# Hayle Coastal Communities Team

# Economic Plan and Business Case

# Project Phase 1 Report

## (Final Version)

February 2016

**This report was written on behalf of the Hayle Coastal Communities Team**

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# 1 Executive Summary

The Hayle Coastal Communities Team project was established by the Hayle Harbour Advisory Committee in 2015 and has been funded by a DCLG Coastal Community grant. The HCCT team is made up of individuals and stakeholders who have a direct interest to support the future sustainable development of Hayle Harbour.

This reports documents to outcome and findings of phase 1 of the HCCT project. This first phase has focused on the issues related to harbour navigation and access, with the aim to identify practical and acceptable solutions to restore and maintain water depth and safe navigation within the harbour and its channels, and to develop a business case to support investment.

The HCCT has been supported in its work by a large group of local stakeholders, the Hayle Harbour Authority, Cornwall Council and by contributors from the marine industry, other UK ports and organisations. Where possible their contributions have been acknowledge throughout the report

The HCCT project has started from a point of very broad consensus and agreement that:-

- The future of Hayle Harbour as a safe operating port is essential for the development of the town and the wider Cornish economy – including the investment made within Hayle
- The situation in the port has now reached a tipping point, whereby channel access and the loss of water depth is now impacting greatly on the ports viability and safe operation
- Future water depth management options (dredging and sluicing) must be done in a way which protects the estuaries important wildlife habitats, public amenities, beaches and sand dunes and properties.
- Action needs to be taken quickly, and in the absence of perfect data and perfect solutions, it is better to get initiatives started which can form the basis for future development.

The conclusion that the Harbour has reached a tipping point is drawn from the comments made by harbour users regarding access and safety, the visible deterioration and variance of the channel, and the survey evidence that the harbour has lost at least 1.5m (possibly 2m) of water depth within the inner harbour, approach channel and at the Hayle bar since the 1970's.

The HCCT project analysis suggest that the issues can be addressed if practical measures are taken and it is therefore recommended that steps are now taken to:

1. Improve water depths by on average 1m and reinstate the channel. The proposed remedial works are less extensive than the solutions identified by the Buro Happold report of 2011, but would still require the removal, and redistribution within the sand cell, of at least 180,000 tonnes of material (cost estimate £460k) and the reinstatement of the training wall.

2. Implement of an ongoing programme of water depth management using a combination of sluicing, targeted dredging and possibly plough dredging which would entail an estimated annual operating cost of roughly £100k per year depending on the mode of operation adopted and the effectiveness of remedial measures.

It is expected that the full remedial programme may take 3 years to execute, however the target should be to reinstate the channel and open navigational access to the channel, leading to the re-deployment of proper channel navigational market buoys in year 2.

Rather than wait for a full solution, it is also recommended that steps are quickly taken to reintroduce a partial sluicing regime from the Carnsew Pool, reinstate the training wall in the channel and begin immediate dredging within the harbour area.

The measures identified have a significant cost, and since it is accepted that removal of material from the sand cell for a commercial return is no longer sustainable, these costs must be either be met from within the Hayle Harbour business model or from other funding sources.

The urgent remedial works are likely to require investment funding. The HCCT project has however set itself the goal to identify additional sources of revenue and new business opportunities which would in time cover the additional operating costs of the harbour. The business case outlined in sections 8 and 9 has identified a number of revenue sources; protecting and enhancing revenue from existing harbour users, attracting new customers and developing new opportunities notably associated with marine energy and the wider growth of research and innovation in the marine industries.

Meeting the increased costs of maintaining the harbour will be a challenge, the analysis suggests however that revenues could be increased relatively quickly if the port is able to establish itself once again as a centre for marine operations, marine innovation and research, and an attractive location for marine leisure and tourist users. If successful it is estimated that the harbour could provide employment for 60 Full Time Equivalent (FTE) people by 2020 and over 100 people by 2025.

The report concludes that the alternative, to do nothing, is not an option. Hayle has a strategic importance as one of the few ports of refuge and potential operation on the North Cornish coast. Hayle has benefited from significant infrastructure and regeneration. There is a risk that full benefits of these investments, and the potential future growth in jobs which has been identified for Cornwall's marine sector, will not be fully realised if the port ceases to function safely.

As important perhaps as the economic benefits, the HCCT conclusions have been greatly influenced by the commitment and support that has been given to Hayle Harbour by numerous local people, stakeholders and businesses.

In the next phase of work outlined in section 10, the HCCT project team hopes to work closely with the Hayle Harbour Authority, Cornwall Council and the Cornwall and IoS Local Enterprise Partnership, to implement the proposed measures and address the outstanding issues identified in the report.

