sand. When dredged, a large proportion of the silts and weak clays will be winnowed out, leaving a predominantly fine sand with a modest gravel content. Some bands of stiff clays are encountered in the eastern end of the Girdler area of the Channel but are found at depths of below –8.00mCD.

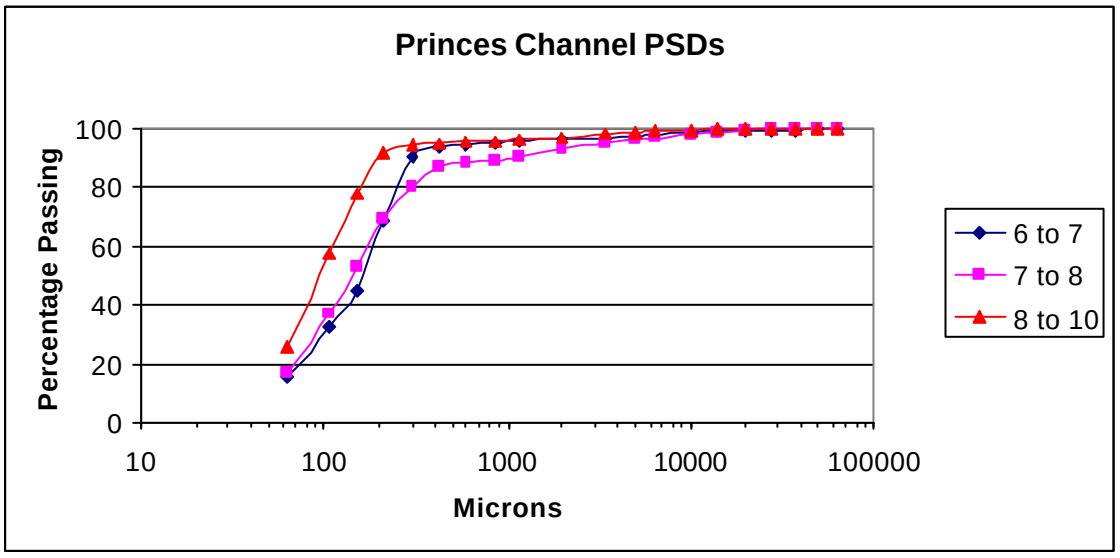

Figure 4 Composition of Seabed Sediment

2.3 Beneficial Use of Dredged Material

The PLA is committed to using dredged material beneficially where possible, in accordance with Government guidance and International requirements, including the London Convention and OSPAR. Investigations are ongoing to identify uses for dredged material from Phase II and all potential uses will be considered, including construction projects, habitat creation, coastal defences and recycling within the estuary system. Offshore disposal at a licensed marine disposal site, e.g. South Falls will be considered a last resort and only when beneficial use is not available, or for material that is physically unsuitable for beneficial use.

The PLA requests that the investigation it has undertaken into beneficial use options should be considered as an alternative in the consideration of the fate of the dredged material. The PLA's current understanding of beneficial use projects is summarised in Table 2.

Table 2 Status of Beneficial Use Projects

BENEFICIAL USE TYPE	PRESENT STATUS
Construction Projects	A number of projects requiring general infill material exist in the vicinity of the Thames Estuary. These are expected to commence in early 2005.
Habitat Creation	Wallasea Island requires a large quantity of dredged material for creation of saltmarsh but the timescale may be beyond the PLA's 2006 deadline. The PLA is in contact with English Nature Conservation Officers for Kent and Essex and the RSPB but no requirements have been identified to date.
Flood Defence	The PLA is in discussion with the EA about the use of dredged material for projects identified in the CHaMPs process. However there are no projects identified to date and the future developments are uncertain.
Other Opportunities	Possible uses for Interreg projects run by Estuary Partnerships but the Thames is not in the project area. Liaison is ongoing.
Beach Replenishment	Beaches in the area are replenished using shingle and the fine sand from Princes Channel is not considered an appropriate beach material.

In recognition of the difficulties associated with aligning the timescale of two or more developments, the PLA is proposing the designation of a sand placement site in the outer Thames Estuary. Sediment would be retained within the sedimentary system by relocating the sand from the western part of Princes Channel to a local area in deeper waters. This proposal is described in detail in Section 2.4.

