Falmouth Cruise Project

Environmental Statement: Non-Technical Summary

Falmouth Harbour Commissioners and
Falmouth Docks & Engineering Company

29 October 2008

Final Report

9S4181

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Document title	Falmouth Cruise Project Environmental Statement: Non-Technical Summary
Status	Final Report
Date	29 October 2008
Project name	Falmouth Cruise project
Project number	9S4181
Client	Falmouth Harbour Commissioners and Falmouth Docks & Engineering Company
Reference	9S4181/R/303346/Exet

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1 INTRODUCTION

1.1 Falmouth Cruise Project

Falmouth Harbour Commissioners (FHC) and Falmouth Docks & Engineering Co. (FDEC) are proposing to undertake a joint project to improve the cruise facilities and navigation at Falmouth, Cornwall. The project's purpose is to facilitate sustained long-term growth of the cruise business operating out of Falmouth Docks. Since the general trend in shipping is to build and operate larger cruise vessels, the long-term success of the cruise business at the Port of Falmouth is linked to FDEC's ability to accommodate visits by these vessels in terms of navigation, berthing and passenger handling.

The proposed Falmouth Cruise Project comprises:

- a deeper and straighter navigation channel from Carrick Roads / The Narrows to the Queens and Northern Wharves, including a deep water berth for cruise vessels along the combined length of the Queens and Northern Wharves, and seabed habitat mitigation in the eastern navigation channel;
- a longer cruise quay combining the Queens and Northern Wharves;
- a new cruise terminal building; and
- a range of infrastructure improvements around docks estate.

1.2 Statement of Need

The cruise industry and its associated ports of call are driven by passenger demand to visit interesting areas and day attractions in the form of shore tours. Tours are an important factor in the choice of ports of call because they are highly profitable for cruise operators and a key selling point for the cruise (Arup, 2008). Falmouth and its surrounding area are able to offer some particularly popular shore tours and hence the potential growth in cruise business at this port.

Cruise business at Falmouth is growing and increasingly forms an important part of FDEC's commercial activity and contributes to FHC's harbour dues. However, the size of vessels that can be berthed at the Docks is restricted by the depths of the channel and berths and the length of quay available. At present, only vessels up to 230m in length can use the Docks due to the restrictions of length along the County Wharf and Queen's Wharf. The available depth of water varies with the tidal cycle. In practise the maximum draught of vessels which can visit the Docks is 8m, this being restricted by the depth of water on the County Wharf. The times at which larger vessels can get into and out of the Docks is restricted by the depth of water within the navigation channel.

Therefore, FHC and FDEC wish to improve the cruise terminal facilities in order to be able to attract a greater range of cruise vessels to Falmouth. By being able to attract a greater range of vessels, this will help secure the long-term business of FDEC and the employment which is directly and indirectly related to the Docks, including those employed by FHC.

In order to be able to attract a greater range of cruise vessels, the cruise terminal facilities require improvement. In particular, a dedicated building is required which can handle passengers and house administrative staff. The Queens and Northern Wharves require improvement in order to increase the length of quayside available for the berthing of larger cruise vessels of lengths in the order of 340m.

In order for larger cruise vessels to be able to access the Docks, the navigation channel requires deepening. By deepening the channel and berths, cruise vessels will be able to access the Docks at a greater range of times and so the Docks will be more attractive to vessel operators as a cruise terminal. Cruise vessels typically like to enter port early in the day and leave in the early evening. By deepening the channel, larger vessels will be able to enter the Docks at this time on a greater number of days.

The channel requires straightening in order to improve the safety of navigation. The existing navigation channel is designed to provide vessels with safe access to FDEC's Docks Basin, but not the wharves. At present, accessing the wharves requires vessels to be lined up for the Docks Basin approach and then manoeuvred northwards around the wharves and vessels moored against them. Realigning of vessels' tracks to northwards requires course alterations and a period of settling onto the new track. This adds unwelcome complexity to the manoeuvre and reduces the margins of safety for larger vessels. The safe handling of large vessels with minimum margins for diverging from the intended track requires a track as straight as possible so that the vessel can be lined up on the intended track and maintained and effectively monitored in safe water throughout the passage.

Increasing the number and size of vessels visiting Falmouth Docks will have additional major benefits for the local economy by increasing the total amount of income that cruise passengers, crew and others associated with cruise vessels will spend in the local area while in port.

1.3 Requirement for Environment Impact Assessment

1.3.1 Regulatory Approvals

The following paragraphs describe the legislation applying to the proposed Falmouth Cruise Project. These paragraphs do not constitute legal advice and are provided to describe the legislative context of the EIA process and other environmental protection mechanisms applying to the proposals.

Both FDEC and FHC have various permissive powers granted to them under the Falmouth Docks Act 1959 and the Falmouth Harbour Revision Order 1991 respectively. These powers entitle them to effectively self-regulate the activities included under their respective Acts. Nevertheless, the proposed Falmouth Cruise Project will require a number of consents prior to construction and operation.

It is anticipated that the following marine works consents will be required:

- Marine & Fisheries Agency (MFA) consent (i.e. Board of Trade consent) for FHC to undertake dredging in the FHC's harbour jurisdiction by virtue of section 10 of the Falmouth Harbour Act 1870;
- MFA consent (i.e. Ministerial approval) for FDEC to deposit dredged material below MHWS by virtue of section 26 of the Falmouth Docks Act 1959 and at least arguably (based upon dredging being a "work" and section 10 of the Falmouth Docks Act 1959 therefore applies to it) also for the dredging itself;

- consent for FDEC and FHC to undertake dredging under section 34 of the Coast Protection Act 1949 insofar as reliance cannot be placed on FDEC's and FHC's powers; and
- licences to deposit materials on the seabed under Part II Food & Environment Protection Act 1985, including:
  - disposal of dredged material at sea (to the Fal Bay disposal site);
  - disposal of dredged material at sea for seabed habitat mitigation in the new navigation channel; and
  - marine construction works for wharf structures.

In addition, FDEC will require FHC's consent to deposit dredged material (for mitigation) in FHC's jurisdiction by virtue of Section 26 of the Falmouth Docks Act 1959.

Planning permission may be required for the landside works, including the cruise terminal building and infrastructure improvements around the docks estate, in accordance with the Town & Country Planning Act 1990, subject to a determination of FDEC's permitted development rights under the Town & Country Planning (General Permitted Development) Order 1995.

1.3.2 EIA Requirements

EIA will be required to support FDEC's and FHC's applications for marine works consents required under the Food & Environment Protection Act 1985 and the Coast Protection Act 1949, and planning approval if required under the Town & Country Planning Act 1989 or if permitted development is disapplied by the Town & Country Planning (General Permitted Development) Order 1995. The requirement for EIA is established by European Directive 85/33/EEC as amended by 97/11/EC on the assessment of the effects of certain public and private projects on the environment (hereafter referred to as the EIA Directive). The EIA Directive is implemented through national law, some of which is applicable to the proposed Falmouth Cruise Project.

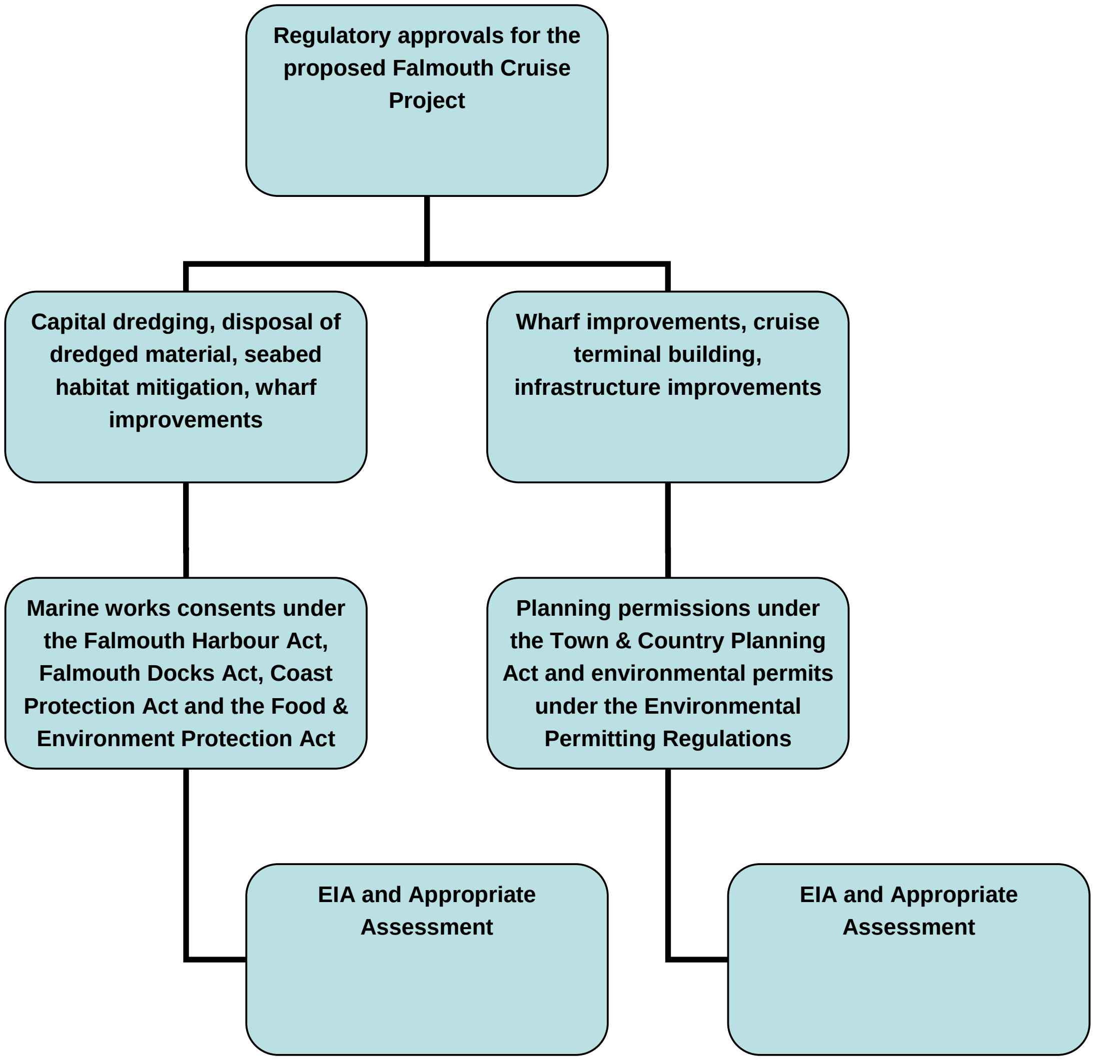
1.3.3 Appropriate Assessment

The proposed project will take place within the Fal and Helford Special Area of Conservation (SAC). In light of this, Natural England have advised that the proposed Falmouth Cruise Project is likely to have a 'significant effect' on the SAC – a Natura 2000 European Site - and, therefore, have advised that appropriate assessment is required in accordance with the Habitats Directive as implemented through the Conservation (Natural Habitats &c.) Regulations 1994. Accordingly, before the proposed Falmouth Cruise Project can be given any consent or approval, a competent authority must make an appropriate assessment of the project's implications for the SAC in view of the SAC's conservation objectives.

1.3.4 Environmental Permits

The proposed project includes for various uses of treated contaminated dredged material for infrastructure improvements within Falmouth Docks. The uses can be exempted from the normal requirements associated with waste disposal in accordance with the options set in Schedule 3 to the Environmental Permitting Regulations 2007. In the context of the proposed project, environmental permits will have to be obtained from the Environment Agency.

Figure 1-1 Summary of Regulatory Approvals and Environmental Requirements



1.4 The Environmental Impact Assessment Process

EIA is a process for assessing and taking account of potential environmental impacts associated with development as part of the approvals processes related to the legislation relevant to the project.

1.4.1 Screening

Screening is the process by which it is determined whether or not a proposed development requires EIA. Under the EIA Directive (and its application through UK law), EIA is mandatory for the types of development listed under Annex I and discretionary for the types of development listed under Annex II. A project proponent may request a formal screening opinion or direction from a competent authority, or may voluntarily decide that EIA applies.

In the case of the Falmouth Cruise Project, FHC decided voluntarily that EIA will be required because the proposals fall under Annex 1, Part 8b of the EIA Directive which identifies the following type of development: 'Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1350 tonnes'. Since EIA is mandatory for development listed under Annex I of the EIA Directive, FHC did not seek a formal screening opinion or direction from a competent authority.

1.4.2 Scoping

Scoping is the process by which the issues to be addressed during the EIA and presented in the environmental statement (ES) are identified. A project proponent may request a formal scoping opinion or direction from a competent authority.

In the case of the Falmouth Cruise Project, FHC commissioned Royal Haskoning to undertake an environmental scoping study. The scoping study comprised a series of tasks to identify the potential environmental issues associated with the proposed project to determine the scope of work required for the preparation of the ES. The report of the scoping study was submitted to the MFA (in their former guise as the MCEU) as part of a request for a scoping opinion made in February 2006. The MFA subsequently replied confirming that they were content with the proposed scope of the EIA, albeit by email (dated 16 May 2006).

1.4.3 Preparation of the Environmental Statement

A range of potential impacts have been identified for the construction and operation phases of the proposed Falmouth Cruise Project. For each of the impacts identified, an assessment has been made of the change to baseline conditions to predict their environmental significance.

Where potentially significant adverse impacts have been identified, mitigating measures have been examined and recommended in order to reduce residual impacts, as far as possible, to environmentally acceptable levels. Resdiual impacts have been identified on the basis of successful implementation of mitigating measures.

The preparation of the ES was undertaken and managed by Royal Haskoning. Additional work to inform the preparation of the ES was undertaken by Bircham Dyson Bell (consents and approvals), HR Wallingford (dredging assessment, computational modelling and assessment of the hydrodynamic and sedimentary regime), Mojo Maritime Ltd (sediment quality and marine ecology - vibrocores survey), Macaulay Analytical Services (sediment quality – physcial and chemical analyses), CEFAS (sediment quality – biological and bioassay analyses), SeaStar Survey Ltd (marine ecological survey), Cornwall Environmental Consultants (landscape and visual impact assessment), and Cornwall Historic Environment Service (archaeological assessment).

2 PROJECT DESCRIPTION

2.1 Introduction

2.1.1 Design Vessel

A design vessel has been used to inform the proposals: the MS Freedom of the Seas. This was the largest cruise vessel in operation at the time of its launch, but newer vessels are bigger and continuing to grow. Its dimensions and operational requirements are accounted for by the proposed Falmouth Cruise Project, including the navigation simulations and conceptual designs for the channel and berthing area. The key features of the ship are described in Table 2-1.

Table 2-1 Key Features of the Design Vessel

Gross tonnage (t)	154,407
Length overall (m)	338.77
Beam (m)	39.03
Draught (m)	8.80
Height (m)	63.7
Decks	15
Berths	4,375
Cabins	1,817
Passengers	4,375
Crew	1,360
Owner / operator	Royal Caribbean
Maiden voyage	2006

2.2 Falmouth Cruise Project

2.2.1 Navigation Channel

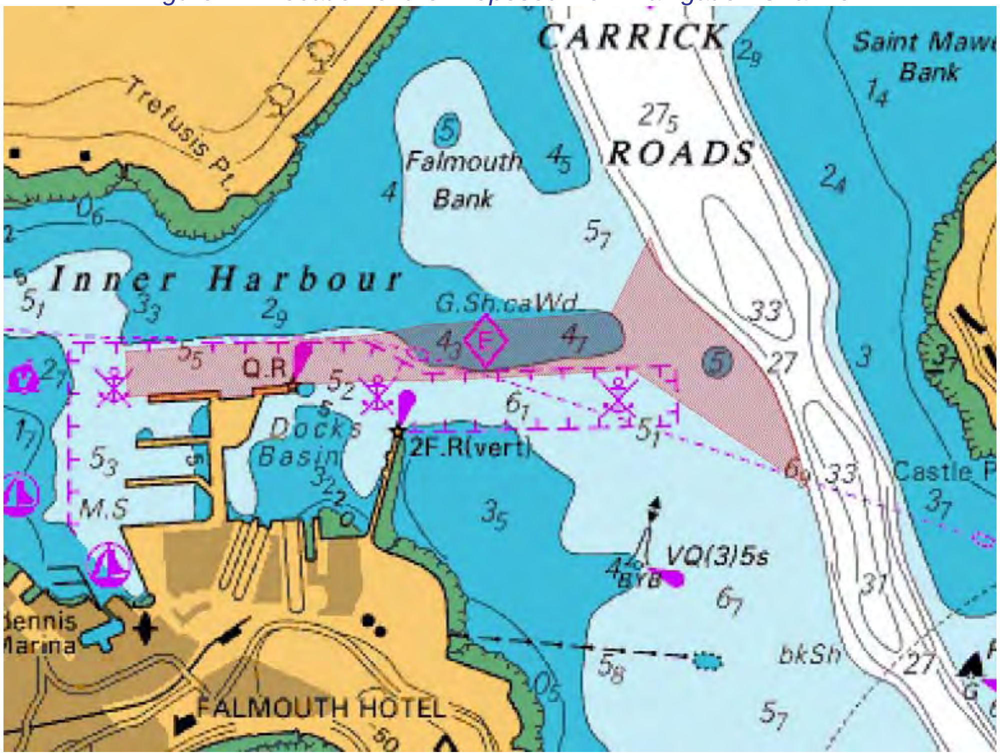
A new navigation channel is proposed to accommodate safe navigation of cruise vessels. The channel location is shown in Figure 2-1. The conceptual channel design is principally based on guidance by PIANC (1997) and Thoresen (2003) (see Royal Haskoning, 2008). The channel dimensions allow for:

- a declared depth of -8.3mCD in the main channel;
- a turning area for vessel manoeuvres of 540m, which is equivalent to 1.6 times the maximum design vessel length (i.e. minimum recommended diameter);
- a channel width of 155m for the eastern part of the proposed channel aligned east-west from Carrick Roads / The Narrows to the Eastern Breakwater; and
- a channel width of 125m for the western part of the proposed channel aligned east-west from the Eastern Breakwater to the Queens and Northern Wharves.