# 2 Introduction and strategic context

## 2.1 About the Hayle Coastal Communities Team (HCCT) project

As a partnership of experienced local business people, harbour users, the Harbour Master, academic, community, environmental and local authority representatives, the Hayle Harbour Advisory Committee (established in 1989 under the Hayle Harbour Act) has brought together a wide range of stakeholders who have a common objective to support the sustainable development and regeneration of Hayle Harbour.

In July 2015, the Hayle Harbour Advisory Committee, set up the Hayle Coastal Communities Team (HCCT) subcommittee to draw up a detailed plan for regenerating the harbour and estuary with the focus on actions that will act as a catalyst for revitalising the town.

The HCCT subcommittee consists of the following individuals and stakeholder groups.

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| **Chair and Hayle Town Councillor** | **Cornwall Council** |
| Cllr Bob Mims | Vanessa Luckwell |
| **Hayle Harbour Authority Operations Ltd** | **Hayle Harbour Users Group** |
| Peter Haddock, Hayle Harbour Master | Robb Lello |
| **Hayle Harbour Advisory Com. & Town Council** | **Hayle Fishermen's Association** |
| Cllr John Bennett | Peter Ghey |
| **Save our Sands and Hayle Town Council** | **Hayle Chamber of Commerce and Canoe Club** |
| Cllr Anne-Marie Rance | Rob Jewell |
| **Wave Hub Ltd** | **RSPB** |
| Helen Wilson-Prowse & Claire Gibson | David Flumm |

The HCCT quickly identified that the priority for phase 1 of the project should be to address the issue of navigational access to the harbour, and the maintenance of the harbour channel and operations. This therefore formed the basis of a successful bid to the Department for Communities and Local Government (DCLG), and the award of a £10,000 Coastal Community grant, to explore how restorative harbour works could be used to improve accessibility to the harbour to strengthen and grow the local economy.

For a number of reasons, which are described in more detail within the report, the issue of harbour sedimentation and proposals to deal with its impacts have been contentious within the local community, and has frequently pitted the requirements of harbour users and economic interests against the concerns of local stakeholders, environmental and conservation bodies.

The issue of dredging, and wider proposals for harbour development, has also been the subject of numerous studies over the last decade including a previous sedimentation and dredging study conducted by Buro Happold in 2010[1].

The HCCT has therefore been very determined not to simply replicate previous studies, or to come to an intransigent position on future options. The ethos of the project, and the way in which the team has worked together, has instead tried to:

- Be open and inclusive of all views and stakeholders concerns at the outset
- Seek to identify areas of agreement and consensus (of which there are many) as the starting point for discussion
- Acknowledge that compromises will have to be made and that there will have to be willingness to consider and try new options
- Identify practical and realistic measures which could be quickly taken – drawing heavily on the team's local knowledge and the experience of other similar harbours around the coast
- Accept that, with imperfect information and imperfect solutions, there will have to be an element of trial and error and that it is better to get initiatives started, monitor their effectiveness and impacts, and then potentially adapt future measures.

The work of the HCCT has been underpinned by a number of key tenets for which there is a very strong consensus:

1) **Something needs to be done.** The current situation which allows the harbour to silt up, with seasonal fluctuations in the channel, is not tenable. It undermines current and future investment and critically threatens both the livelihood and the safety of the harbour and its users.

2) **That it is critical now to make a start** – working together to initiate a programme of measures which can then be adapted or extended to unlock further opportunities and help to address environmental concerns

3) **Dredging and any other mitigation measures should not jeopardise the sand, beaches, flooding and coastal environment.** As a general principle the HCCT has accepted that while dredging and other measures are necessary, ways should be found such that sand is not removed from the overall "sand cell" but may instead be better used to improve sand dune and beach regeneration.

4) **Protecting Hayle's historic and environmental legacy is critical.** Hayle has a unique place within Cornwall's industrial history, which is now recognised as part of its UNESCO World Heritage designation. Hayle Harbour, its tidal lagoons and coastal environments have also become important habitats for wildlife, as well as providing amenity space for local people and visitors.

[1] Buro Happold Hayle Harbour – Maintenance Dredging Protocol Document May 2010

With the objective to maintain and improve harbour access and safety, while protecting the harbour and coastal environment, the HCCT team has therefore explored a number of potential options to assess their practical effectiveness and associated costs. The practical options considered by the team, which include sluicing, plough dredging and mechanical dredging, seek to make best use of existing assets and infrastructure within the harbour, and to provide cost effective solutions which could be quickly implemented within the existing planning and environmental constraints.

One recurring challenge for the HCCT has been to consider how any future measures will be funded. The harbour, like many small harbours, currently does not make a profit and has a very limited operational income based on revenue from harbour users and some additional funding from the harbour owners and other sources. While it is clear that the harbour creates, and has the potential to create, significant value both for the town and wider region, a way needs to be found to translate that inherent value into a sustainable business model.