2.4 Dredged Material Placement

There is a possibility that beneficial use may not be found in the relevant timescale (see Section 2.5) or that some of the dredged material may not be suitable for beneficial use. Should these circumstances occur, then an alternative solution will be required. Ideally, this alternative should permit the dredged material to be put in the same sedimentary cell that contains the channel. Princes Channel is part of the complex area of channels and banks over which water flows when it is leaving or entering the Thames Estuary from the East and South. It is well known that these channels (Princes, Fishermen's Gat, the Edinburghs etc.) change depth fairly regularly, as do the sand banks that separate and surround them (D'Olier, 1998). The seabed in this area is, thus, known to be mobile. Opportunities therefore exist to relocate dredged material to suitable zones in this area, where the material can then be re-cycled within the sedimentary system.

2.4.1 Consideration of Alternatives

A number of potential sand relocation areas were considered and one was selected as the preferred area. Figure 5 shows these areas. The preferred option is located in the North Edinburgh Channel. In addition the option of using the existing disposal site at South Falls has been considered.

Alternative Sites in the Thames Estuary

Five alternative areas and two different deposition methods (bottom placement and thin layer spreading) were considered as shown in Figure 5. These areas were initially selected based on hydrodynamic parameters and water depths. The hydrodynamic parameters included the current velocities and direction and, due to the aim of entraining the sediment within the system, areas with low current velocities were excluded. The main current direction in the outer Thames Estuary is east-west as shown by the orientation of the sandbanks. The interaction of both North Sea and English Channel currents provides complexity and channels across the sandbanks are caused by the differentials in water depths to either side of the banks (pers. comm. Brian D'Olier, 2004).

The Thames Estuary hosts the largest cockle fishery in the UK and the extensive intertidal mud and sand banks provide the cockle habitat. Shellfish beds are also found on sandbanks in the outer estuary. It is widely accepted that shellfish are particularly sensitive to sedimentation thus shallow sandbanks were ruled out of the consideration of sand placement sites. The edges of these sandbanks are, however, subject to frequent and large movements of sand and these areas and the adjacent channels were considered further.

Commercial fishing is an important economic activity in the Thames Estuary with trawling occurring in some of the channels and drift-netting on some banks. Extensive studies of the commercial fishery were undertaken for the London Gateway Port Development and a baseline understanding of the fisheries was prepared by MacAlister Elliot and Partners Ltd.

Navigation requirements for minimum channel depths influenced the selection of only those areas with depths of >10m at low water.

Options 5, 6, 7 and 8 were quickly discounted due to the relative importance of these areas for fishing and the proximity to the proposed London Gateway dredging areas (and hence the inherent potential for cumulative effects). Options 2 and 3 were discounted during discussions with the fishing industry as being important fishing grounds for vessels from Whitstable and nearby ports. Following a meeting and discussions with representatives of Kent and Essex Sea Fisheries Committee (KESFC) and local fishing associations, a preferred option was selected by the fishing industry. This option is the North Edinburgh Channel (Option 4, see Figure 5). The fishing industry representatives also confirmed that no fishing activity occurs in Princes Channel East (Option 1) but that the adjacent banks are fished.

Given the above, the PLA has taken the advice of the fishing industry and selected the North Edinburgh Channel as its preferred option, subject to the findings of the environmental characterisation. Princes Channel East is considered potentially viable but will not be pursued further at this stage.