2.2.2 Deep Water Berth

The proposed conceptual channel design includes a deep water berthing pocket alongside the combined length of the Queens and Northern Wharves. The berthing pocket will be deepened and lengthened the berth along its proposed lateral dimensions (510m by 50m) to accommodate berthed cruise vessels on all states of the tide. Based on the design vessel, the new berthing pocket will have a declared depth of -9.5mCD.

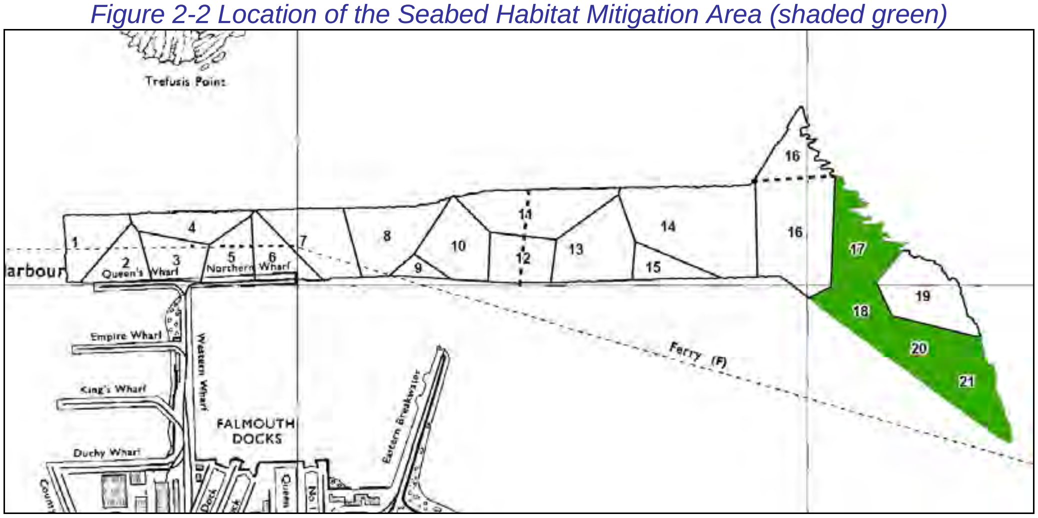
Figure 2-1 Location of the Proposed New Navigation Channel



2.2.3 Seabed Habitat Mitigation

In order to offset the potential loss of seabed habitat, it is proposed that an area of seabed within the eastern part of the navigation channel be dredged to a depth of approximately one metre more than the declared depth in order to remove non-maerl substrate, and then be filled with maerl substrate. The area for seabed habitat mitigation is highlighted as the green areas on Figure 2-2. For the purposes of nature conservation, the maerl substrate is of more habitat value than the substrate it replaces and contributes to offsetting the potential impacts associated with capital dredging.

Figure 2-2 Location of the Seabed Habitat Mitigation Area (shaded green)



2.2.4 Disposal of Contaminated Dredged Material

Contaminated dredged material (c.100,000m^3) is to be treated to reduce its water content and possibly to improve its physcial characteristics to the extent that it can be used as a construction material for the proposed docks infrastructure improvements, with the excess to be taken off site and disposed of to landfill, unless other uses become available.

2.2.5 Disposal of Clean Dredged Material

Clean dredged material (c.600,000m^3) is to be deposited at sea at the Falmouth Bay disposal site. It may be possible use the maerl substrate within the dredged material as a soil improver, which would offset the need to dispose of (some of) it at sea.

2.2.6 Cruise Quay

A dedicated cruise quay of some 430m in length is to be provided by combining the lengths of the Queens and Northern Wharves. The majority of the Queens Wharf already comprises an open piled structure that is in good condition (see Figure 2-3), having been re-constructed in 2003 following fire damage. However, to provide a continuous quay capable of supporting cruise operations, it is necessary to:

- construct new quay infrastructure to connect the Queens Wharf and Northern Wharf (see Figure 2-4, left); and
- improve the condition of the existing Northern Wharf's infrastructure, which is 55 years old and currently comprises a combination of mass concentre and timber piled structures, which are in poor condition (see Figure 2-4, right)).

Figure 2-3 Location of the Cruise Quay and Infrastructure Improvement Works

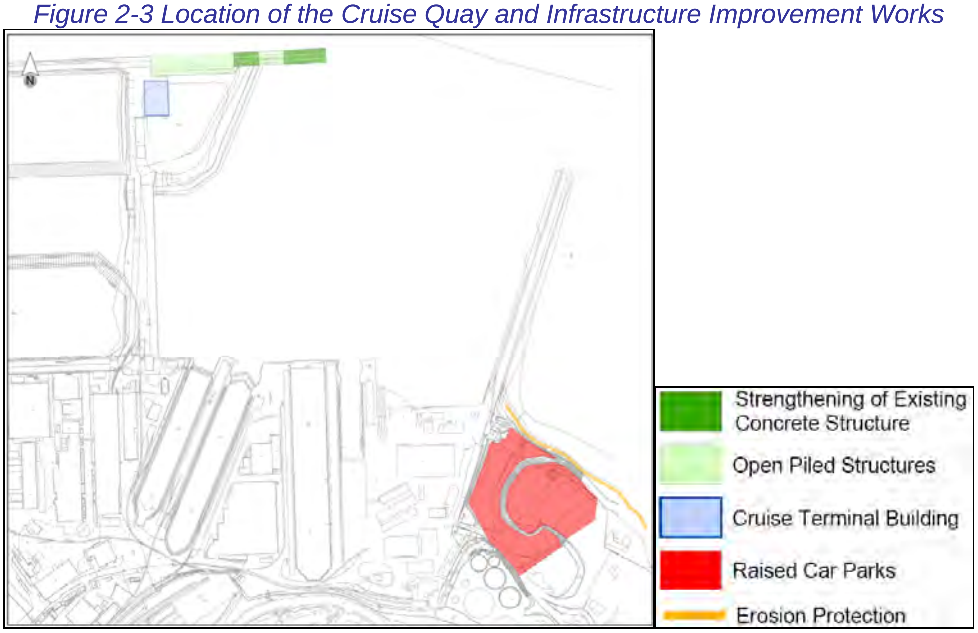


Figure 2-4 Existing Area between the Northern Wharf and Queens Wharf (left) and the Existing Northern Wharf (right)

2.2.7 Cruise Terminal Building

The new cruise terminal building is to be situated on the reclaimed land near the Queens and Northern Wharves. The building's conceptual architectural design is illustrated in Figure 2-5. It comprises a steel framed super-structure standing on concrete foundations and enveloped by a combination of clad, rendered and panelled walls, aluminium framed doors and windows, and a standard seam roof.

The building's ground floor is dedicated to the handling of cruise passengers and incorporates three areas including a large multi-purpose area, a passenger reception area and a facilities area with toilets, a store room and a central stair well to the floors above. The ground floor has a footprint of approximately 510m^2. A further three floors are situated above the facilities area. The first and second floors comprise offices, and the third floor comprises a port operations office.

Figure 2-5 Cruise Terminal Building's Architectural Design (source: CSA Archtitects)

2.2.8 Ground Improvement for Car Parking in the Eastern Part of the Docks Estate

The proposals include for construction to improve two existing car parking areas in the eastern part of the docks estate (see Figure 2-3). One area is the land area that surrounds the landward edge of an existing waste disposal tip (area = c.0.75ha) and currently provides car parking for turnaround cruise passenger vehicles and for the

Falmouth Marine Skills Centre (see Figure 2-6). This area will be raised by c.2m to reduce flood risk and levelled to prevent ponding of surface water.

Figure 2-6 Existing Car Parking Area in the Eastern Docks

The other area is the land area on top of an existing waste disposal tip (area = c.0.65ha). This area will be raised by c.1m to provide a cap to the top of the waste disposal tip and levelled to prevent ponding of surface water.

2.2.9 Coastal Erosion Protection for the Waste Disposal Tip in the Eastern Part of the Docks Estate

The existing waste disposal tip in the eastern part of the docks estate is subject to erosion on its seaward face to the extent that its contents appear to be exposed and potentially slumping onto the foreshore (see Figure 2-7). To arrest the erosion, it is proposed to re-grade the seaward face to reduce the slope angle, and to protect it with fill material and rock armour. The proposed work will extend east as far as the existing rock armoured structure built by South West Water in the 1990s.

Figure 2-7 Coastal Erosion along the Existing Waste Tip in the Eastern Docks

2.3 Description of the Construction Phase

2.3.1 Capital Dredging

Capital dredging will be undertaken to create the proposed navigation channel and deep water cruise berth as described in Sections 2.2.1 and 2.2.2, and to replace seabed habitat as described in Section 2.2.3.

Backhoe dredgers and barges (see Figure 2-8) will be used for the capital dredging of the proposed Falmouth Cruise Project because they offer a degree of technical capability and flexibility, and an environmental performance, that cannot be offered by other dredging methods for dredging a combination of contaminated sediment, clean sediment and weathered bedrock, and for undertaking the seabed habitat mitgation (see Dredging Research, 2008). Capital dredging is estimated to last approximately 26 weeks when based on two backhoe dredgers supported by barges.

Figure 2-8 Backhoe Dredgers and Barges (source: Van Oord and Boskalis Westminster Dredging)

2.3.2 Treatment of Contaminated Dredged Material

The treatment plant (see Figure 2-9) will be brought to the docks by road on low-loaders or by sea aboard barges. The treatment plant will be set up on the reclaimed land area behind the Northern Wharf. If necessary, temporary buildings will be erected to cover the material while it is being stored.

Figure 2-9 Indicative Layout of a Treatment Facility (source: Boskalis Westminster Dredging)

After dredging, the contaminated dredged material will be left overnight in a barge. During this time, the solid material will settle leaving some of the liquid to be pumped out to an appropriately licensed mobile water treatment plant. The dredged material will be transferred from the barge onto the reclaimed land behind the Northern Wharf using a long-reach excavator with a bucket or clamshell grab.

The contaminated dredged material will be screened to remove extraneous material unsuitable for treatment (e.g. debris). After screening, the material will be dewatered by either centrifuging (i.e. spinning) or mechanical pressing (i.e. squeezing). Dewatering will reduce the dredged material's moisture content and consolidate it to facilitate handling and reduce the volume for any subsequent treatment and disposal.

If tests show that centrifuging or pressing will not be sufficiently effective, then a solidification/stabilisation agent such as hydrated lime or cement may need to be added. This mixture can have the additional benefits of physically encapsulating (i.e. by solidification) and chemically immobilising (i.e. by stabilisation) the contaminants within the resulting solid mass of treated dedged material.

Plant mobilisation and set up, pre-treatment and treatment, and plant removal and demobilisation will take place over approximately 30 weeks, with most of this time (c.25 weeks) being dedicated to treatment.

2.3.3 Disposal of Contaminated Dredged Material: Ground Improvement for Car Parking in the Eastern Part of the Docks Estate

The treated contaminated dredged material will be used for ground improvement works over two existing car parking areas within the eastern part of the docks estate. The areas are used for car parking by turnaround cruise passenger vehicles.

Approximately 17,000m^3 of treated dredged material will be required for the two ground improvements in the eastern part of the docks estate. The material will be transported from the treatment site (on the reclaimed land next to the Northern Wharf) by dump trucks.

Construction consists of raising existing ground levels in these areas using treated dredged material. Construction includes placement of the material in layers and distributing it with a bull-dozer and compacting it with a roller. Ground levels will be raised by up to 2m around the existing waste tip and by approximately 1m at across the top of the existing waste tip. The total construction programme for ground improvement works for two car parking areas in the eastern part of the docks estate is estimated to take five weeks.

2.3.4 Disposal of Contaminated Dredged Material: Coastal Erosion Protection for the Waste Disposal Tip in the Eastern Part of the Docks Estate

Approximately 2,000m^3 of the treated dredged material will be used as fill material as part of the proposed coastal erosion protection for the seaward face of the existing waste disposal tip in the eastern part of the docks estate. Approximately 3,700m^3 of rock will be required for armouring the new slope. The dredged material will be transported from the treatment site (on the reclaimed land next to the Northern Wharf) by dump trucks. The rock will be transported from an ffsite location either by trucks or by sea (i.e. barge).

Construction consists of re-grading the seaward face by re-profiling some of the tip's contents and placing treated dredged material to create a stable slope. The slope would be re-profiled by an excavator. Rock armour would be placed over the re-graded slope using an excavator. The total construction programme for coastal erosion protection works in the eastern part of the docks estate is estimated to take 3.5 months.

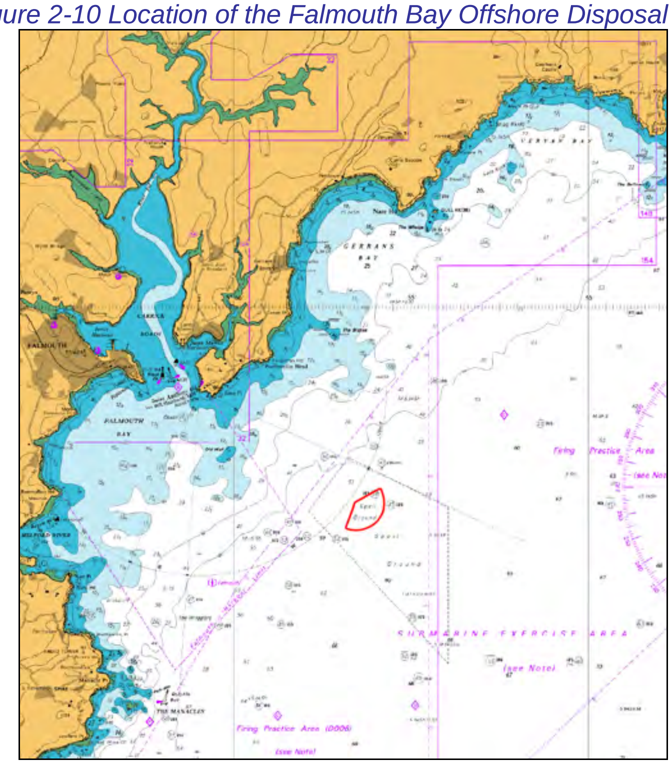
2.3.5 Disposal of Contaminated Dredged Material: Disposal Off Site

Assuming the ground improvement and coastal erosion protection works require 17,000m^3 and 2,000m^3 of the treated dredged material respectively, the remainder (approximately 61,000m^3) will need to be taken off site and used elsewhere and/or disposed of at a landfill site(s). Transport of the excess material off site is estimated to take place over the duration of the treatment of the contaminated dredged material, and will therefore extend over 30 weeks.

2.3.6 Disposal of Clean Dredged Material: Falmouth Bay Offshore Disposal Site

The preferred disposal option for the clean dredged material is to dispose of all the material at the Falmouth Bay offshore disposal site which is situated some 7km south-east of the Fal Estuary's mouth at the location shown in Figure 2-10. The water depth is approximately -50mCD or deeper across the disposal site. Self-propelled sea-going barges are likely to support the use of backhoe dredgers and will be used to carry out disposal. Typically, the barge sails to the offshore site and deposit the dredged material into the water via doors in the hull. The dredged material falls to the seabed within the boundaries of the offshore site, as required by disposal licensing requirements made under the FEPA. The barge then returns to the dredging area.

Figure 2-10 Location of the Falmouth Bay Offshore Disposal Site



2.3.7 *Disposal of Clean Dredged Material: Re-use as a Soil Improver*

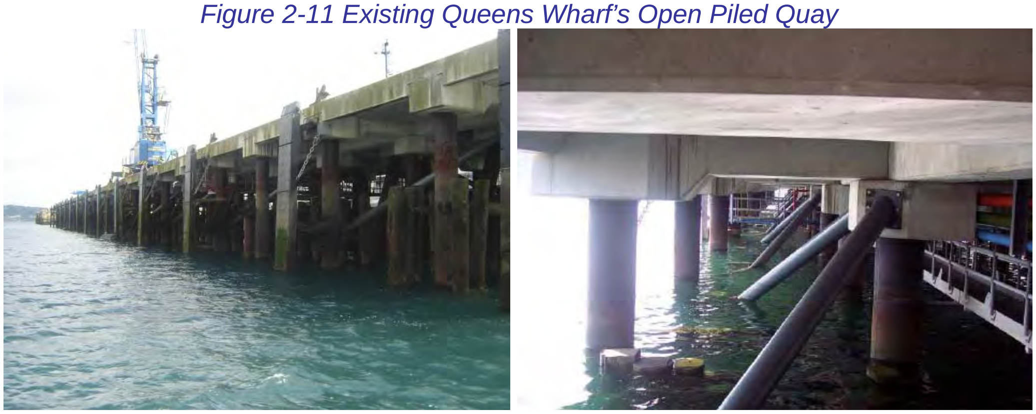
The maerl substrate within the dredged material has a potential re-use value as a soil improver. Dead maerl used to be dredged from the Fal Estuary under a licensed extraction activity, brought ashore, treated (i.e. washed) and bagged and sold as a soil improver. It is intended to minimise the volume of clean dredged material to be disposed of at the Falmouth Bay offshore site by re-using the maerl and maerl matrix substrates as a soil improver. However, at the time of conducting the EIA process, it is possible that this option may prove to be unfeasible, and therefore the proposed Falmouth Cruise Project includes for a worst case scenario based on all clean material being disposed of in Fal Bay.