The options considered, associated costs and recommendations for future solutions, are presented in the remainder of this report.

***Hayle Coastal Communities Team July 2015***

***"A safe and fully functioning harbour will contribute to the vitality of the whole of Hayle through the growth of investment, jobs and increased spending.***

***While it is uncontested that the harbour must be improved through maintenance and improvements to the channel, it has been difficult to move forward due to unresolved conflicts between the needs of different users and agencies. While the harbour is authorised to conduct a wide range of activities under the 1989 Hayle Harbour Act it is also constrained by being within the Cornwall and West Devon Mining World Heritage Site and the Hayle Estuary and Carrack Gladden SSSI.***

***Our goal will be both to identify the financial benefits to the community of rejuvenating the harbour while searching for innovative solutions to the technical and environmental constraints under which it operates."***

***John Bennett, Chair HHAC, 24/07/2015***

## 2.2 Hayle Harbour history

Hayle Harbour and its environs were designated as a UNESCO world heritage site as part of the Cornwall & West Devon Mining Landscape, with and inscription that states that "*Hayle is the most important 19th century mining port and steam engine manufacturing centre in the world*".

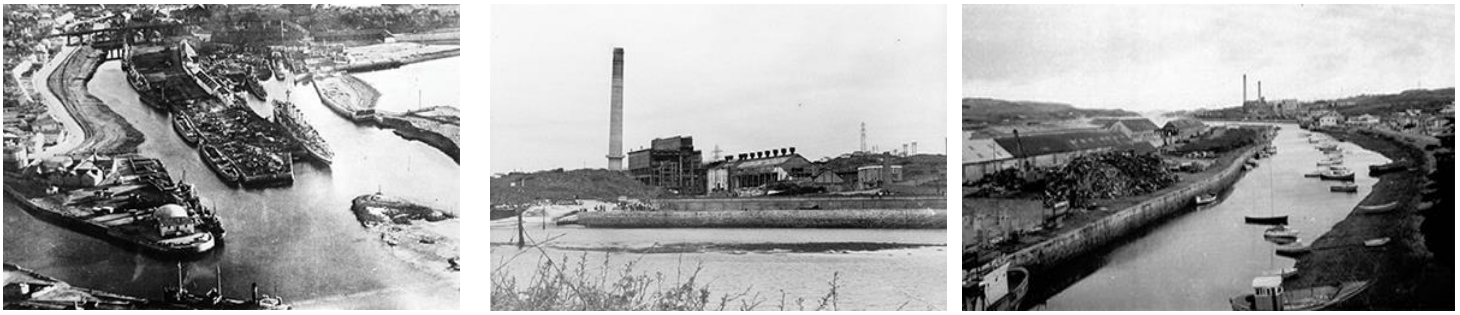


**Figure 1 Historic Hayle – images from Hayle's Industrial Heritage**

At one stage over 80% of the world's steam engines, and the world's largest steam engine, were manufactured in Hayle by the once great and competing Harvey's Foundry and Copperhouse Foundry. Linked by a rail network its key role in the mining industry, shipbuilding, engineering, wartime supply and power generation has positioned the port in Hayle as a vital part of Cornwall's economy since the 18 century.

In the twentieth century Hayle Power station (built in 1910) became the first power station in Cornwall. Until it was closed in 1977, the power station was powered by coal shipped in by tramp freighters from South Wales.

The legacy of Hayle's industrial past, which is still relevant for its future development, include the extensive quays and industrial landspace, 333kv/142kv electricity substation, rail and road links and mill ponds plus the skill base in marine and engineering industries which are still present in the town.

Also relevant to the discussion about the future operation of Hayle Harbour is to consider that while problems around silting in the harbour has always been an issue, it was in the past able to accommodate larger vessels carrying coal, ore and industrial cargos because the harbour and its channels were actively managed by regular sluicing from both the Copperhouse and Carnsew pools. This, plus the fact that the harbour was more heavily used by vessels, ensured that the harbour channels were kept clear.

More detail and information about Hayle's maritime and industrial history is provided on the Hayle Harbour Authority and the Hayle Heritage Centre websites (which also includes links to the Harvey's Foundry Trust). A good summary of its mining, industrial and wartime history is well documented in the Hayle Historical Assessment 2000[2] written by the Cornwall Archaeological Unit.

[2] Hayle Historical Assessment 2000l – Cornwall Archaeological Unit 2000

## 2.3 Hayle Harbour today

The following map(s) show key landmarks in the Hayle Harbour area referred to in this report.