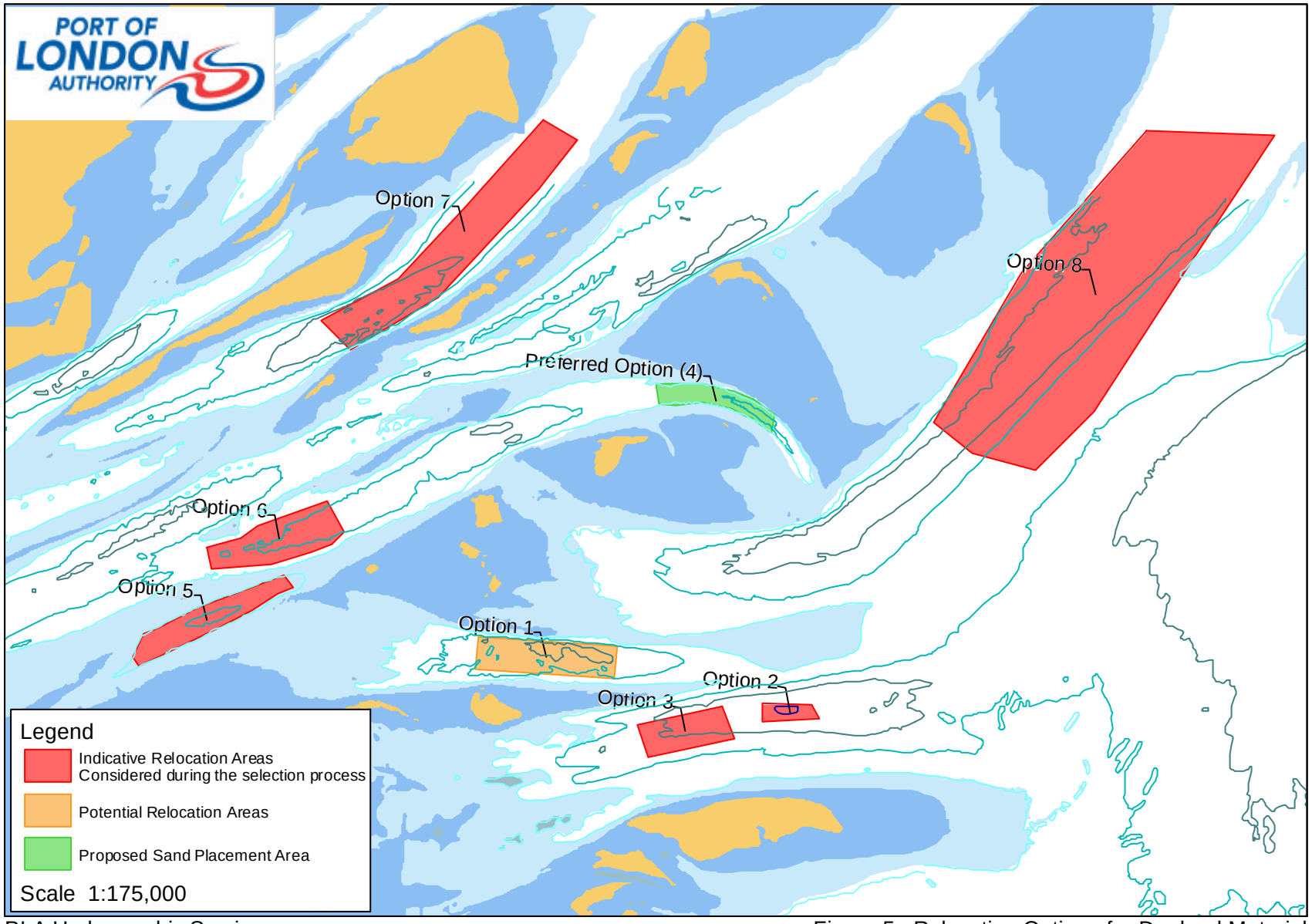

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Figure 5: Relocation Options for Dredged Material

South Falls Disposal Site

The nearest licensed marine disposal site to the Thames Estuary is South Falls off North Foreland. South Falls is approximately 55km from Princes Channel. The site is used for both maintenance and capital dredged material predominantly from the Medway Estuary but with occasional use by operators in the Thames Estuary. Currently the site has 1 active licence permitting a total quantity of 280,000 tonnes.

The advantage of using South Falls is that it is an already impacted area and would prevent the need for another area of seabed to be potentially adversely impacted. However, the great distance from the dredge site to South Falls places a significantly increased cost on the development (approximately 50%). The PLA's proposal is to place sand at a location where there are presently large movements of sand and to essentially blend the placement operation in with those natural processes. Section 7 presents data that shows the lack of stable biological habitats in the placement site due to the sand movements and compares the effect on marine biology and natural fisheries of the placement operation at North Edinburgh with the effects of a similar operation at South Falls.