2.3.8 *Cruise Quay: Queens Wharf to Northern Wharf*

The preferred improvement option is construction of an open piled structure of c.750mm vertical tubular piles with a concrete deck. This option is similar to the existing structure of the existing Queens Wharf (see Figure 2-11).

The construction method is predicted to be similar to that for the existing Queens Wharf, and therefore primarily comprises installation of tubular steel piles and a concrete deck. Piles are likely to be delivered by sea and offloaded at the Northern Wharf and will be installed with a specialist drilling rig. Concrete will be delivered by truck from an on site batching plant and cast in situ to form the deck. Finally, the structure will be completed by the installation of pre-fabricated fenders, services, a walkway and furniture. This length will require a total of six months of construction.

Figure 2-11 Existing Queens Wharf's Open Piled Quay



2.3.9 *Cruise Quay: Northern Wharf*

Three lengths of the Northern Wharf will be improved. Two lengths comprise mass concrete structures of which the upper sections need replcing. Accordingly, the preferred improvement option for these two lengths is to break out the upper sections (3m and 0.5m) and reinstate them with new reinfirced concrete monolithic structures tying into their lower existing structures and incorporating facilities such as crane rails. Where possible the concrete that has been broken out will be crushed and reused as fill on site. Concrete will be delivered by truck from an on site batching plant and cast in situ to form the deck. These lengths will require 11 and 5 weeks of construction.

In between these two lengths the Northern Wharf comprises the original vertical timber piled structure. It is currently disused as its condition is very poor the preferred improvement option for this length is to replace the timber piled structure with a new open piled structure, which will have the same design and construction method as described for the open piled structure comprising the existing Queens Wharf and proposed to bridge the gap between the Queens and Northern Wharves. This length will require a total of three months of construction.

2.3.10 Cruise Terminal Building

Initially, the ground will be prepared by levelling, clearance and minor excavation and a sub-structure comprising a concrete raft with reinforced ground beams will be cast in situ. Concrete will be supplied from a temporary batching plant located in the eastern part of the docks estate.

Subsequently, the building's super-structure of prefabricated steel sections will be bolted tgether and pre-cast concrete stair cases and landings will be installed. The external walls will be built from standard seam cladding, coloured rendering and composite panelling, and powder-coated aluminium glazed doors and windows will be installed. The roof will comprise a standing seam roof with powder-coated zinc fascias and barge-boards, a rainwater drainage system and a man-safe system. All pre-cast and prefabricated items will be transported to site on a flatbed lorry and lifted into place by a mobile crane. Mobile elevated work platforms will be used by construction personnel to enable access to higher parts of the building in order to bolt together the frame, attach cladding and install other external fittings. Finally, the internal blockwork walls and metal stud partitions, screed and finished floors, suspended ceilings, internal doors, internal glazing and all utilities will be fitted by personnel using small power tools.

An indicative construction programme for the cruise terminal building comprises approximately three weeks for the ground works and sub-structure, approximately six weeks for the super-structure, external walls and roof, and approximately six weeks for internal fixtures and fittings.

2.4 Description of the Operational Phase

2.4.1 Cruise Terminal Activities

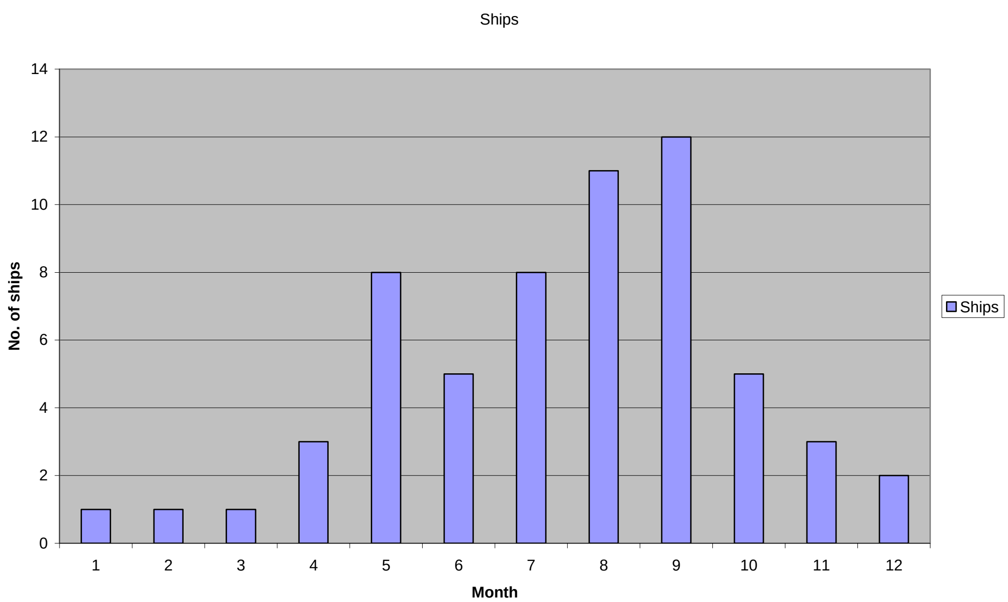
With the proposed Falmouth Cruise Project in place, cruise vessels will berth alongside the dedicated cruise quay at the combined Queens and Northern Wharves and passengers will embark / disembark directly to the dedicated cruise terminal building. It is anticipated that there will be no or very little need for mooring at the deepwater anchorage and tendering passengers ashore.

Day calls occur when a cruise vessel visits Falmouth as part of a cruise's itinerary and tend to use Falmouth between May and September. For day calls, cruise vessels will berth alongside the cruise quay of the combined Queens and Northern Wharves. In the morning, passengers will disembark and enter the cruise terminal building where they will be allocated a coach for their shore excursion or a shuttle bus for transfer into Falmouth. For their return in late afternoon, passengers will be brought back to the cruise terminal building and will embark the cruise vessel.

Turnaround calls occur when a cruise vessel uses Falmouth as its base port for the start and end of a cruise, and use Falmouth throughout the year. For turnaround calls, passengers will arrive by coach, car or be dropped off by friends and relatives. If arriving by coach, passengers will be dropped off at the cruise terminal building. If arriving by car, passengers will park in the car parking areas within the docks estate and be bussed to the cruise terminal building. The car parking areas in the eastern part of the docks estate will have been subject to ground improvement works. This will not affect their use for car parking within the docks estate, although the predicted increase in turnaround passengers will require an increased use of the improved car parking areas. All passengers will check in themselves and their luggage through the cruise terminal building before embarking the cruise vessel.

Figure 2-12 shows the monthly distribution of cruise calls based on figures from 2006 and serves to illustrate the concentration of day calls from May to September against the turnaround calls that occur throughout the year.

Figure 2-12 Monthly Distribution of Cruise Calls at Falmouth in 2006



2.4.2 Numbers of Cruise Vessels

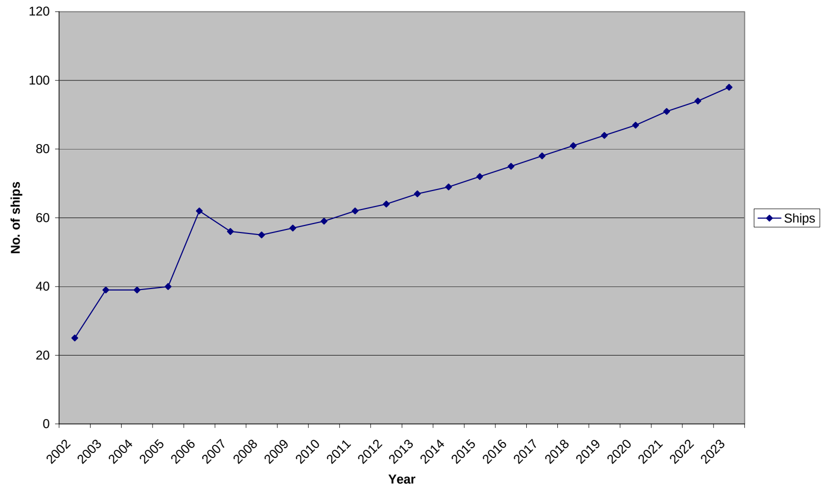
With the proposed Falmouth Cruise Project in place and operational:

- Arup (2008) predict combined numbers of vessels to increase from 40 in 2005 to 68 in 2020 (see Table 2-2); and
- FDEC predict the combined numbers of vessels visiting Falmouth for day calls and turnaround calls to increase from 57 in 2009 to 98 in 2023 (see Figure 2-13).

Table 2-2 Predicted Cruise Calls to Falmouth (source: Arup, 2008)

Year	2005	2008	2009	2010	2015	2020
Combined calls	40	46	49	51	65	68
Day calls	22	34	36	37	47	50
Turnaround calls	18	12	13	14	18	18

Figure 2-13 Predicted Combined Cruise Calls to Falmouth



2.4.3 Numbers of Cruise Passengers

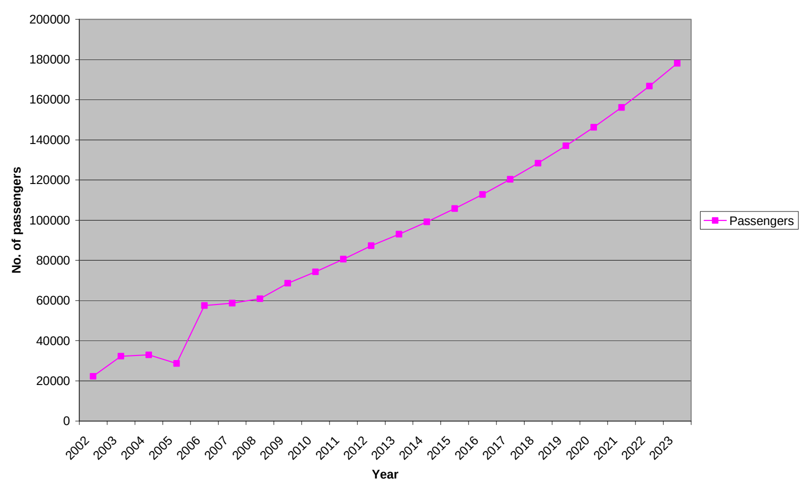
With the proposed Falmouth Cruise Project in place and operational:

- Arup (2008) predict combined numbers of passengers to increase from 28,700 in 2005 to 95,007 in 2020 (see Table 2-3); and
- FDEC also predict the combined numbers of passengers visiting Falmouth on those vessels to increase from 68,565 in 2009 to 178,081 in 2023 (see Figure 2-14).

Table 2-3 Predicted Passengers at Falmouth (source: Arup, 2008)

Year	2005	2008	2009	2010	2015	2020
Combined passengers	28,700	38,200	42,020	46,222	74,440	95,007
Day call passengers	15,785	27,886	30,675	33,742	54,341	69,355
Turnaround passengers	12,915	10,314	11,345	12,480	20,099	25,652

Figure 2-14 Predicted Passengers at Falmouth (source: Arup, 2008)



2.4.4 General Port Operation and Maintenance Activities

As at all ports, the components of the proposed Falmouth Cruise Project will be subject to the general operation and maintenance activities. These activities are ongoing at Falmouth Docks at present, and therefore there will be little day to change over existing activities.

The Falmouth Cruise Project is not expected to require maintenance dredging in the foreseeable future and it is not proposed as part of the operational phase.

3 CONSIDERATION OF ALTERNATIVE OPTIONS

3.1 Do Nothing Scenario

Arup (2008) developed a do nothing scenario to inform their economic assessment of the proposed Falmouth Cruise Project. Under this option, the navigation channel and deep water berth would not be dredged, and the wharf improvements and cruise terminal building would not be constructed. The do nothing option would involve a gradual reduction in port and docks activities at Falmouth, with the cruise industry choosing to use other ports and the gradual silting up of the existing channel meaning that the larger ships currently coming in for repair would find it more difficult to do so.

Under the do nothing scenario, Arup (2008), predict that there will be a decline in cruise passenger numbers and ship repair contracts at the docks. Table 3-1 enumerates the predicted decline in cruise passenger numbers that will occur under the do nothing scenario, using 2005 as the base year.

Table 3-1 Predicted Passengers at Falmouth under the Do Nothing Scenario (source: Arup, 2008)

2005	2008	2009	2010	2015	2020	2025
28,700	38,200	36,290	34,475	29,304	24,908	19,927

According to Arup (2008), the socio-economic implications of the do nothing scenario include a reduction in the pilotage revenue of FHC and the towage activities and ship repair activities of FDEC/A&P, and a loss of job opportunities as enumerated in Table 3-2.

Table 3-2 Predicted Job Creation under the Do Nothing Scenario (source: Arup, 2008)

Scenario	Expected Construction Employment	Expected Increase in Employment at Falmouth Docks	Expected Increase in Employment (due to increased tourist expenditure)	Total
Do nothing	**0**	**0**	**0**	**0**
Do project	**118**	**140**	**124**	**382**

3.2 Alternative Cruise Project Locations

Only the ports of Fowey and Plymouth are able to offer alternative cruise project locations in south-west England. However, neither port is able to offer the navigational and/or berthing requirements necessary to accommodate the design vessel for the

Falmouth Cruise Project or the shore excursions that are viable from Falmouth. Shore excursions are important because the cruise industry and its associated ports of call – particularly day calls - are driven by passenger demand to visit interesting areas and day attractions. Shore excursions are a key factor in the choice of ports of call because they are highly profitable for cruise operators and a key selling point for the cruise (Arup, 2008).

3.3 Alternative Channel Design Options

3.3.1 Existing Channel Alignment

The existing channel alignment was designed to provide vessels with safe access to the dry docks, but not to the Northern and Queens Wharves and hence it includes an S-bend. At present, accessing the wharves requires vessels to be lined up for the dry docks approach and then manoeuvred northwards around the wharves. The realigning of the vessels' tracks to northwards requires course alterations and a period of settling onto the new track, adding unwelcome complexity to the manoeuvre and reducing the margins of safety for large vessels. Using the existing channel alignment is not appropriate for large cruise vessels as it requires them to negotiate two turns in rapid succession, and therefore this alignment could not be taken forward for a channel design that meets the standard PIANC guidance.

3.3.2 South-East Channel Alignment

The main alternative channel alignment for the Falmouth Cruise Project comprised a channel aligned from the eastern end of the Northern Wharf towards the south-east until it connected to Carrick Roads / The Narrows. This channel alignment option was not taken forward as the preferred option for the following reasons:

- the larger volume of material that would require dredging and disposal;
- FHC pilots' concerns about the navigation suitability of the channel; and
- Royal Caribbean International's concerns about the width of the channel for navigation.

3.4 Alternative Dredging Methods

Capital dredging can be undertaken by a variety of different dredging methods subject to the project's location characteristics (e.g. enclosed harbours or open seas), material to be dredged (e.g. stiff clay, soft mud or hard rock), hydrodynamic conditions (e.g. currents, waves and tidal range), disposal options (e.g. on land, at sea, for reclamation or habitat creation), sensitivity of the surrounding environment (e.g. contaminated dredged material, sediment dispersion and deposition, water quality, nature conservation, fisheries, etc), and cost-effectiveness.

3.4.1 Grab Dredgers

Compared to backhoe dredgers, grab dredgers are less capable of removing the weathered rock believed to be present within the capital dredging area for the Falmouth Cruise Project.

3.4.2 Trailing Suction Hopper Dredgers and Cutter Suction Dredgers

Compared to backhoe dredgers, suction dredgers are less accurate and dilute the dredged material to cause more material and water requiring treatment, are less flexible in terms of dredged material separation, and are more likely to cause significant environmental effects due to the creation, dispersion and deposition of sediment plumes.

3.5 Alternative Treatment Options for Contaminated Material

The contaminated dredged material will require treatment prior to its re-use and disposal to landfill. Rather than mechanically dewatering and, if necessary, adding a solidification/stabilisation agent, an alternative would be to add larger amounts of solidification/stabilisation agent to reduce the moisture content.

3.6 Alternative Disposal Options for Contaminated Material

3.6.1 Disposal at Sea of Untreated Contaminated Material: Falmouth Bay Offshore Disposal Site

This option comprises depositing the contaminated dredged material at the Falmouth Bay offshore disposal site. Consultation with CEFAS indicated that the concentrations in the contaminated dredged material are sufficiently high that this disposal route would not be permitted under the Food & Environment Protection Act 1985. Accordingly, this option was ruled out for the Falmouth Cruise Project.

3.6.2 Disposal at Sea of Treated Contaminated Material: Falmouth Bay Offshore Disposal Site

This option comprises depositing treated contaminated dredged material at the Falmouth Bay offshore disposal site. Consultation with the MFA identified that the material becomes controlled waste when it is brought on land for treatment and, therefore, this disposal route could not be permitted under the Food & Environment Protection Act 1985. Accordingly, this option was ruled out for the Falmouth Cruise Project.

3.6.3 Disposal at Sea of Untreated Contaminated Material: Capped Disposal in Falmouth Bay

This option comprises placing the untreated contaminated dredged material on the seabed and capping it with clean material. The purpose of the cap is to isolate the contaminated material from the overlying the marine environment. This disposal method has a history of use in countries including the United States, the Netherlands and Japan (e.g. Palermo, 1987). In the UK experience is limited to an ongoing trial offshore of north-east England and involves approximately 60,000m^3 of contaminated dredged material which contains contaminants (including TBT) at concentrations normally unacceptable for disposal at sea, and approximately 135,000m^3 of clean material as a cap. Given that the trial is ongoing in north-east England, there remains uncertainty in the UK about the environmental and technical performance of capping. Accordingly, this option was ruled out for the Falmouth Cruise Project.