**Figure 2 – map showing key landmarks in the Hayle Harbour area, as referred to in this report.**

The harbour today supports a variety of activities, harbour users and other organisations including:

- Berths and moorings the harbour supports more than 120 boats (36 commercial)
- Fishing – the harbour has a resident fleet of 28 registered fishing vessels landing circa £300k of shellfish and fish. Vessels are typically relatively small 5 to 10m potting (lobster) boats with some seasonal hand lining boats. Shellfish represents the majority of this catch at over 80% with 13% pelagic fish (principally mackerel) and 5% demersal fish (bottom feeding fish).
- Marine leisure including yachting and motor cruising with waiting lists for both leisure and commercial berths.
- 15 recreational user groups including kayaking, angling, diving and kiteboarding
- Marine operations – including a number of permanent and visiting workboats
- Marine energy – operations and maintenance – discussed in more detail below.

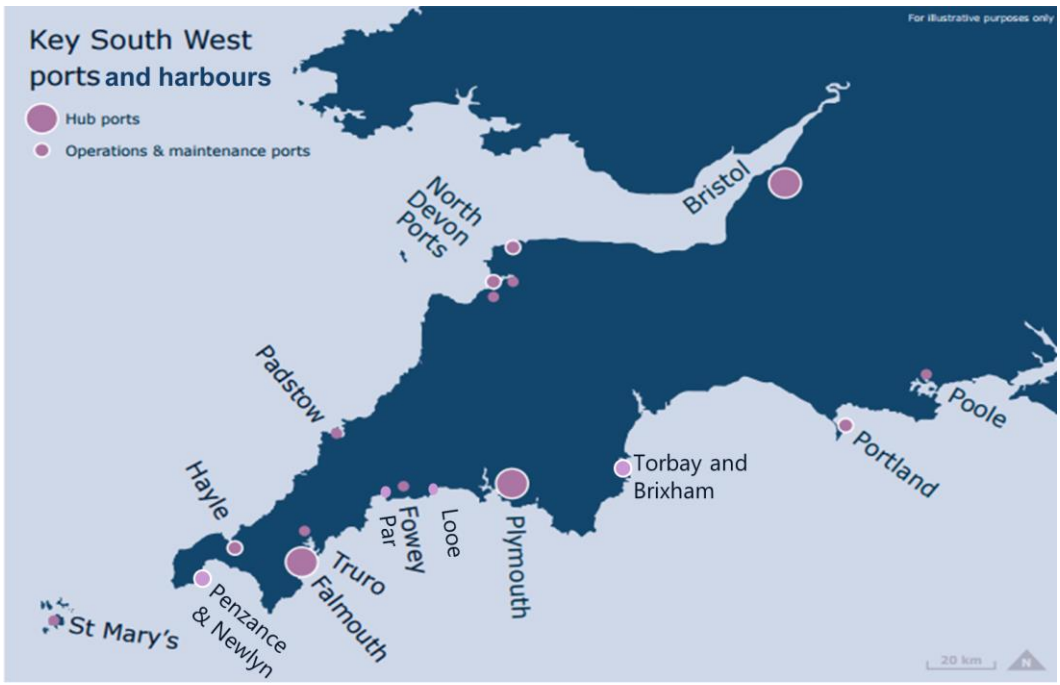
**MV ARROMANCHES October 2015**

**Typical fishing and leisure craft at South Quay**

The harbour and much of the surrounding estate has been owned and managed in the private sector. From 2004 to 2015 the harbour was owned by ING Real Estate – a Dutch property development company. In 2015 the harbour and estate was sold to another property development company Corinthian Land.

## 2.4 A strategic location for marine activities in Cornwall

The importance of Hayle Harbour as a key strategic port on the north coast of Cornwall came through very strongly in the feedback received from marine users and marine operations and engineering companies.




Its maritime importance stems from a number of factors:

- Hayle is one of a small number of ports on the North Cornish and Devon coast which can offer harbour facilities and a base of operations for coastal vessels operating in the Celtic sea, outer Bristol Channel and western approaches.
- Sheltered from the predominant south westerly's, Hayle Harbour and nearby St Ives Bay offer one of the few ports of shelter along the North Cornish coast and an option for vessels waiting for a weather window to go around Land's End, or cross over to the Isles of Scilly
- Hayle offers a very good stopover location for yachts and leisure cruisers heading along the North Cornish Coast, into the Bristol Channel or considering a crossing to Ireland (Rosslare) or South Wales (Pembrokeshire). A days sailing either from Padstow and Newlyn/Penzance – Hayle provides a stepping stone in what would otherwise be a long transit (120 km).
- Transport links – road and rail - Hayle's quayside facilities are 2 km from the A30 dual carriageway, 1 km from the Hayle railway station and 50 km from Newquay Cornwall Airport.
- Fit with Falmouth and other south west ports. Hayle provides a complimentary offer for smaller vessels conducting operations and maintenance activities, while across the peninsula Falmouth provides large scale engineering and dockyard facilities for construction, installation and heavy engineering.
- Proximity to marine energy resources. Hayle Harbour is the closest port location to the Wave Hub demonstration zone and is the most obvious location for the operation and maintenance of future wave energy projects off North Cornwall and in the southern Celtic Sea. (see below)
- Significantly Hayle is also the landing point for the Wave Hub electrical cable and has a main 33/132kv substation making Hayle the natural hub for the growth of marine and other renewable energy projects – offshore and in western Cornwall