It is, however, anticipated that a small amount of clay will be encountered during the dredging process, for example in a pocket at the eastern end of the dredge area. This material (<50,000m^3) would be unsuitable for placement at a dispersive sand site and, subject to obtaining the appropriate consent, would be transported to South Falls.

Placement Methodology

Two types of potential placement options were considered: bottom placement and thin layer spreading. Bottom-placement involves the release of dredged material from a hopper at an identified location and can be carried out in a number of ways, for example, whole hopper loads infilling a grid system or discharge spread over the disposal area by the dredger steaming through the site. Dredged material can also be placed just above the seabed by discharge via the dredge pipe. Dispersion of dredged material would be by both bedload movement and entrainment by tidal currents.

Thin-layer spreading would comprise the discharge of dredged material at the water surface or into the shallow water layers. The dredged material would then be distributed by the hydrodynamic processes operating in this part of the water column. Material dispersed by this route may travel further and wider than material placed near the seabed. As a result there is a greater potential for sedimentation occurring on the sensitive sandbanks and in the frequently fished channels.

Following discussion with the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), the method of thin layer spreading (dispersion of dredged material into the water column to form a thin layer on the seabed) was discounted due to the difficulties in demonstrating the effects of such a technique. CEFAS advised that, without prejudice to the outcome of an environmental characterisation, there is an

advantage in confining impacts because monitoring can be carried out to show the effects.

A form of bottom placement has been selected as the appropriate placement methodology. Further to the initial environmental considerations, the environmental characterisation has considered the effects of this methodology on the various environmental features in the study area.

2.4.2 North Edinburgh Channel Placement Site

The North Edinburgh Channel is the preferred option for the PLA due to its relative proximity to the dredged area and the advice from the fishing industry that the area is not heavily fished. In addition, the existing dynamic nature of the channel and its adjacent sandbanks support the concept of recycling the dredged material within the sedimentary cell.

The dredging will be carried out using a trailer suction hopper dredger (TSHD) and placement at the relocation area would be by bottom dumping in a grid system. The material would be placed in such a way to ensure that the majority of the hopper load travelled directly to the seabed and did not become entrained in the ambient currents. Loads would be of the order of 3,000 to 5,000 m^3 per cycle initially, but could be increased in size if the dredger capacity was increased once the depths at the dredging site allowed. The loads would be placed accurately using GPS to ensure that a notional –10.00m CD channel depth was not infringed at any time.

Although the PLA hopes to find beneficial use for the majority of the dredged material there is a possibility that no such use will arise in the timescale. With this in mind, the environmental characterisation and assessment of the North Edinburgh placement site is based on it receiving the total quantity for Phase II of up to 2.5Mm^3 (with the exception of 50,000m^3 of cohesive clay).

An assessment of the site's capacity to receive periodic maintenance dredging has also been undertaken and is reported in Section 2.4.3 and Section 17.

2.4.3 Maintenance Dredging Requirements

Bathymetric monitoring along a series of survey lines has been carried out over the 12 months since the Phase I dredge of Princes Channel. The monitoring indicates that, due to the lack of accretion in the ten months since the Phase I dredge, maintenance dredging requirements will be low (PLA, 2004). However, given the dynamic nature of the area it would be appropriate to plan for such a low level maintenance dredging campaign (i.e. 100,000m^3) once every five years.

2.5 Programme

It is important that the PLA meets the recommendation for improving the safety of navigation in the southern approaches in as short a timescale as possible. However, given the current traffic levels and the high quality of vessel traffic management exercised by the PLA, the requirement is not yet essential, although it is becoming increasingly urgent. The PLA would wish to complete the development of Princes Channel, from a navigation point of view, within the next two and a half years e.g. by the end of 2006. Should this not prove feasible and dredging has to continue beyond this period, close liaison will be maintained with the developers of London Gateway in order to co-ordinate dredging operations, and thus avoid potential conflict and possible in-combination effects.

This programme provides for the commitment of the PLA to identify beneficial use for as much as possible of the material from the Phase II dredge. The PLA has been in discussion with those involved in potential beneficial use projects and has based the programme on their advice, within the constraints of the overall timescale. Consideration has also been given to other projects that are likely to commence within the project timescale and these issues are discussed in Section 16.