3.6.4 Disposal at Sea of Treated Contaminated Material: Docks Basin – Wharf Structures

During the course of the EIA process, a number of sites were considered for using the treated contaminated dredged material as a fill material for the wharf improvements required along the Queens and Northern Wharves, and other structures within the docks. The permitting route for this option is complicated because, potentially, both the Environmental Permitting Regulations and the Food & Environment Protection Act apply given that the dredged material would have to be placed both above and below MHWS. It may have been possible to have used the treated contaminated dredged material as an infill material for the wharf structure below MHWS under the Food & Environmental Protection Act (i.e. placement of a construction material), and possibly for the wharf structure above MHWS (for up to 2m of depth) under Schedule 3 (9) of the Environmental Permitting Regulations (i.e. for ground improvement works). This option was not investigated because an indicative costing exercise of the conceptual design for wharf structures identified that this option, under any of the permitting routes, was not financially feasible. Accordingly, this option was not viable and ruled out for the Falmouth Cruise Project.

3.7 Alternative Disposal Options for Clean Material

3.7.1 Disposal at Sea: Beneficial Use of Maerl Substrate for Habitat Enhancement

During the course of the EIA process, consultation with Natural England led to a number of options being devised for using potentially large quantities of the maerl component of the clean dredged material for habitat enhancement within the Fal Estuary. Enhancement was proposed at a number of locations formally subject to commercial maerl extraction for use as a soil improver. However, further consultation with Natural England ruled out this option on the grounds that habitat enhancement would increase the overall impact footprint of the proposed project within the Fal and Helford Estuaries SAC.

3.7.2 Disposal at Sea: Beneficial Use of Maerl Substrate for Habitat Creation

During the course of the EIA process, consultation with Natural England led to an option being devised for using the maerl component of the clean dredged material for habitat creation within the Fal Estuary, at a location east of the Eastern Breakwater. However, further consultation with Natural England ruled out this option on the grounds that marine ecology survey data (Axelsson et al., 2008) indicates that the proposed habitat recreation site and its surroundings already support maerl habitat and associated marine communities, and therefore it is not considered suitable as a beneficial use site.

4 OVERVIEW OF BASELINE ENVIRONMENTAL CONDITIONS

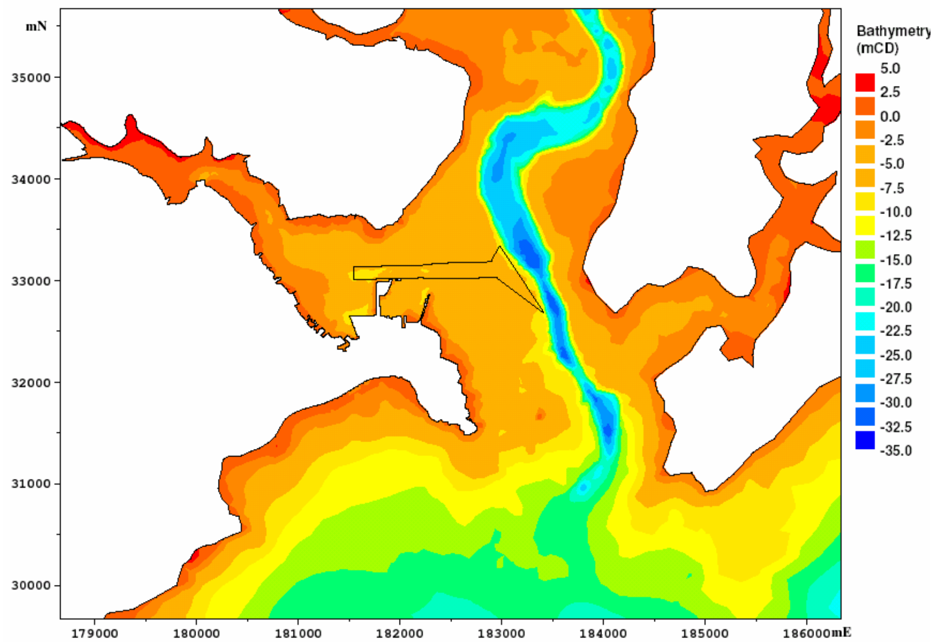
4.1 Hydrodynamic and Sediment Regime

The EIA process concerning the hydrodynamic and sediment regime was informed by data collection, computational modelling and interpretation, as reported in the Falmouth Cruise Terminal Hydrodynamic and Sedimentary Studies (HR Wallingford, 2008).

The Fal Estuary is located on the south coast of Cornwall, where it extends 18km inland from its entrance between Pendennis Point and St Anthony Head to the tidal limit at

Tresillian. The estuary is a drowned river valley or ria. Its main channel dates back to the last Ice Age when sea levels were considerably lower than the present day. The estuary may be divided into two main sections: the inner tidal tributaries and the outer tidal basin. This outer basin, known as Carrick Roads, makes up over 80% of the main body of the estuary and is characterised by a deep meandering channel with depths up to 34m at the seaward end (see Figure 4-1).

Figure 4-1 Computational Model Bathymetry of the Lower Fal Estuary (source: HR Wallingford, 2008)



The estuary is macrotidal with a mean spring tidal range of 4.6m and a mean neap tidal range of 2.2m. Peak spring tidal currents in the vicinity of the proposed project are $0.8ms^{-1}$, whilst peak neap tidal currents are $0.2ms^{-1}$. Tides at this location are flood dominant. Flows in and out of Falmouth harbour entrance are complicated by a series of eddies during both the flood and ebb tides as the flow in and out of the inner harbour interacts with that in and out of Carrick Roads. Wave conditions around Falmouth are a combination of offshore swell and locally generated wind-waves. The most common and largest observed winds are in the sectors 225^o to 285^o, accounting for 47% of the observed wind data. There are very low average suspended sediment concentrations in the estuary (i.e. <10mg/l).

4.2 Sediment Quality

The EIA process concerning sediment quality was informed by surveys for physcial, chemical, biological and toxiclogical parameters, as reported in the Report on the Analysis of Marine Sediment Samples from Falmouth (Macaulay Enterprises, 2007), Bacteriological Results for Marine Sediment Samples Collected at Falmouth (CEFAS, 2007a), Report on Alexandrium Spp. Cyst Counts in Sediments from the Fal Estuary (CEFAS, 2007b) and Acute Toxicity of Fal Estuary Whole Sediment and Sediment Elutriate (CEFAS, 2007c).

In the area of the proposed new navigation channel, physically, the present seabed exposes (i.e. at its surface) fine-grained material, notably clay, across the western part of the navigation channel including the berth off the Queens and Northern Wharves, and medium- and coarse-grained material, notably maerl and sand, across the eastern part of the navigation channel.

Chemically, the surface sediment of the western part of the navigation channel including the cruise berth contains concentrations of organo-tins (TBT and DBT), some metals (As, Cu, Hg, Pb and Zn), PAHs and total PCBs that are generally elevated when compared to assessment criteria by CEFAS (2000) and the CCME (2002). The sub-surface sediment of the western part of the navigation channel including the cruise berth and the surface and sub-surface sediment of the eastern navigation channel contain concentrations of organo-tins, metals, PAHs, total PCBs and OCPs that are generally much lower.

Biologically, the present seabed contains very low to non-detectable concentrations of bacteria (CEFAS, 2007a) and very low to non-detectable concentrations of algal biotoxins (as viable cysts) (CEFAS, 2007b).

Toxicologically, the present seabed (based on the most contaminated sediment) can cause a range of lethal and sub-lethal effects, reflected by mortality and reduced casting endpoints respectively (CEFAS, 2007c). However, the endpoints are not statistically significant for all bioassay tests and comparison to other assessment criteria by Jones and Franklin (1998) and Roddie (1997) indicates that sediment quality ranges from good to impaired.

In the lower Fal Estuary, notably around the western end of Falmouth Harbour, the present seabed exhibits similar sediment characteristcs to the seabed area covered by the proposed new navigation channel.

4.3 Water Quality

The EIA process concerning water quality was informed by monitoring data provided by the Environment Agency for years 2000-2007 and by data collection, computational modelling and interpretation as reported in the Falmouth Cruise Terminal Hydrodynamic and Sedimentary Studies (HR Wallingford, 2008).

The baseline conditions for water quality are described in the context of the requirements of European laws, namely the Dangerous Substances Directive (DSD), the Shellfish Water Directive (SWD) and the Bathing Water Directive (BWD).

The DSD applies to all water areas in the Fal Estuary and establishes environmental quality standards (EQSs) for a number of chemical contaminants. Water quality monitoring data from the Environment Agency indicates that TBT already exceeds the EQS and is an existing water quality concern in the Fal Estuary, while metals are generally below their respective EQSs.

The SWD applies to a number of delineated shellfish waters that largely cover the Fal Estuary (including Carrick Roads, Penryn River and Percuil River shellfish waters) and establishes water quality criteria for a range of physcial, chemical and biological parameters. Water quality monitoring data from the Environment Agency indicates average suspended sediment concentrations in the order of <10mg/kg and metal concentrations below the EQSs established under the DSD.

The BWD applies to a number of designated bathing waters in Falmouth Bay (including Gyllangvase Beach, Swanpool Beach and Maenporth) and establishes water quality criteria for biological paraters. Water quality monitoring by the Environment Agency is such that the bathing waters have been classified as achieving 'excellent' water quality since (at least) 2000.

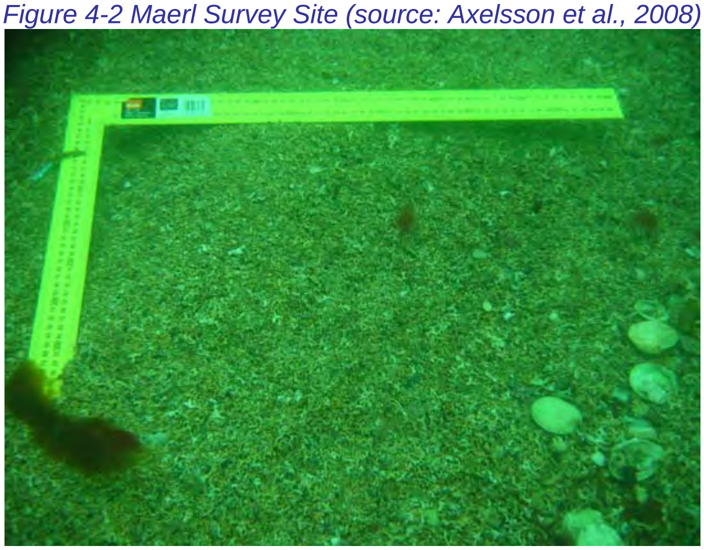
4.4 Marine and Coastal Ecology

The EIA process concerning marine and coastal ecology was informed by a survey, statistical analysis and interpretation as reported in the Falmouth Cruise Project EIA – Marine Ecological Survey (Axelsson et al., 2007).

The proposed Falmouth Cruise project is situated within the Fal and Helford Estuaries SAC and is designated under the EC Habitats Directive (Council Directive 92/43/EEC), which is transposed into UK law by the Conservation (Natural Habitats &c.) Regulations 1994. The site was designated for a number of marine habitats and features and these include 1110 sandbanks which are slightly covered by sea water all the time, 1140 mudflats and sandflats not covered by seawater at low tide, 1160 large shallow inlets and bays, 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), 1130 estuaries and 1170 reefs.

During August and September 2007 SeaStar Survey carried out a Marine Ecological Survey (Axelsson et al., 2008) of the project area and its surroundings, including an assessment of the benthic communities, with particular focus on maerl habitats and communities. Maerl is a collective term for several species of calcified red seaweed: typically, *Lithothamnion corallioides* and *Phymatolithon calcareum,* in the south of Great Britain. It grows as unattached nodules on the seabed, and can form extensive beds in favourable conditions. Maerl is slow-growing, but over long periods its dead calcareous skeleton can accumulate into deep deposits (an important habitat in its own right), overlain by a thin layer of pink, living maerl. The maerl habitats within the SAC form sub-features of designated features within the SAC.

Figure 4-2 Maerl Survey Site (source: Axelsson et al., 2008)



Maerl is a UK Biodiversity Action Plan (BAP) listed priority habitat. The actions plans objectives and targets include:

- maintain the geographical range of maerl beds and associated plant and animal communities in the UK subject to best available information; and
- maintain the variety and quality of maerl beds and associated plant and animal communities in the UK subject to best available information.

The intertidal zone within Falmouth Harbour comprises areas of gently to steep sloping riprap, existing quay infrastructure and harbour walls. No specific intertidal surveys were undertaken in order to characterise the site, due to its disturbed nature and the limited potential for intertidal species of interest. The communities are generally characterised as fucoids on sheltered marine shores on low energy littoral rock, LR.LLR.F, backed by some salt tolerant plant species in the supralittoral fringe (splash zone). These species are common and typical of the disturbed environment present within the harbour and are not of any conservation importance.

4.5 Ornithology

Falmouth Harbour does not lie within or adjacent to any international, national or local sites designated for their ornithological interest. It does, however, support a nationally important population of black-tailed godwit (*Limosa limosa*) and supports good numbers of divers and rarer grebes (Conway, 1996). The estuary, particularly the sheltered waters of Carrick Roads, is of county importance for supporting the county's largest concentrations of goldeneye (*Bucephala clangula*) and wintering red-breasted merganser (*Mergus serrator*) (Langston et al., 2003; ERCCI 2004). Other species commonly found on the estuary include dunlin (*Calidris alpina*), curlew (*Numenius arquata*), oystercatcher (*Haematopus ostralegus*), redshank, (*Tringa totanus*), greenshank (*Tringa nebularia*), shelduck (*Tadorna tadorna*), teal (*Anas crecca*) and wigeon (*Anas penelope*).

Based on Wetland Birds (WeBs) counts, no listed species of grebe or divers were recorded in the lower Fal Estuary sectors during 2004-2005, but this probably reflects the survey covering exposed foreshore at low tide while grebes/divers remain on the water to feed and rarely come onto land. Species recorded in the lower esuary include black-tailed godwit, low numbers of red-breasted merganser, widespread and numerous redshank, curlew and mallard, small numbers of little egret and greenshank, and many dunlin.

Scrub habitat within the harbour provide sub-optimal foraging habitat for common breeding birds.

4.6 Terrestrial Ecology

The EIA process concerning terrestrial ecology was informed by a survey as reported in the Falmouth Docks Phase 1 Habitat Survey (Royal Haskoning, 2007).

The survey identified that the majority of the habitat within Falmouth Docks is hardstanding comprising gravel or concrete. Other habitats identified within Falmouth Docks are common and of low nature conservation interest comprising ruderal, scrub and coastal species. No suitable habitat for bats or common lizard was identified. Sub-optimal breeding bird habitat was identified within the study area, but it is sparse and exposed to the elements and the docks are relatively noisy from the presence of humans, machinery and traffic. The woodland habitats on Pendennis Point provide more suitable cover, breeding and foraging habitat.

4.7 Fish and Shellfish Resource

The EIA process concerning the fish and shellfish resource was informed by survey data from the Environment Agency (2002-2007) and consultation.

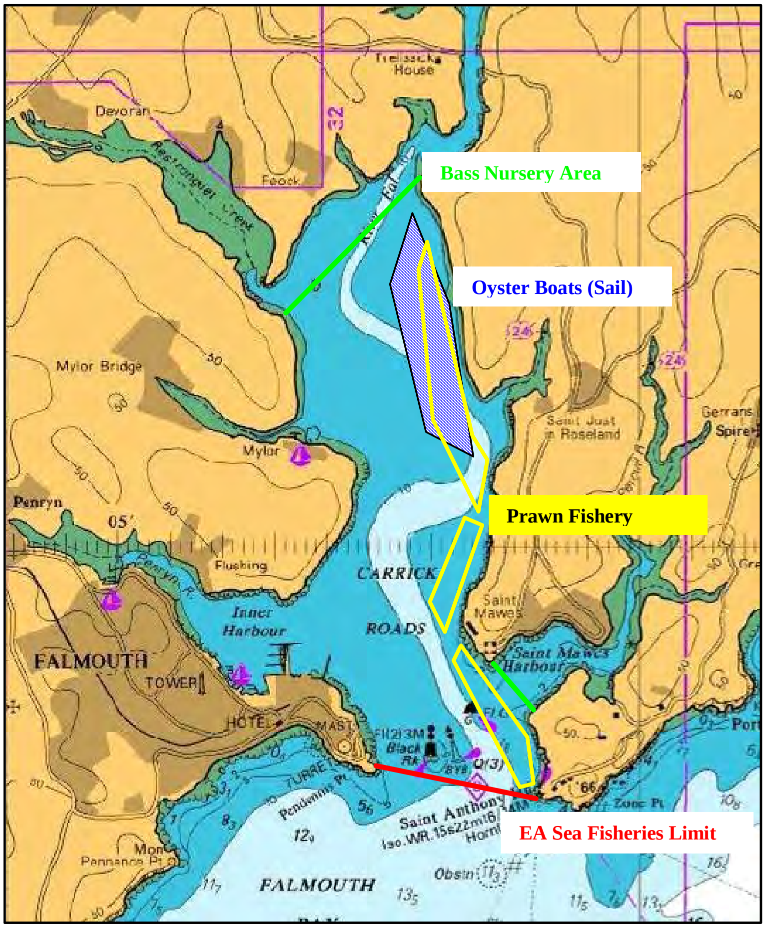
In terms of finfish, the Fal Estuary contains high fish species diversity, possibly as a result of the diverse range of habitats present. Recent surveys conducted by the Environment Agency (2002-2007) have recorded 43 species with the commonest by number being sand smelt *Atherina presbyter*, sprat *Sprattus sprattus* and common goby *Pomatoschistus microps*. Rarer species include the Norwegian topknot *Phrynorhombus norvegicus*, warm water species such as gilt head bream Sparus auratus, and a single seahorse *Hippocampus spp* caught during routine monitoring at Carrick Roads (Environment Agency, 2008). Some fish of potential commercial importance are also present and include grey mullet *Liza ramada*, mackerel *Scomber scombrus*, lemon sole *Microstomus kitt*, whiting *Merlangius merlangus*, flounder *Platichthys flesus*, pollack *Pollachius pollachius*, plaice *Pleuronectes platessa*, cod *Gadus morhua*, saithe *Pollachius virens*, dab *Limanda limanda* and Dover sole *Solea solea* (Environment Agency, 2003). The estuary is also noted for itsr populations of elasmobranch species such as thornback ray *Raja clavata*, and historically large localised populations of spotted ray *Raja montagui* and greater spotted dogfish *Scyliorhinus stellar*is (Environment Agency, 2004).