***Strategic location***

***'Having Hayle as a fully functioning port would be a massive benefit to us and all commercial marine operators in the area with huge savings in safety, fuel and labour cost by not having to transit to Newlyn or Padstow. It will also enable short weather windows to be maximised and will be very beneficial when the North Coast is workable but when the Lands' End area is impassable. Hayle could also be a good port to supply the Isles of Scilly with cargo that needs transhipping on vessels other than the scheduled services such as when we need to transport our construction materials.'***

***'Hayle Port is an important asset for the whole area and should not be left to become a historical reminder of its former glory.'***

**Steve Roue, Falmouth Divers**

**Subsea and marine civil engineering**

## 2.5 New and recent investment

Hayle Harbour and the surrounding area has already been identified as a prime target area for regeneration and economic development[3]. As a result significant investments have been made within the harbour area over the past 5 years.

Funded by a combination of private sector investment, European regional funding and Cornwall Council these investments have included a number of flagship projects:

- £15m Hayle Harbour Primary Infrastructure investment providing
  - a new bridge over Copperhouse Pool and new road constructed
  - The creation of a promenade along North Quay and flood protection works.
  - The repair of harbour walls on North and East Quay,
  - A new fish landing stage and quayside improvements
- £24m Marine Renewables Business Park business park which features 7 industrial units totalling 1,328 m2 (with space for a further 800 $m^2$) of managed workspace, including flexible workshops and modern office accommodation designed principally to serve the marine renewables and marine technology sectors including companies working at Wave Hub. The business park also benefits from laydown area and quayside access at North Quay.
- £30m development of South Quay in Hayle including the construction of a supermarket, 30 homes, a restaurant and retail unit. Units. A new pedestrian bridge, raising flood defences and creating new promenades before the commercial development begins.

Alongside these large investments smaller investments have continued including most recently the installation of new pontoons for marine access on South Quay.

**Figure 3 - Hayle Marine Renewables Business Park – left: hybrid office workshop units, right: refurbished North Quay facility with laydown area.**

[3] Cornwall Council Hayle Area Plan 2005-2025

## 2.6 Opportunities for future growth – Marine Energy & "blue tech" industries.

The economic and commercial opportunities which could be exploited by Hayle Harbour are discussed in more detail in sections 8 and 9 of this report. At a summary level however the key opportunities for future growth come from a combination of:

1. Protecting and extending existing harbour activities
    - Fishing
    - Commercial and leisure berths
    - Marine leisure activities
2. Attracting new marine users – especially the potential to attract visiting yachts and motor cruisers – potentially leading to a future marina expansion
3. New marine operations, maritime industries ("blue tech") and marine science activities – especially associated with the development of marine energy and Wave Hub

Of these areas of opportunity the most exciting, and potentially far reaching, is the opportunity to position Hayle as a hub port for the development and operation of marine energy projects. Hayle is already the home of Wave Hub – the world's largest offshore test facility for marine energy – and the completion of the Marine Renewables Business Park has put Hayle at the centre of this new industry.

In this regard Hayle should not be considered in isolation. The facilities and infrastructure at Hayle broadly complement the wider assets and capabilities provided in Cornwall and across the South West peninsula. These include; the Wave Hub site, engineering and dockyard facilities at Falmouth and Plymouth, Exeter and Plymouth University's research facilities such as FabTest, DMAC and the new COAST marine centre at Plymouth University, plus the combined facilities of the CUC campus at Penryn.

Rather than being considered as a port on the far peninsula of Cornwall, Hayle is in fact, once again, at the heart of a new industry, and although this industry is still at an early stage of development it is already attracting significant inward investment from companies based in Europe, Australia, Scandinavia and North America.

Hayle forms a vital part of Cornwall's marine industry infrastructure and features strongly in the future plans for the development of both marine energy and the wider growth of marine industries within the "blue tech" economy. Hayle is therefore identified as a key asset in Cornwall's **Marine Renewable Energy Roadmap**[4] which sets out a strategic target to create a minimum of 100 new businesses and 700 new high value jobs in the sector in Cornwall by 2020.