Generally, the majority of estuarine finfish species tend to be most abundant in autumn. This temporal characteristic is supported by the Environment Agency's surveys in the Fal Estuary, which recorded 31 species of fish present in the spring and 43 species present in the autumn.

The Fal Estuary is considered an important nursery ground for bass and some waters are designated bass nursery areas (see Figure 4-3). This designation prohibits the fishing for bass from a boat between 30th April and 1st January or fishing with live sandeel. As well as being a designated bass nursery area, it is likely that the estuary is a good nursery ground for a number of other fish species such as flounder, mackerel and whiting (Coull et al, 1998), gilthead bream and grey mullet (Goodwin, 2002).

Falmouth Bay (including the area of the dredged material disposal site) supports a number of fish species, including some of commercial importance. Local vessels are known to target shellfish, sole and monkfish as well as a variety of mixed demersal species in the area. Beam trawl surveys carried out by CEFAS (2007) recorded red gurnard *Aspitrigla cuculus*, sole, plaice, monkfish *Lophius piscatorius* and hake *Merluccius merluccius*. Squid *Loligo sp*. species are also known to occur widely in Falmouth Bay and egg masses are often found attached to static gear such as pots and nets (Cotter et al., 2006).

Figure 4-3 Fish and Fishery Resources in the Fal Estuary (source: adapted from Pilcher, 2007)



Offshore, the Western Approaches is particularly important as a nursery area for mackerel, and the 'Mackerel Box' was introduced in 1986 in order to reduce pressure on the juvenile stock. Falmouth Bay falls within this area which is also used as a nursery ground by whiting. Spawning maps also indicate that sprat also use the area for as a spawning ground, although spawning is widespread.

In terms of migratory species, the River Fal and its tributaries support populations of sea trout *Salmo trutta* and salmon *Salmo salar,* although the latter are scarce. The main sea trout runs occur up the Tresillian River (Hillman R. pers. comm., 2008). Adult salmon and trout pass from sea to freshwater habitats year round, with peak activity occurring in the spring and lowest activity from November to February. Juveniles migrate out of the freshwater habitats during the spring (although trout may move as early as February). There are historical records of allis shad *Alosa alosa* and twaite shad *Alosa* fallax. In addition, European eel *Anguilla Anguilla* and brook lamprey *Lampetra planeri* are also present within the estuary, although they are not found in large numbers (Hillman R. pers. comm., 2008).

In terms of shellfish, the estuary supports a wide range of shellfish, many of which are of high commercial importance, including prawn *Palaemon serratus* (see Figure 4-3)*,* velvet crab *Necora puber,* green crab *Carcinus maenas,* edible crab *Cancer pagurus,* spider crab *Maia squinado,* lobster *Homarus gammarus,* crawfish *Palinurus elephas,* scallop *Pecten maximus,* whelk *Bucinum undatum,* mussel *Mytilus edulis* and *Pacific* and *European oyster (Crassostrea gigas* and *Ostrea edulis* respectively). The main oyster beds in the Fal Estuary are situated to the north of Pennarow Point, with the main grounds for crab and prawn in the Carrick Roads (Environment Agency, 2004) (see Figure 4-3).

Commercial shellfish cultivation requires good water quality in order to prevent contamination. Water quality in the southwest's shellfish waters is consistently good, with 87% meeting the mandatory standards of the Shellfish Waters Directive (SWD) in 2003. There were four failures in 2003 (an increase on the year before), one of these being the Fal Estuary for dissolved oxygen; probably resulting from high temperatures (Food Standards Agency, 2007).

A number of commercially important shellfish beds are found within the estuary and have been classified into a number of production areas, in accordance with the Shellfish Hygiene Directive (SHD). Monitoring data from the Food Standards Agency for 2006-2007 identify that the majority of the Fal Estuary's shellfish waters contain levels of bacteria that require the the shellfish must be either purified, relayed and/or heat treated prior to human consumption.

4.8 Commercial Fisheries and Shellfisheries

The EIA process concerning commerical fisheries and shellfisheries was informed by survey data from the Environment Agency (2002-2007) and consultation.

Various bodies control and have powers to regulate certain fishing activities within the Fal Estuary and coastal areas including the Environment Agency, the Cornwall Sea Fisheries Committee, the MFA and the FHC. Legislation establishes no fixed nets for any fish, no trawling and no scallop dredging in the estuary.

The bass nursery areas in the Fal Estuary are regulated by the MFA. Fishing from a boat between 30th April and 1st January or fishing with live sandeel within these nursery areas is prohibited. The mussel and oyster fisheries are regulated by Carrick District Council (CDC) under the Truro Port Fishery (Variation) Order 1975. The Fal and Helford Designated Area (Fishing Restrictions) Order 2008 is currently under consultation and, if implemented, will prohibit dredging for shellfish and demersal trawling within the limits of the SAC.

The local fishing fleets operate from Falmouth, St Mawes, Mylor, Flushing and Penryn.

The majority of fishing effort in the Fal Estuary is directed towards potting for crabs (brown, green, spider and velvet), lobsters and prawns, with many of the velvet and green crab catches destined for the Spanish market. The main grounds for potting are in the Carrick Roads and in the winter months this takes place in the deeper channel (Environment Agency, 2004). The majority of the prawn grounds are within the Carrick Roads on the eastern side between St Anthony's Head and Turnaware Point. Commercial trawling and scalloping activity is generally limited to outside the estuary as much of the area is within the SAC.

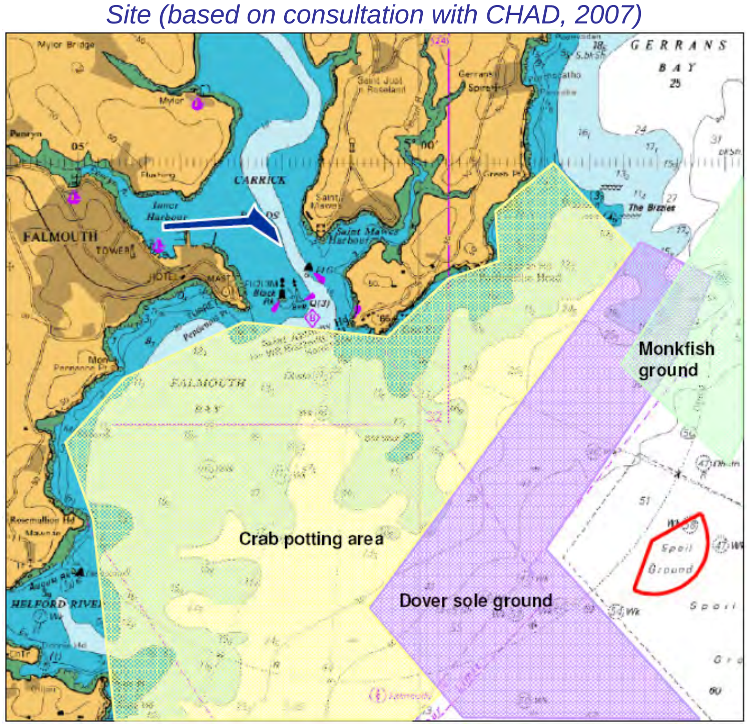
The Fal Estuary has a traditional and unique native oyster fishery. The Port of Truro Oyster Fishery has been operational since Roman times and is the largest natural oyster fishery in Europe whereby only traditional forms of dredging are allowed. It is also the last oyster fishery in the world still fished under sail and the last commercial sailing fleet left in Europe. There are approximately 12 sailing boats working the Fal Estuary, and the main beds lie north of Pennarrow Point. The fishing season starts on 1 October and lasts through to the end of March. It is estimated approximately 50-60 tonnes of oysters are taken from the Fal fishery per year (Bate C. pers. comm., 2008).

Mussel culture takes place immediately below King Harry Ferry, with crosses between Feock and Philliegh in the northern extents of Carrick Roads (Toms, S. pers comm., 2007).

The sea area off south Cornwall supports some of the highest fishing effort in the UK's waters. The water area covering Falmouth Bay is notably high in effort for demersal species and shellfish (from static gear). Within the Falmouth Bay there are a number of significant fishing grounds, particularly for shellfish, lemon sole and monkfish. The shellfish catch forms a significant part of the regional fishing industry, with landings representing almost half (44%) of the total landings, which is far greater than the national average. Whilst the exact fishing grounds are slightly unclear due to a lack of substantial information and some conflicting information from local sources, it is understood to receive a wide variety of fishing effort from trawling, scalloping, potting and netting (Tomlinson, T. pers. comm., 2007).

Figure 4-4 has been compiled from the information provided by Cadgwith, Helford & District Fishermen's Association (CHAD) on the fishing grounds within the vicinity of the disposal ground. The main areas for sole fishing are fished seven days a week (weather permitting) between May and December by around four boats. The crab potting grounds are fished all year by a minimum of four vessels (CHAD, 2007).

Figure 4-4 Fishing Activity in Falmouth Bay relative to the Dredged Material Disposal Site (based on consultation with CHAD, 2007)

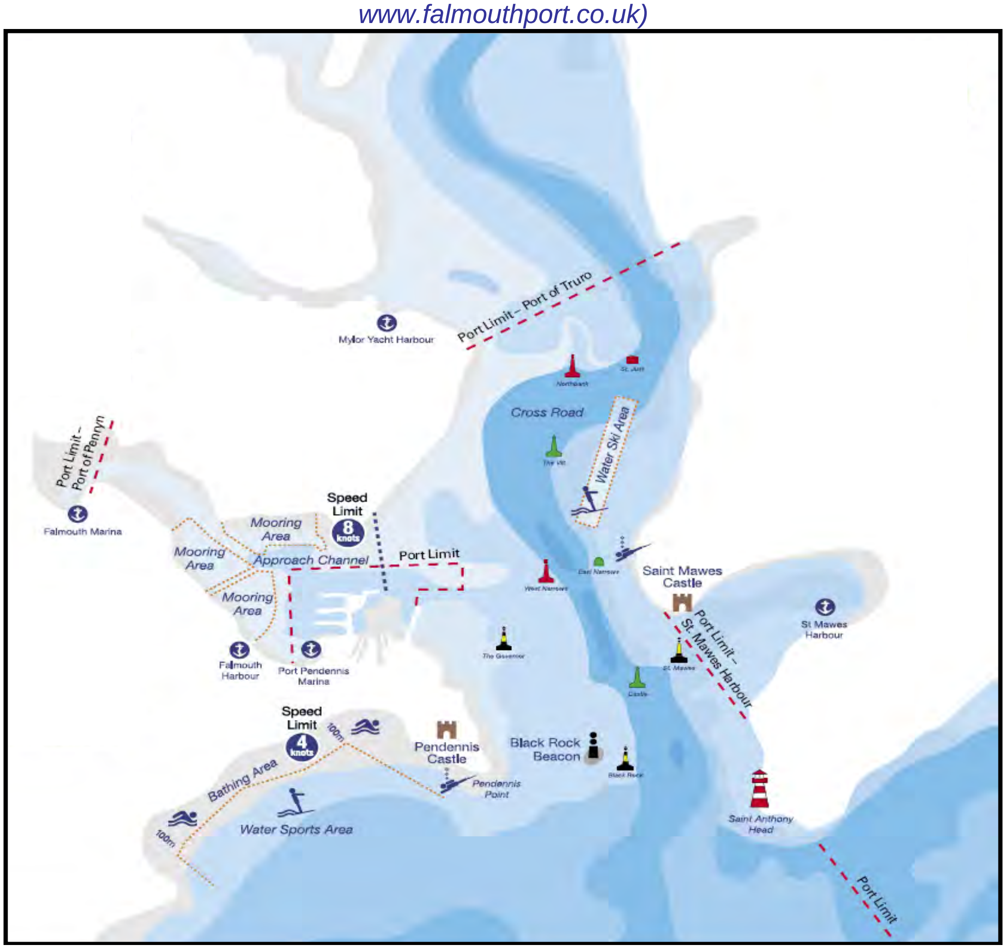


4.9 Navigation and Recreation

Falmouth Docks is essentially a port that services passing vessels, including cruise vessels, and provides specialist ship repair in its dry docks. At Falmouth Docks, FDEC currently operate the County, Duchy and Queens Wharves for alongside mooring for vessels up to 230 metres in length and requiring -8mCD of water depth, and three dry docks for ship repair. Other vessels can be moored at the sheltered deepwater lay-up moorings in the Carrick Roads for vessels up to 220 metres in length. In the eastern part of the docks, Falmouth Oil Services (FOS) operates a jetty along the eastern breakwater. Falmouth also offers the UK's largest offshore bunker station, providing a fuel bunkering service round the clock. By contrast, the Port of Truro is close to the main road network of Cornwall and provides facilities for the distribution of bulk commodities. Penryn and St Mawes provide small harbour areas with little commercial trade apart from passengers.

Passenger ferry services connect Falmouth to Tolverne and Truro (seasonal from April to October), and to Flushing and St Mawes (year round). Please craft operate from Falmouth, offering environmental cruises and pleasure cruises around the Fal and Helford Estuaries.

Figure 4-5 Port Limits and Recreational Areas in the Fal Estuary (source: www.falmouthport.co.uk)



Currently the Fal Estuary holds approximately 4,700 leisure craft moorings; 1,500 of which are located within the Port of Truro and about 350 in Penryn. There are a further 800 moorings and pontoon berths at Mylor Yacht Harbour and at Falmouth Marina (Port of Truro, 2008), and a number of privately operated marinas (e.g. Port Pendennis Marina) (see Figure 4-5). The demand for leisure moorings in the Fal Estuary outstrips supply.

A number of port and harbour authorities are responsible for navigation around the Fal Estuary. Figure 4-5 shows the port limits under FHC's jurisdiction, which extend over the lower part of the Fal Estuary and out into Fal Bay, relative to the limits of Falmouth Docks, the Port of Penryn, St Mawes Harbour, and the Port of Truro. The port and harbour authorities have a duty to regulate navigation within the estuary to ensure efficient and safe operation of the port. They have the power to make bye-laws which provide general rules for navigation and the conduct of a vessel within the jurisdiction of a harbour authority. In addition to these powers, the harbour masters are able to give directions to vessels within their areas of authority in respect of when and how they may enter the harbour.

FHC provide pilotage for certain vessels using the ports, harbours and docks in the estuary, and vessels passing through Falmouth Bay (see FHC, 2008). Pilotage requirements do not apply to naval vessels or to vessels of less than 20m in length or registered fishing vessels of less than 47.5m. Piloted movements increased from 1518 in 2005 to 1665 in 2006, with 1511 pilot boat operations undertaken (FHC, 2008).

Quarterly data provided by FHC shows that typically there have been between 300 and 500 commercial vessel movements per quarter over the past three years, except in the latter half of 2007 when movements increased to around 800 per quarter. Data from FDEC shows that the cruise business operating from Falmouth Docks has contributed up to 60 vessels (120 movements) per annum in the years since 1996. Day calls tend to occur between May and September, while turnaround calls occur throughout the year.

Diving is popular in Falmouth Bay and Carrick Roads, and shore dives into Falmouth Bay take place from the beaches. Popular diving areas are indicated in Figure 4-5 although divers may be encountered anywhere, particularly on a number of wrecks and reefs in the bay (see Figure 4-6).