[4] Cornwall and Isles of Scilly - Marine Renewable Energy Roadmap 2015

Hayle is also at the centre of an ongoing bid, led by the Local Enterprise Partnership and Cornwall Council, to create a new **Marine Industries Enterprise Zone** in west Cornwall. The Enterprise Zone would be centred around Hayle, Falmouth and the offshore test sites at Wave Hub and FabTest. Hayle Harbour, and its Marine Renewables Business Park, also key to the development of a wider "Marine Research and Development Innovation Hub" proposal which is currently being developed by a number of partners including Exeter, Falmouth and Plymouth Universities, Cornwall College, Cornwall Council and the local supply chain industry.

These future investment proposals underline the importance of maintaining Hayle Harbour as an operational port. In a worst case scenario – if Hayle ceased to be viable as an O&M port for maritime industries – this could jeopardise the future development of commercial marine energy projects off North Cornwall.

***As a vessel operator in offshore wind it is clear that there is massive cost pressure on the operations and maintenance of offshore renewable assets. The viability of wave assets being deployed off the North Coast will be questioned without a viable North coast port due to the increased costs of vessels having to mobilise from the South Coast for maintenance. A viable North coast port will maximise the wave deployment opportunities around the Cornish coast.'***

***Peter Scriven, Wind and Wave Workboats***

There is therefore a very strong consensus and broad agreement that action needs to be taken to secure Hayle Harbour as an operating port. The work of the HCCT has therefore received significant support and encouragement from the harbour authority, Hayle Town Council, local MP George Eustice, the Local Enterprise Partnership and Cornwall Council.

The HCCT has also canvased, and received support from, a wide range of businesses including some of the main marine engineering and operations companies in the south west. The feedback from industry has been very positive and this forms a key part of the business case evidence base which is detailed in Section 8 and 9.

# 3 Key challenges – harbour navigation, access and safety

## 3.1 Sedimentation and navigation – current situation

The key challenge for the future operation of the harbour is the problem of access and navigation, and the risk to harbour user safety, which has been created by the increased sedimentation and channel movement within the inner harbour and approach channel.

The deterioration of the harbour and channel access has been very well documented in a number of reports including the Buro Happold study of 2010[5] and a recent summary produced by the harbour master[6].

Without repeating the detail of these studies the summary issue is that Hayle Harbour, in common with most estuarine harbours, suffers from sediment deposition. This is because the ebb flow velocity is insufficient to carry sediment out of the harbour in suspension. Conversely the more powerful flood tide has the tendency to push sediment up into the inner harbour and river estuary on successive tides. This is especially true during winter storm periods when wave surge causes further deposition and infill of the channel from adjacent beaches.

As well as infilling the harbour and reducing channel depth, a secondary impact has been to cause the channel to lose definition and to "meander" eastwards. The eastward movement of the channel has been confirmed by timeline photography and is now clearly visible since original channel marks are now well to the west of the channel.



**Images – copyright Over Cornwall 2008/09**

[5] Hayle Harbour – Maintenance Dredging Protocol Document May 2010

[6] Navigational Maintenance Dredging briefing note Hayle Harbour Authority 27 October 2015

**Figure 4 – aerial photos by Over Cornwall showing the variation in the route of the Harbour access channel in the space of 8 months.**


**Figure 5 Hayle Harbour Outer Channel and bar autumn 2015, copyright Peter Channon**

While the loss of channel and harbour depth has reduced access to the harbour to less than 2 hours either side of high tide for vessels with a draft of 2.5m, the variability of the channel has created a significant safety issue. Since the channel is no longer perpendicular to the wave direction, vessels now must approach the channel at an angle, which causes them to lay broadside to the wave swell and ground sea, which is generated in the area around the Hayle Bar. In response to this risk the Harbour Authority has, in consultation with Trinity House and its stakeholders, removed the existing Port and Starboard Buoys and replaced them with a hazard marking North Cardinal Buoy. This is the maritime equivalent of a “danger - keep out” sign at the harbour entrance. This temporary measure, taken in 2012, will now remain in place until such a time that the channel can be re-instated.

The infill is clearly visible within the inner harbour in the area around the Cocklebed. Repeated deposition, without effective dredging or sluicing, has allowed the sediment to become hard packed i.e. it is no longer transportable by the usual tidal flows or vessel activity.

There is a general agreement that the harbour has now reached a tipping point. Over the last two winters especially, the harbour master and local fishermen have noted a further deterioration in the channel which is now adversely affecting the time window for vessels to operate.

With reduced activity, the decline in water levels is to an extent, self-fulfilling as vessel motion itself reduces sediment build up and consolidation as vessel prop-wash (turbulence created by ship propulsion) stirs up sediment which can then be washed out to sea on the outgoing tide.

The issue of navigational access is also having a direct impact on new businesses who might otherwise have used the harbour facility. Already a number of wave energy developers and their marine operations partners have expressed concern about the use of Hayle and have considered basing their operations at other ports.

| **Summary Table**<br><br>**Key impacts of sedimentation and loss of channel depths** |
|---|
| The challenges affecting the safe and effective functioning of the harbour at present can be summarised as follows:<br><br>Water levels in access channel are very low – effectively 0m at spring low (channel height is above chart datum) and 4.6m at spring high. Currently access is typically (average) limited to +/- 3 hours either side of high tide for vessels with 1.5m draft and less than +/- 2 hours for vessels with a draft of 2.5m. Neap tides are further restricted.<br><br>The location of the access channel between Porth Kidney Sands and Hayle Beach is constantly moving to the point where it can be in a significantly different location between the departure and return on a day trip for a vessel (see Figure 4)<br><br>Entrance to the access channel is hampered by a sand bar which creates dangerous breaking wave conditions. This is often exacerbated by the access channel transiting the beach at a shallow angle, meaning vessels have to cross the sandbar beam on to the waves. In summer 2015 a fishing vessel lost all the windows in the wheel house due to waves breaking over the vessel.<br><br>Water levels inside the harbour are low and steadily declining as new sediments are deposited and consolidated – this has been particularly noticeable in winter 2013/14 and 2014/15 (according to local commercial fisherman Lech Kwiatkowski). Water levels are currently such that no wet berths are available, although the pot storage area does have sufficiently deep water for a small number of vessels to remain afloat.<br><br>East Quay, South Quay and the newly refurbished North Quay provide NAABSA (not always afloat but safely alongside) berthing, but this may be insufficient for some work vessels (particularly aluminium hull vessels) and wave energy devices anticipated at North Quay.<br><br>Repeated deposition and lack of dredging has allowed the sediment to become hard packed – thereby reducing the effectiveness of sluicing and sediment transportation |

**A fisherman's view - Lech Kwiatkowski.**

Lech is a member of the Hayle Fisherman Association and shellfish fisherman, principally potting for lobster. Lech operates all year round except for 2 months in the winter and explained that he can get his 1m draft boat in and out of the harbour for an average of +/- 2 hours 40 mins either side of mean high tide.

Lech observed that this is steadily declining and that the last two winters have seen significant reductions in the operating window, putting pressure on fisherman to push the edges of the available time envelope. His main concern with Hayle Harbour is improving the safety of the sand bar at the entrance to the access channel – he explained that the current arrangement posed a loss of life threat to all fisherman in small vessels such as his.

In summer 2015, a Hayle fisherman lost all the windows in his wheel house when waves broke over the boat whilst crossing the sandbar. Lech pointed out that whilst the sand bar will always exist even with significant dredging, by reinstating the training wall and a deeper, straighter access channel, safety could be significantly improved as boats would be able exit and enter the harbour perpendicular to the wave fronts.

***Wave energy developers view - Seatricity***

Seatricity was the first wave energy developer to deploy its Oceanus Wave Energy device at Wave Hub. Construction and installation was mobilised from Falmouth but Seatricity has used Hayle as its main operational base for its aluminium catamaran workboat "Ocean Enterprise". It was however forced to use Padstow for the deployment of its concrete foundations. An indication of Hayle's current limitation but also a good example of how Cornish ports can be used in conjunction to provide a variety of services.

***'Seatricity Ltd has already committed to Hayle as a harbour of choice for our workboat operations at WaveHub but it has not been without its challenges and problems. We support any proposals to develop the port access and infrastructure and are confident that the investment will be rewarded - not least in our own plans to focus our business more locally.'***

**Andy Bristow, Seatricity**

# 4 Previous dredging activity and constraints

Reinstating the channel and maintaining water depths is certainly achievable (see solutions proposed in Section 3 below) but it should be clear that there are no easy solutions and all potential options will require funding and may also have impacts.

## 4.1 Traditional approach – sluicing and plough dredging

Traditionally, when the port was in full operation with a regular movement of larger vessels, Hayle was able to keep its channels clear with a combination of "vessel self-dredging", periodic mechanical and manual dredging and the regular use of sluicing from both the Carnsew and Copperhouse pools.

At that time sluicing was more effective since the pools themselves contained less sediment and a higher volume of water. The release of impounded water from the tidal pools approximately 3 hours after high water of water has been described as akin to a tidal bore that increased the velocity of water on the ebb tide and maintained it above 4 m/s for longer. This had the effect of clearing the harbour area with the additional benefit of straightening the outer channel and lowering the Hayle bar.

Keeping the channel straight (in a northerly direction from Chapel Anjou Point) was an important factor, not only for navigation purposes, but also to reinforce the natural movement of sediment out of the harbour and into the St Ives Bay sand cell from where it would be deposited on adjacent beaches. The increased velocity of water in the outer channel also cleared out any sand that was that was wave washed or windswept into the channel from Porth Kidney Sands and Hayle Beach.