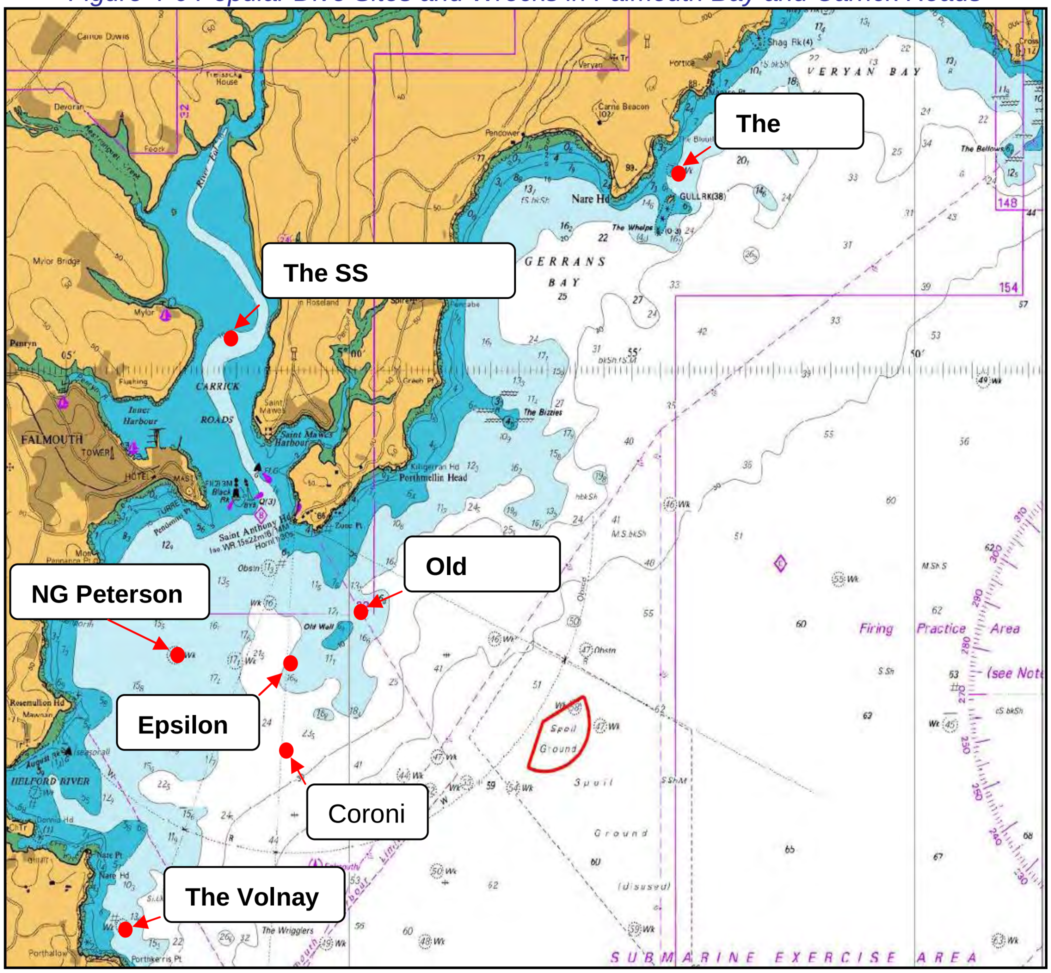
FHC have a protocol in place concerning recreational diving in the estuary and bay (FHC, 2004). The protocol requires that "diving activities must be planned, and carried out, in such a way that divers keep well clear of these shipping movements, and so as not to obstruct or impede any commercial activity in the Harbour Area." The protocol states that "No recreational diving is permitted in the vicinity of Falmouth Docks Wharves or Jetties or within the Docks Basin."

As identified on Figure 4-5, water-skiing takes place in the estuary at a marked water-ski area to the east of Carrick Roads. Other allocated recreational areas include the buoy-marked bathing water areas off Gyllyngvase and Swanpool beaches. These areas extend 100m off the beaches. There is a water sports area beyond this zone.

There are approximately 30 recreational sailing clubs in and around the Fal Estuary and sailing events that take place throughout the year, including the Falmouth Sailing Week, village regattas, championship races, special club races, club series and offshore races.

All events or races are conducted on courses and times approved in advance by the Harbour Master.

Figure 4-6 Popular Dive Sites and Wrecks in Falmouth Bay and Carrick Roads



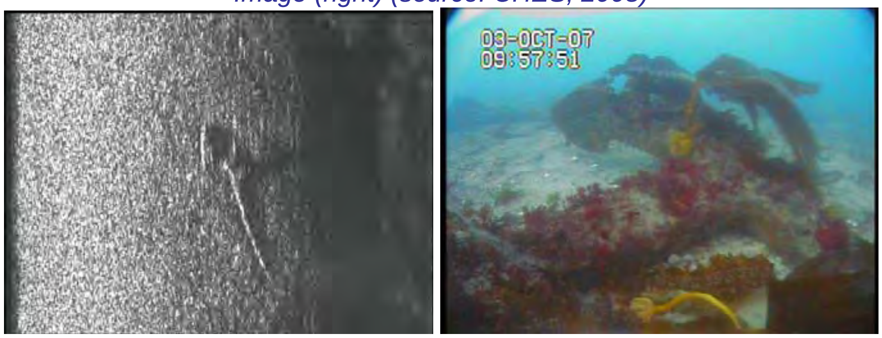
4.10 Archaeology and Heritage

The EIA process concerning archaeology and heritage was informed by a desk-based assessment, vibrocore inspection, geophysical survey and anomalies investigation, as reported by CHES (2008).

Only five recorded historic sites were identified in the study area by the desk-based assessment (CHES, 2008). These are Falmouth Docks itself with the Northern and Queen's Wharves, the Falmouth to St Mawes ferry route, and the Examination Anchorage in Falmouth Haven, an area of sea marked by buoys where ships would wait to be inspected in war time.

Two hundred and thirty-three anomalies were detected by the geophysical survey (CHES, 2008), of which 90 were classified as of possible archaeological interest. A representative sample of 24 anomalies was targeted for inspection on the seabed by Remotely Operated Vehicle (ROV), and each was filmed on video. Whilst most of the targets are modern debris some are of historic interest, including four anchors (e.g. see Figure 4-7), various artefacts which have been recovered from the estuary in the past, such as the famous St Mawes tin ingot, suggest that there is the possibility that other finds could be recovered.

Figure 4-7 C19th Round Crown Anchor Geophysical Survey Image (left) and ROV Video Image (right) (source: CHES, 2008)



A vibrocore assessment provided evidence that, at least on the northern edge of the eastern part of the proposed new navigation channel, a major buried early Holocene landsurface exists beneath the seabed at a depth of 6.8m to 7.5m below Chart Datum (CD). The declared dredge depth in the navigation channel will be 8.3m below CD.

A search of NMR and UKHO records showed that there is no wrecks in the proposed new navigation channel and one wreck (with no further details recorded) within the licensed disposal area and two, a modern fishing boat and a WWII steamship, on the boundary.

4.11 Traffic and Transportation

At the time of preparing this section of the ES, a transportation assessment (TA) was not available to inform the EIA process. Accordingly, the EIA process was not informed by a detailed breakdown of traffic flows per vehicle type and an assessment of junction capacities.

The A39 starts (or ends) at Falmouth Docks and passes through Falmouth (as Melvill Road, Western Terrace and Dracaena Avenue), and subsequently forms the main road connecting Falmouth and Truro. The A39 joins the A390 in Truro and the combined road runs around Truro town centre (Tregolis Road) until they split. After the split with the A390, the A39 heads north (known as Newquay Road) through Trispen until it joins the A30. The A30 is the main highway link west to Penzance and Lands End, and east to Exeter where it connects into the M5 and Honiton where it connects into the A303.

Cornwall County Council's automatic traffic counters have recorded two-way flows for annual average daily traffic (AADT) including the percentage of HGVs at key locations along the A39, which is the principal road through Falmouth to and from Falmouth Docks and have recorded seasonality in the two-way average flows for all vehicles (see Table 4-1), and have recorded annual average two-way flows for peak morning (AM) and afternoon (PM) flows of all vehicles (see Table 4-2).

Table 4-1 AADT Two-Way Traffic Flows in Falmouth in 2007 and Average Seasonal Peak Two-Way Average Traffic Flows on 7 August 2007 (source: CCC, pers. comm., 2008)

Road Location	AADT 2007	AADT 2007 % HGVs	7 August 2007
A39 Ponsharden	25,400	c.3	28,100
A39 Dracaena Avenue	13,600	c.3	15,500
C7 Budock Hospital	15,200	c.3	15,900

Table 4-2 Annual Average Peak Hour Two-Way Traffic Flows in Falmouth in 2007 (source: CCC, pers. comm., 2008)

Road Location	Peak AM	Peak PM
A39 Ponsharden	1,950	2,300
A39 Dracaena Avenue	1,000	1,200
C7 Budock Hospital	1,500	1,600

In terms of rail, a branch line connects stations at Falmouth Docks and Falmouth with Truro. From Truro there are main line connections west as far as Penzance and east to Plymouth, Exeter and beyond including lines to London's Waterloo and Paddington stations.

Public transport includes local passenger ferry services connect Falmouth to Tolverne and Truro (seasonal from April to October), and to Flushing and St Mawes (year round). In recent years a park and float facility has started operating from Falmouth, providing a ferry link from the out of town car parking facility at Ponsharden with the town centre. A normal park and ride also operates between Ponsharden and the town centre.

4.12 Noise and Vibration

The EIA process concerning noise and vibration was informed by a baseline noise survey, as reported by Royal Haskoning (2008).

Falmouth Docks are located east of Falmouth town centre. The site operates as a commercial port for cruise-liners and includes dry docks and other ship repair facilities. The estate includes other activities such as boat building (Pendennis Shipyard), fuel storage (Falmouth Oil Services) and training. On the whole, the port's activities are continuous (24 hours a day). The areas immediately surrounding the port comprise a mix of residential suburban / urban, commercial and industrial uses.

A baseline noise survey has identified the existing noise levels in the areas identified in Figure 4-8. The survey covered weekday and weekends, daytime and nighttime, and times of vessel movements and occupied and unoccupied berths within the docks. The results are summarised in Table 4-3.

Figure 4-8 Baseline Noise Survey Locations

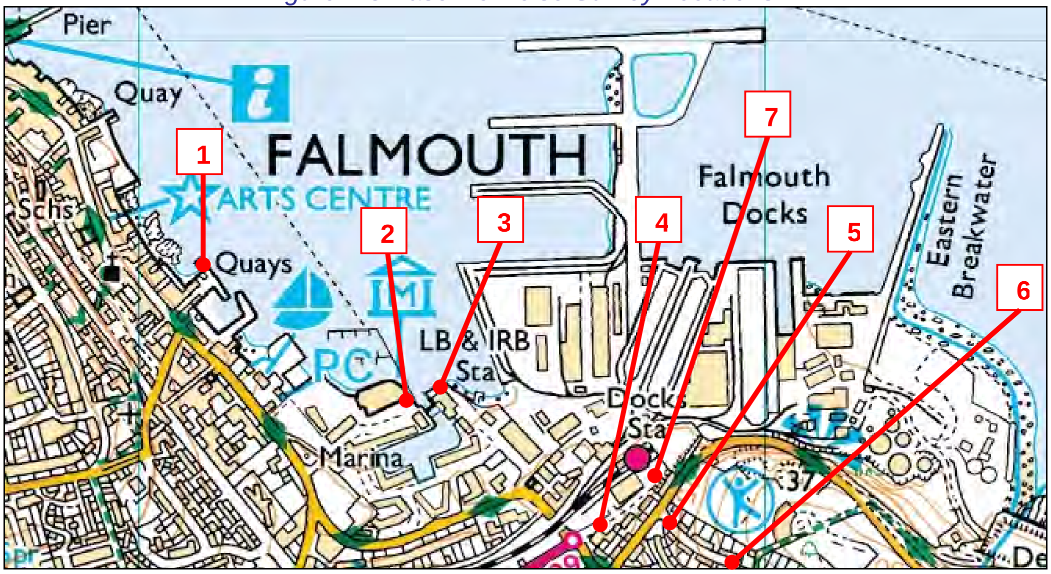


Table 4-3 Summary of existing measured noise levels

Location	Time	dB L_{A90} Boat in	dB L_{A90} Boat out	dB L_{Aeq} Boat in	dB L_{Aeq} Boat out
King Charles Quay	Weekday	51	42	52	45
	Sunday	49	46	50	50
	Night	45	38	46	39
Custom House Quay	Weekday	59	38	60	46
	Sunday	57	46	56	45
	Night	-	-	-	-
Port Pendennis	Weekday	61	43	62	46
	Sunday	56	49	57	52
	Night	43	38	43	39
Pendennis Rise	Weekday	45	45	49	49
	Sunday	-	46	-	49
	Night	37	36	39	37
Tredynas Road	Weekday	42	39	57	57
	Sunday	-	43	-	57
	Night	37	41	38	42
Top (SE) Tredynas Road	Weekday	40	-	42	-
	Sunday	-	39	-	41
	Night	-	42	-	43
Docks railway station car park	Weekday	Non recorded due to construction noise			
	Saturday	45	-	47	-
	Night	-	42	-	43

Of the potentially noise sensitive receptors in Falmouth, the locations can be divided into two clearly distinct environments; waterfront Falmouth and suburban Falmouth. Trefusis Beach represents a third environment completely different environment, the nature of which was not observed but can be inferred.

4.13 Air Quality

The EIA process concerning air quality was informed by baseline air quality data (e.g. Figure 4-9) obtained from the UK Air Quality Archive (UKAQA) and Carrick District Council (CDC) and computational modelling by Royal Haskoning.

Projected concentrations of NO_2, PM_{10} and SO_2 for 2010 include estimated contributions from nearby roads and industrial sources. The concentrations indicate that the relevant air quality objectives are expected to be achieved and that concentrations, although higher in Falmouth than in the surrounding area, are low in the context of typical urban pollution in the UK. Locally elevated concentrations of SO_2 are likely to be due to marine activity around Falmouth Harbour and the docks. It should be noted that, as a result of the European Directive on the Sulphur Content of Marine Fuels (2005/33/EC), the sulphur content of marine fuels for all ships in the English Channel has been reduced from 4.5% to 1.5% since 2007. From 2010, there will be a 0.1% sulphur limit on fuel used by ships at berth in EU ports. These measures should result in a significant decrease in local concentrations of SO_2.

Figure 4-9 Annual Mean Sulphur Dioxide from UKAQA ($\mu g.m^{-3}$)

The Environment Act 1995 introduced a framework of Local Air Quality Management (LAQM) and placed a duty on local authorities to formally assess air quality in their areas. Assessments indicate that all air quality objectives are expected to be achieved across the district in areas where the public might be exposed to air pollution. In Falmouth, high concentrations of NO_2 have been recorded along Market Street, Church Street and Arwenack Street, but recent monitoring confirmed that the annual mean objective for NO_2 was being achieved.

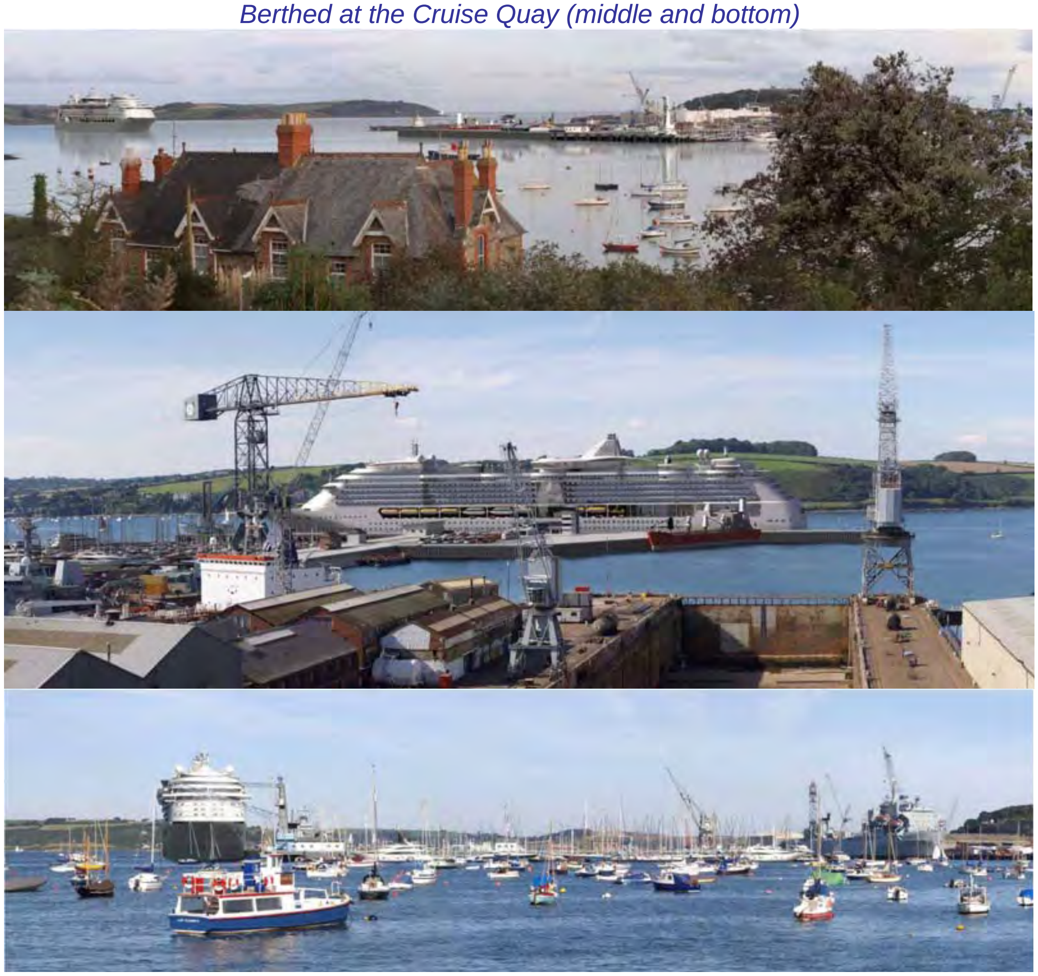
Monitoring was also carried out on the A39, at Dracaena Avenue. The annual mean objective for NO_2 was exceeded at the junction with Grenville Road but it was noted that there are no relevant receptors nearby.

4.14 Landscape and Visual Setting

The EIA process concerning landscape and visual setting was informed by a landscape and visual impact assessment (LVIA) including photomontages (see Figure 4-10), as reported in Falmouth Cruise Project Landscape and Visual Impact Assessment (CEC, 2008).

The landscape within the study area is predominantly of gently undulating to rolling character, with good hedgerow vegetation including trees. There are a number of woodlands on the slopes and in the valleys as well as along the creek sides. There are strong urban influences in some areas, namely Falmouth and Penryn. Carrick Roads are central to the study area with wide expanses of water and adjacent strong maritime influences including industrial features associated with the docks and harbour. The headlands of Pendennis, Trefusis and St Mawes are important landscape features within the study area.

Figure 4-10 Photomontages of Design Vessel Approaching the Cruise Quay (top) and Berthed at the Cruise Quay (middle and bottom)



Landscape designations within the 5km study area likely to experience effects due to implementation of proposals are the Cornwall Area of Outstanding Natural Beauty (AONB), the Roseland Heritage Coast, Pendennis and St Mawes Castle Scheduled Monuments, the South West Coast Path National Trail and Falmouth and Flushing Conservation Areas.

The landscape character within the study area is relatively unified with most of the area being part of the national Cornish Killas national character area and the local Fal Ria area. Other areas encroach around the edges of the study area, but have no real influence on its overall character.

Visually, land within the study area is dominated by marine and maritime influences, Falmouth and Penryn urban areas, the docks and harbour near the coastline, and by strongly rural landscapes with good tree and shrub cover inland. This results in two distinct visual scenarios. One includes long, open views with large water areas and significant amounts of existing development in the scene. The other is one of intimate and often foreshortened rural views due to the undulating landscape in combination with Cornish hedge vegetation and woodlands.

4.15 Land Quality

The EIA process concerning land quality was informed by the Falmouth Cruise Project Phase 1 Contaminated Land Desk Study, by Royal Haskoning (2008).

Falmouth Docks is mainly surrounded by sea with the exception of the south of the site where the dry docks and associated buildings and services and industries such as an oil depot, sewage works and works are present. Residential areas are located further south and to the west.

A review of historical information indicates that the site was developed and used a wharfage area which comprised a series of quays. Trackways and small buildings were also noted. A site walkover showed that trackways were no longer present and that there was an area of reclaimed land. Storage areas, fly-tipping (derelict ship equipments), drums, tanks, and a car park were noted.

The site lies over a layer of made ground overlying the Portscatho Formation of the Devonian Period. This is in turn underlain by the Porthtowan Formation, comprising thick sequence of slate and sandstone, in turns underlain by the Pendower Formation. Ground investigations carried out by Integral geotechnique (Wales) Ltd confirmed this geological sequence.

According the British Geological Survey full radon protective measures are necessary in the construction of new dwellings or extensions for this site.

The site lies over a minor aquifer (variably permeable) and soils are classified as of high leaching potential.

According to Environment Agency records there is one active discharge consent located in the south of the site and held by FDEC.

There have been five pollution incidents within 250m of the site. One of them relates to release of oils-waste oils to tidal waters and has been classified as significant. This occurred approximately 8m to the south-west of the site.

A site investigation by Integral Geotechnique (Wales) Ltd in March 2007 on an area including the study area made the following findings:

- made ground was encountered ranging from 4mbgl (metres below ground level) to 15.5mbgl and comprised generally a sandy clayey shale matrix with some ash and fragments of brick, concrete, coal, tarmac, wood and slate;
- groundwater was recorded in one borehole at 5.85mbglr
- soil results showed the presence of concentrations of metals and hydrocarbons across the site;
- sulphide was found at concentrations ranging from <0.5mg/kg to 7.9mg/kg; and
- ammonia and carbon dioxide were detected during monitoring.

4.16 Socio-Economics

The EIA process concerning socio-economics was informed by the Economic Impact Study and Assessment of Port of Falmouth (Arup, 2008).

Cornwall's population is slowly increasing, however, within this population the proportion of individuals in younger age brackets is decreasing. The proportion of individuals in older age ranges is increasing and expected make up more than a third of the local population by 2028.

The southwest regional employment rate between 2005 and 2007 fell from being slightly above to being slightly below the England and Wales average. The Cornish employment rate is significantly below the regional average. The unemployment rate for Cornwall between 2006 and 2007 was broadly similar to the regional average and is significantly below the national average, implying that there are a significant number of "under-employed" individuals within the workforce who are ineligible for unemployment benefits but may be available and willing to work should work be available.

2007 wage levels in Cornwall and Isles of Scilly are about 8% lower than the southwest region and England and Wales as a whole.

Employment in Cornwall is dominated by the distribution, hotels and restaurant sector and by the public sector (public administration, education and health). Of the two largest sectors, the distribution, hotels and restaurant sector employs only 1% less of the workforce than the public sector. This figure highlights the area's reliance on tourism.

The Indicies of Multiple Deprivation (IMD) is a measure for comparing the relative deprivation of different areas. Within Penyn 12 areas had a IMD score between 40 and 50 indicating moderate to high levels of deprivation. Falmouth is generally less deprived than Penryn with the majority of output areas having an IMD score of 20-40. The areas surrounding the Falmouth/Penryn conurbation generally have scores of between 10 and 20 indicating low levels of deprivation. The town of Redruth is 10 miles to the North West of Falmouth. 3% of the Docks employees commute from this town. Several output areas in Redruth have IMD scores of 57 and are among the most deprived areas in Cornwall.

In terms of education, while a greater proportion of individuals in Cornwall hold qualifications at NVQ levels 1-3 at national level, a lesser proportion hold qualifications at the highest levels of NVQ4 level four and above.

Falmouth Harbour and the docks play an important role in the economy of the town and region. It is the largest private employer in the area currently providing jobs to 978 people. There are five major employers based in the yard, including A&P Falmouth Limited (i.e. FDEC). In addition 17 other firms are located within the docks area. Marine related businesses at Falmouth are estimated to achieve a combined turnover of £60.5 million per year.

5 IMPACT ASSESSMENT

Table 5-1 provides definitions of the significance of predicted impacts in an effort to provide a consistent framework across the various environmental parameters.

Table 5-1 Terminology for Classifying and Determining Impact Significance

Impact	Definition
Negligible	The impact is not of concern
Minor adverse	The impact is undesirable but of limited concern
Moderate adverse	The impact gives rise to some concern but it is likely to be tolerable (depending on its scale and duration)
Major adverse	The impact gives rise to serious concern; it should be considered as unacceptable
Minor beneficial	The impact is of minor significance but has some environmental benefit
Moderate beneficial	The impact provides some gain to the environment
Major beneficial	The impact provides a significant positive gain

Table 5-2 provides an overall summary of the findings of the ES and lists the potential environmental impacts that are predicted to arise during the construction and operational phases of the proposed development, including the disposal of dredged material. The significance of each of the potential impacts is stated, along with any mitigation measures that are recommended to reduce or avoid adverse impacts. The residual impact (i.e. the significance of the potential impact remaining following mitigation) is also stated.

Figure 5-2 Summary of Potential Impacts, Impact Significance, Mitigation Measures and Residual Impacts

Impact	Significance	Mitigation	Residual impact
HYDRODYNAMICS AND SEDIMENTARY REGIME			
Construction			
Change to suspended sediment concentrations during capital dredging	Minor change around the dredger (50mg/l) to negligible change with distance from the dredger (3-5mg/l)	None required	Minor
Change to sediment deposition due to capital dredging	Minor change (1.7mm) to negligible change (0.5mm)	None required	Minor – negligible
Change to suspended sediment concentrations due to disposal of clean dredged material at sea	Minor change (20mg/l)	None required	Minor
Change to sediment deposition due to disposal of clean dredged material at sea	Moderate change (up to 0.5m) within disposal site, minor change (0.05m) within 1km of the disposal site, negligible change (<0.005m) beyond 1km of the disposal site	None required	Moderate – negligible
Operational			
Change to wave conditions	Minor change (<0.2m) at a few sites (mainly in the docks) under certain conditions and negligible change elsewhere	None required	Minor – negligible
Change to tidal conditions	Negligible change	None required	Negligible
Change to mud transport conditions	Negligible change (610m^3/yr)	None required	Negligible
Change to sand transport conditions	Negligible change (20m^3/yr)	None required	Negligible
Change to coastal processes	Negligible change at Falmouth Docks, Kiln Quay and Trefusis. No change at Gyllyngvase and Castle Beaches, Castle Headland, Port Pendennis Marina, the National Maritime Museum, Discovery Quay, Custom House Quay, Visitors Yacht Haven, Fish Strand Quay, Prince of Wales Pier, Admirals Quay, Greenbank Quay and Flushing	None required	Negligible - no change

Impact	Significance	Mitigation	Residual impact
Sediment quality			
Construction			
Impact on sediment quality in the new navigation channel due to capital dredging	Minor adverse impact physically, moderate to major beneficial impact chemically and toxicologically, negligible biologically	None required	Minor adverse physically, moderate to major beneficial impact chemically and toxicologically, negligible biologically
Impact on sediment quality beyond the new navigation channel due to capital dredging	Negligible impact physically, chemically and toxicologically and no impact biologically	None required	Negligible physically, chemically and toxicologically and no impact biologically
Impact on sediment quality due to disposal of dredged material	Minor adverse impact physically, neglingible impact chemically, biologicall and toxicologically	None required	Minor adverse physically, neglingible chemically, biologicall and toxicologically
Operational			
Impact on sediment quality in the new navigation channel after capital dredging	Negligible impact physically, chemically, biologically and toxicologically	None required	Negligible
Water quality			
Construction			
Impact on dangerous substances water quality due to capital dredging - TBT	Moderate adverse impact for TBT, negligible for other contaminants	None required	Moderate adverse - negligible
Impact on shellfish water quality due to capital dredging	Minor - moderate adverse impact for TSS in Carrick Roads and Penryn shellfish waters, negligible impact for other contaminants in Carrick Roads and Penryn shellfish waters, no impact in Percuil shellfish water	None required	Minor - moderate adverse (TSS) and negligible (other contaminants) in Carrick Roads and Penryn River and no impact in Percuil River
Impact on bathing water quality due to capital dredging	No impact	None required	No impact

Impact	Significance	Mitigation	Residual impact
Impact on water quality due to accidental spills and leaks during construction	Not applicable – risk, not impact	Oil spill planning and pollution prevention guidance	Not applicable – risk, not impact
Operational			
Impact on dangerous substances water quality due to capital dredging	Moderate beneficial impact due to removal of contaminants, especially TBT	None required	Moderate beneficial
Impact on water quality due to wastewater from the cruise terminal building	No impact due to use of appropriate sewage treatment works	None required	No impact
Impact on water quality due to wastewater from cruise vessels	No impact due to international law on ship waste management	None required	No impact
MARINE AND COASTAL ECOLOGY			
Construction			
Loss of maerl in the proposed new navigation channel due to capital dredging	Major adverse impact from removal of viable maerl habitat	Seabed habitat mitigation is proposed in order to replace viable maerl habitat, this will offset any net loss of maerl habitat as a result of the dredge.	Moderate – minor adverse
Loss of benthic communities in the propsed new navigation channel due to capital dredging	Moderate adverse impact as a result of the loss of benthic communtites	See above	Minor adverse
Physical impacts to benthic fauna from increased TSS concentrations due to capital dredging	Minor adverse impact on benthic communities from increased TSS from dredging	None required	Minor adverse
Physical impacts to benthic fauna from increased sediment deposition due to capital dredging	Minor adverse impact on benthic fauna	None required	Minor adverse

Impact	Significance	Mitigation	Residual impact
Chemical impacts on benthic fauna from increased contaminant concentrations in the sediment due to capital dredging	Minor adverse impact	None required	Minor adverse
Impacts on benthic ecology due to wharf improvements	Negligible impact	None required	Negligible
Impacts on intertidal ecology due to coastal erosion protection	Minor adverse impact	None required	Minor adverse
Physical impact on benthic fauna from sediment desposition due to the disposal of dredged materail	Minor adverse impact	None required	Minor adverse
Operational			
Impacts to marine ecology from changes to hydrodynamics and sediment transport due to the new navigation channel	Minor adverse impact	None required, however monitoring is proposed to ensure that there are no unanticipated impacts	Minor adverse
ORNITHOLOGY			
Construction			
Temporary loss of breeding and foraging habitat due to construction	Negligible	None required	Negligible
Noise disturbance from construction activities	Negligible	None required	Negligible
Light disturbance from construction activities	Negligible	None required	Negligible
Operational			
Disturbance to feeding and roosting waterbirds due to increased shipping activity	Negligible	None required	Negligible

Impact	Significance	Mitigation	Residual impact
TERRESTRIAL ECOLOGY			
Construction			
Loss of habitat	Negligible	None required	Negligible
Operational			
None predicted			
FISHING AND SHELLFISH RESOURCES			
Construction			
Physical impacts to shellfish from increased TSS concentrations due to capital dredging	Minor adverse at the nearest point of the Truro oyster beds, when dredging near Carrick Roads	None required	Minor adverse
Physical impacts to finfish from increased TSS concentrations due to capital dredging	Negligible	None required	Negligible
Physical impacts to shellfish from increased sediment deposition due to capital dredging	Minor adverse	None required	Minor adverse
Physical impacts to finfish from increased sediment deposition due to capital dredging	Negligible	None required	Negligible
Chemical impacts to shellfish from increased contaminant concentrations in the water due to capital dredging	Minor adverse for TBT but not other contaminants	None required	Minor adverse
Chemical impacts to shellfish from increased contaminant concentrations in the sediment due to capital dredging	No impact	None required	No impact
Chemical impacts to finfish from increased contaminant concentrations in the water due to capital dredging	Minor adverse	None required	Minor adverse

Impact	Significance	Mitigation	Residual impact
Physical impacts to shellfish and finfish from sediment deposition due to disposal of dredged material	Minor adverse due to most sediment depositing within the disposal site	None required	Minor adverse
Impacts to fish and shellfish from direct uptake by dredgers	Negligible	None required	Negligible
Operational			
Impacts to shellfish resulting from changes in hydrodynamic regime due to the new navigation channel	Negligible	None required	Negligible
COMMERCIAL FISHERIES AND SHELLFISHERIES			
Construction			
Potential impact on fishing gear and fishing activity due to capital dredging and the disposal of dredged material	Minor adverse impact on fishing activity immediately adjacent to the disposal site, negligible impact on fishing activity in the Fal Estuary and on fishing gear deployed in Falmouth bay and the Fal Estuary	Extra publicising of works prior to works through media and during work through VHF broadcasts, creation of a dedicated sailing route and deposition zone for works, FHC to revise its Policy on the Deployment of Fishing Equipment within Falmouth Harbour Area	Negligible
Potential impact on commercial fisheries from increased chemical contaminant concentrations due to capital dredging	Minor adverse impact on the Truro oyster fishery from increases in TBT concentrations	None required	Minor adverse
Potential impact on oyster depuration from increased chemical contaminant concentrations due to capital dredging	Minor adverse impact	If the lease is maintained, it may be necessary for the authorities monitoring programme to be extended to cover TBT concentrations	Minor adverse

Impact	Significance	Mitigation	Residual impact
Operational			
None predicted			
NAVIGATION AND RECREATION			
Construction			
Impact on commercial navigation due to construction in the water	Negligible	None required	Negligible
Impact on general recreation due to construction in the water	No impact on marinas, leisure mooring areas and designated zones for water-skiing, bathing and water sports	None required	No impact
Impact on diving due to construction in the water	Moderate adverse impact on diver safety and recreational diving activities	Publicising of works prior to works through media and during work through VHF broadcasts, creation of a dedicated sailing route and deposition zone for works, FHC to revise its protocol for recreational diving in the Falmouth Harbour and Bay areas	Minor adverse
Impact on angling due to construction in the water	Minor adverse impact on angler safety and recreational diving activities	Publicising of works prior to works through media and during work through VHF broadcasts, creation of a dedicated sailing route and deposition zone for works, FHC to revise its Policy on the Deployment of Fishing Equipment within Falmouth Harbour Area	Negligible
Operational			
Impact on commercial and recreational navigation due to the cruise vessel movements	Negligible	None required	Negligible

Impact	Significance	Mitigation	Residual impact
ARCHEOLOGY AND HERITAGE			
Construction			
Changes to the Northern Wharf and Queens Wharf due to wharf improvements	Minor adverse impact due to demolition and disturbance to the Northern Wharf's structures	Photographic record of the Northern Wharf	Negligible
Disturbance to wrecks and wreckage due to capital dredging	Potential major adverse impact due to disturbance of features and wreckage	Archaeological Protocol and Written Scheme of Investigation including an archaeological watching brief and a system for recording finds	No impact
Dredging disturbance to prehistoric landsurfaces	Minor - major adverse impact due to loss of sequence record	Archaeological Protocol and Written Scheme of Investigation including a long vibrocore and full archaeological analysis and dating	Minor - moderate beneficial
Disturbance to prehistoric landsurfaces due to disposal of dredged material at sea	Potential moderate adverse impact due to wreck damage	Under the WSI identified earlier, the condition of wreck 17502 should be verified, and following discussion with English Heritage, a possible exclusion zone for dumping of dredged material may be defined.	Negligible
Operational			
Change to the visual setting of scheduled monuments due to the cruise building and wharf improvements	Negligible impact	Sympathetic and high quality detailed design and architecture for the cruise terminal building	Negligible
Change to the historic landscape character due to the cruise building and wharf improvements	Potential moderate adverse impact	Sympathetic and high quality detailed design and architecture for the cruise terminal building	Minor beneficial

Impact	Significance	Mitigation	Residual impact
TRAFFIC			
Construction			
Changes to traffic flows on the local road network during construction	Moderate adverse impact on the docks estate's road network	Conduct TA, derive and adopt suitable mitigation measures	Minor adverse
Changes to traffic flows within Falmouth Docks during construction	Moderate adverse impact on the local road network	Conduct TA, derive and adopt suitable mitigation measures	Minor adverse
Operational			
Changes to traffic flows due to day calls	Moderate adverse impact on the local road network	Conduct TA, derive and adopt suitable mitigation measures	Minor adverse
Changes to traffic flows due to turnaround calls	Minor adverse impact on the local road network	Conduct TA, derive and adopt suitable mitigation measures	Minor adverse
NOISE AND VIBRATION			
Construction			
Disturbance due to on-site construction noise	Moderate adverse impact on Falmouth receptors and potential major adverse impact on Trefusis receptors due to piling works, and no impact due to other construction works	Agreement with the local Environmental Health Department including hours of working and construction methods, including piling. General application of the principles of Best Practicable Means (BPM), as defined in BS 5228 and The Control of Pollution Act 1974. Community liaison	Minor – moderate adverse during piling works
Disturbance due to construction traffic	Moderate adverse impact on site, particularly to receptors at the Maritime Apatments. Moderate or major adverse impact off site, particularly to receptors along haul routes	On site: maintain surface of haul road in good condition to prevent adverse noise caused by vehicle jolting over surface irregularities. Ensure low speed within the site. Community liaison	Minor adverse

Impact	Significance	Mitigation	Residual impact
		Off site: conduct TA and produce and mitigation measures accordingly	
Operational			
Disturbance due to cruise vessels	Moderate beneficial impact due to berthed vessels	None required	Moderate beneficial
Disturbance due quay operations	Minor to moderate adverse impact	Guidance on the use of PA systems	Minor adverse
Disturbance due to traffic	Moderate adverse impact as a result of extra vehicle movements	Conduct TA and produce and mitigation measures accordingly	Minor adverse
AIR QUALITY			
Construction			
Inpact on air quality during construction	Moderate adverse impact from dust emmsions on sensitive receptors	Environmental management plan	Minor adverse
Operational			
Emission of pollutants due to increased sizes and numbers of vessels	Minor adverse impact due to more vessel calls and larger engines	None required	Minor adverse
Emission of pollutants due to increased road traffic	Moderate adverse impact on nearby sensitive residential receptors	Conduct TA, refine the impact assessment, and, if necessary, to derive suitable mitigation measures	Minor adverse
LANDSCAPE AND VISUAL SETTING			
Construction			
Impacts to landscape designation	Major adverse impact during works on Cornwall AONB and South West Coat Path National Trail	None required	Major adverse
Impacts to landscape character	No impact	None required	No impact
Impacts to landscape elements and features	No impact	None required	No impact
Visual impacts as a result of the construction of the project	Various moderate to major adverse impacts depending on location of the visual receptor	Minimise the duration of the works as far as possible	Moderate to major adverse

Impact	Significance	Mitigation	Residual impact
Operational			
Changes to landscape and visual interests due to cruise vessels	Major beneficial impact when design vessel is berthed and no impact when sailing or bething	None required	Major beneficial and no impact
Changes to landscape character due to landside development	No impact	None required	No impact
Changes to landscape elements and features due to landside development	Minor adverse impact from loss of vegetation on the AONB	Replacement planting	Negligible
Changes to visual interests due to land-side development	Moderate to major impact on a number of visual receptors in the area, adverse on beneficial dependant on subjective point of view	Sympathetic choice of materials. Terminal design in line with other marine development in the area.	Moderate to major adverse / beneficial
SOIL QUALITY AND GEOLOGY			
Construction			
Impact to human health – site workers	Medium adverse risk	Various risk management actions	Low adverse
Impact to shallow perched groundwater	Medium adverse risk	Various risk management actions	Low adverse
Impact to deep groundwater	Medium adverse risk	Various risk management actions	Low adverse
Impact to surface water	Medium to high adverse risk	Various risk management actions	Low adverse
Impact to neighbouring properties and land use	Low adverse risk	Various risk management actions	Low adverse
Impact to ecological receptors	Medium adverse risk	Various risk management actions	Low adverse
Impacts to buildings and structures	Medium adverse risk	Various risk management actions	Low adverse
Operation			
Impact to human health – site workers	Medium adverse risk	Various risk management actions	Low adverse
Impact to shallow perched groundwater	Medium adverse risk	Various risk management actions	Low adverse
Impact to deep groundwater	Medium adverse risk	Various risk management actions	Low adverse
Impact to surface water	Medium to high adverse risk	Various risk management actions	Low adverse
Impact to neighbouring properties and land use	Low adverse risk	Various risk management actions	Low adverse
Impact to ecological receptors	Medium adverse risk	Various risk management actions	Low adverse

Impact	Significance	Mitigation	Residual impact
Impacts to buildings and structures	Medium adverse risk	Various risk management actions	Low adverse
SOCIO-ECONOMIC			
Construction			
Increased local employment through construction	Moderate beneficial impact	None required	Moderate beneficial
Operational			
Additional direct revenue to port based businesses from cruise ships	Minor beneficial	None required	Minor beneficial
Additional spend by cruise passengers and crew	Moderate beneficial	None required	Moderate beneficial
Additional employment by A&P Falmouth and other port related businesses	Moderate beneficial	None required	Moderate beneficial

6 CUMULATIVE IMPACTS

6.1 Introduction

As part of the EIA process, it is important to consider the potential for the significant impacts that are predicted to arise as a result of the proposed development to interact with each other and with those of other existing or reasonably foreseeable future plans or proposed projects. Cumulative effects imply interaction between potential impacts, possibly resulting in an impact of greater (or lesser) significance than the effects in isolation. The scope of plans or projects to be included in a cumulative impact assessment can be defined as those projects whose effects may overlap with the proposed scheme in space or time. The assessment of cumulative impacts is limited to plans or projects for which sufficient information exists to allow consideration of the potential for a cumulative effect to arise. In the absence of publicly available information (usually in the form of a planning application), it is not possible to undertake a proper consideration of cumulative effects (i.e. if proposals are speculative or where assumptions regarding potential impacts may be contentious).

Any impacts arising from already implemented projects (e.g. re-building of the Queens Wharf, National Maritime Museum, Maritime Apratments) are manifest in the baseline conditions described in this ES. Therefore, these impacts have been taken into account in the main impact assessment (i.e. Sections 5 to 20) and are not considered as cumulative impacts.

The following paragraphs summarise the cumulative impacts associated with four projects which have the potential to result in cumulative impacts with the proposed Falmouth Cruise Project.

6.2 Cumulative Impacts with Port Falmouth Marina

Port Falmouth Marina will be situated in the western part of Falmouth Docks. It comprises five floating mooring pontoons enclosed by a floating breakwater and provides c.300 berths, shore-side car parking for 300 cars, waste reception and recycling facilities, and a marina reception building (converted from a historic dock building) including office, shower, toilet and laundry facilities.

This marina development is expected to be in place before the proposed Falmouth Cruise Project construction period and the potential for cumulative impacts is largely limited to its operational phase. In terms of the marine environment, the proposed Falmouth Cruise Project and marina are not expected to interact significantly and therefore there will be negligible cumulative impact on hydrodynamic conditions, sediment transport conditions, sediment quality, water quality, marine ecology and fisheries. In terms of the land environment, the proposed Falmouth Cruise Project and marina will operate side by side within Falmouth Docks and will interact to have cumulative impacts, particularly for traffic (e.g. numbers of vehicles using the local road network) and associated noise and air quality, and on archaeology (e.g. visual setting of historic monuments) and landscape (e.g. visual interest).

6.3 Cumulative Impacts with Port Pendennis Marina Extension

Port Pendennis Marina is situated at Challenger Quay, between the National Maritime Museum and Falmouth Docks. The marina extension will require an eastwards repositioning and northwards extension to the main access pontoon, a new pontoon and some new moorings.

The marina extension is expected to be in place before the proposed Falmouth Cruise Project construction period and the potential for cumulative impacts is largely limited to its operational phase. The cumulative impacts will be of a similar nature as those described for Port Falmouth Marina, but will be less significant since this project is an extension to an existing marina, is adjacent to but not within Falmouth Docks, and is smaller in scale compared to Port Falmouth Marina.

6.4 Cumulative Impacts with Visitors Yacht Haven Capital Dredging

The Visitors Yacht Haven is situated in Falmouth Harbour between Custom House Quay and Fish Strand Quay, and has approximately 100 berths. It is believed that FHC is considering whether to dredge approximately 1000m^3 to improve access. Dredging and disposal of dredged material at the designated disposal site in Falmouth Bay could overlap with the Falmouth Cruise Project.

The cumulative impacts will be of a similar nature as those described for Port Falmouth and Port Pendennis Marinas, but will be much less significant since this project is more distant from Falmouth Docks. The volume of material to be disposed of is likely to be very small (c.1000m^3) compared to the volume from the proposed Falmouth Cruise Project (600,000m^3). Therefore, should the disposal activities coincide the cumulative impact will not be noticeably different from that impact resulting from the Falmouth Cruise Project alone.

6.5 Cumulative Impacts with Port of Truro Maintenance Dredging

The Port of Truro is situated in the upper extents of the Fal Estuary and requires dredging on a semi-regular basis to maintain access to and mooring at its berths. The dredged material is disposed of at sea at the designated disposal site in Falmouth Bay. It is believed that a future dredging and disposal operation could overlap with the Falmouth Cruise Project.

None of the predicted impacts of the proposed Falmouth Cruise Project will extend into the northern half of the Fal Estuary and will not overlap with the areas subject to maintenance dredging at the Port of Truro. Accordingly, the only potential for cumulative impacts relates to disposal of dredged material at the designated disposal site in Falmouth Bay. The volume of material to be disposed of is likely to be very small compared to the volume from the proposed Falmouth Cruise Project (600,000m^3. Therefore, should the disposal activities coincide the cumulative impact will not be noticeably different from that impact resulting from the Falmouth Cruise Project alone.

7 IMPLICATIONS FOR THE DESIGNATED STATUS OF THE FAL & HELFORD ESTUARIES SAC

7.1 Overview of Potential Impacts on the SAC

This section builds upon the EIA process to provide information to inform an ‘appropriate assessment’ of the proposed Falmouth Cruise Project in relation to the Fal and Helford

Estuaries SAC, and in accordance with the Conservation (Natural Habitats &C) Regulations 1994.

The SAC includes the following designated features:

- large shallow inlets and bays;
- sandbanks which are slightly covered by sea water all the time;
- mudflats and sandflats not covered by seawater at low tide; and
- Atlantic salt meadows (English Nature, 2000).

Natural England's conservation objectives for the SAC are to maintain the features in favourable condition, subject to natural change.

The main way in which the SAC features could be affected is through removal of habitats and communities from the SAC during the capital dredging works. Assessments have been made for the following potential effects:

- removal of habitats due to capital dredging;
- removal of species / communities due to capital dredging;
- potential changes to hydrodynamics due to capital dredging;
- potential impacts relating to sediment quality due to capital dredging; and
- potential impacts relating to water quality due to capital dredging.

In order to mitigate the impact associated with the removal of maerl habitats and to ensure that the extent of the maerl matrix habitat is not reduced, it is possible to overdredge specific areas and place mixed maerl habitat back onto the seabed to ensure that a viable habitat remains (i.e. a habitat of substrate depth of at least 1m). By undertaking habitat mitigation, the total area of maerl and mixed maerl habitats may be returned to that of the pre-dredge area of 18.8ha.

7.2 Implications for Integrity of the SAC

An assessment predicted that none of the favourable condition targets are expected to be affected beyond a temporary change in habitats until mitigation replaces the lost habitat and a longer term change in community types until recolonisation occurs. It is therefore considered that the dredging associated with the cruise terminal facilities will not have an adverse long term effect on the integrity of the SAC. This is for the following reasons:

- the communities that have returned to the areas subject to maerl extraction in 2004 are the same community type as those that occur in the channel area;
- there is unlikely to be a requirement for regular maintenance dredging, particularly in the outer channel area where the mitigation is proposed;
- the predicted effects on hydrodynamics are minimal causing small, localised changes in tidal currents and wave energy;
- the communities that occur in the channel also occur on a variety of substrate types and as such are not specific to narrow habitat requirements;
- the sedimentary characteristics of the site can, through the implementation of mitigation measures, be returned to pre-dredge conditions during the dredge activity;
- recovery of species within other areas of the estuary has occurred within three years to similar community dominance structures although to different community types thought to be due to the change in sediment types;

- recovery of coarse sediment communities has been well studied in the past and studies have shown success at recovering to similar communities; and
- studies on community succession have enabled accurate predictions to be made on the ability of communities to recover; and
- the recovered communities should continue to make the same contribution to favourable status for the interest features as it did when the site was designated.

8 PROPOSALS FOR MONITORING

8.1 Changes to Suspended Sediment and Contaminant Concentrations in the Fal Estuary due to Captial Dredging

It is anticipated that water quality monitoring will need to take place during the capital dredging to record the changes to suspended sediment (as TSS) and a range of chemical contaminants. This will allow the changes to be compared to the water quality requirements of the relevant EC Directives.

A monitoring plan will need to be agreed with the Environment Agency. It is anticipated that a baseline will not need to be established prior to the capital dredging works since the Environment Agency already monitor wate quality in the estuary. Sampling sites will have to be agreed with the Environment Agency, and it may be most suitable to use the sites already used to monitor water quality (e.g. for shellfish waters in Carrick Roads, Penryn River and Percuil River).

It is anticipated that monitoring may have to take place on a real time basis. Therefore, it may be appropriate to install turbidity metres that record and send data at regular intervals (e.g. 15 or 30 minutes). If it is necessary to provide real time results for TSS and chemical contaminants, then the turbidity data would need to be calibrated against measured TSS concentrations and translated into chemical contaminant concentrations using the TSS concentrations and partition coefficients.

8.2 Changes to Bathymetry and Marine Ecology in Falmouth Bay due to Disposal of Dredged Material

It is anticipated that bathymetry and marine ecology monitoring will need to take place after the disposal of dredged material to record the changes to bathymetry and benthic communities in and around the Falmouth Bay disposal site.

A monitoring plan will need to be agreed with the MFA and CEFAS. It is anticipated that a baseline may need to be established prior to the disposal activities. It is anticipated that monitoring will include a pre- and post-disposal bathymetric survey, and at least a post-disposal survey of benthic communities.

8.3 Recovery of Maerl Habitat and Communities due to Mitigation Seabed Habitat

The suggested mitigation measures and recovery potential for the habitats in the SAC affected by the capital dredging will require monitoring to record the habitat distribution and the recolonisation patterns. The monitoring will have the objective of checking that the site does recolonise as expected. The detailed monitoring plan will need to be agreed with Natural England in advance of any works.

A monitoring plan will need to be agreed with Natural England. It is anticipated that a baseline will need to be established prior to the capital dredging works, with sampling sites selected based on the previous surveys and the proposed mitigation works.

8.3.1 Habitat Monitoring

It is anticipated that monitoring of habitat types will need to be undertaken immediately after dredging to record the effectiveness of the habitat mitigation. This should be undertaken by suction pipe sampling and analysis to record the depths of sediment present within the new navigation channel.

It is anticipated that monitoring will need to be undertaken in the areas surrounding the new navigation channel to ensure that the sediment plume created during dredging does not deposit and hereby affect any sensitive habitats. Computational modelling predicts that the plume should remain to the west of the channel area and should therefore not affect the live maerl bed and the seagrass beds to the east and north of the channel area. However, it is recommended that these habitats are monitored following the dredging activity to ensure that no impacts have occurred due to sediment deposition. This monitoring would include the seagrass beds on the shallow sandbanks between Trefusis and Penarrow Points.

8.3.2 Community Monitoring

Sampling will follow the methodology used for the previous surveys, namely diver core samples and transects across the channel areas. The monitoring will be quantitative to enable statistical analysis to be undertaken to determine changes in community types over time. The monitoring will be undertaken at annual intervals at the same time as the baseline is established (ideally this will be undertaken in summer) for a duration of at least five years. Annual reports will be produced which would be discussed at a regulators meeting where any actions necessary will be agreed.

8.4 Archaeological Watching Brief and Recording of Finds during Capital Dredging

Mitigation for a number of potential impacts on archaeology includes monitoring activities to be undertaken according to an Archaeological Protocol and Written Scheme of Investigation (WSI).

The Archaeological Protocol will include monitoring in the form of an archaeological watching brief during capital dredging of the new navigation channel, with provision for intervention if archaeological material of maritime interest is identified during this process. It would not be practicable or productive for an archaeologist to be on site constantly during the dredging and a pragmatic approach to the watching brief should be adopted. For example, the project archaeologist could visit the site on the first day of dredging to inspect the method of working and the potential for archaeological screening and to liaise with the appointed constructor's staff with regard to the identification of artefactual material. Subsequently, the watching brief would operate on a call out basis, with the appointed contractor contacting the project archaeologist in the event of anything out of the ordinary being dredged up and the archaeologist making a weekly visit to inspect the work in progress.

A system for reporting finds of archaeological interest could be adopted, closely following the British Marine Aggregate Producers Association and English Heritage Protocol. The appointed contractor would nominate one of their staff as a Site Champion for archaeology that would be issued with a flow chart setting out the actions to be taken when they are told about a discovery. The Site Champion would fill in a pro forma Preliminary Record sheet for each find, and would inform the Project Archaeologist. The Project Archaeologist should be present when the areas of selected targets such as GT 31 and GT 40/41 are dredged with a view to recovering at least one of these objects to enable a positive identification to be made.

The monitoring will allow for any features or wreckage to be preserved by record, and could potentially add additional information to our knowledge and understanding of the site and the historical development of Falmouth.

8.5 Gas Monitoring for Detailed Risk Assessment

A contaminated land site investigation has been carried out on the site to be affected by the proposed Falmouth Cruise Project. While it is considered that the number of window samples provided a sufficient spatial coverage for a preliminary assessment, however, of the boreholes constructed only two dual monitoring wells were installed for ground gas and groundwater sampling. Since ground gases have been identified at the site, it is recommended that further gas monitoring wells are installed to fully assess the risks associated with the presence of ground gas at the site and delineate the areas affected by the ground gases. These further boreholes may also provide additional information on groundwater quality and flow regime.