The traditional system was not perfect and did require periodic dredging as well as the upkeep and maintenance of the sluice gates and the training wall in the approach channel. However the higher volume of vessels combined with regular sluicing was effective, and for over 100 years Hayle was able to accommodate a range of larger vessels transporting everything from ore and coal to steel and stream engines.

## 4.2 Recent dredging activity – extraction dredging 1999-2010

With the closure of the Hayle power station in 1977 fewer bulk carriers have used the harbour. Since that time the effectiveness of sluicing has also been reduced through a combination of less maintenance, sediment deposition within the pools and lack of funding. As a result the sluice gates fell into disrepair and in recent years sluicing ceased to be used.

This inevitably led to the build-up of sediment within the harbour and the deterioration of the outer channel raising concerns about navigational safety and access.

Hayle Harbour Authority is empowered under the Harbour Act 1989 [7]to periodically dredge the harbour, channels and approaches – provided no dredged materials are deposited below the high water except in places designated as disposal areas. This last point is significant since it means that dredged materials (lifted clear of the water column) cannot currently be disposed of in the bay area or on adjacent beaches below high water.

Since the period from 1999, for which records exist, there has been periodic mechanical (digger) and suction dredging of the harbour and channel with tonnages as show in Figure 6 below.

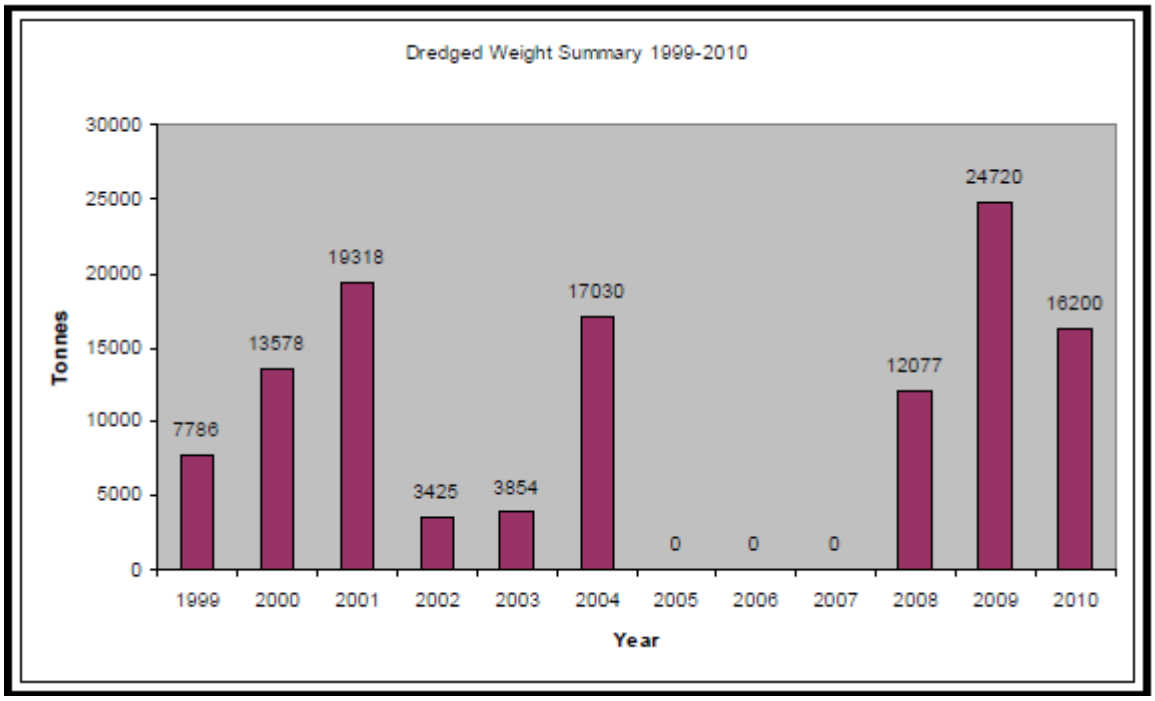



**Figure 6 Dredging activity 1999-2010 Source Buro Happold report 2010**

The level of dredging has varied over the period since 1999 and in the last dredging campaign from July 2008-April 2010 the then owner/operator of Hayle Harbour, ING Group (ING) and their contractors extracted over 50,000 tonnes - 20% being used for dune replenishment and the balance sold as aggregates thereby making the process financial self-sustaining.

## 4.3 Objections to extraction dredging

The increased level of sand extraction in 2008-2010 further raised objections from a number of stakeholders who were concerned about the permanent removal of sand from within the St Ives Bay and Hayle sand cell. Stakeholders and conservation bodies represented by the Save our Sands group had argued that the removal of sand from within the sand cell has had a detrimental impact on

[7] Harbour Act 1989 section 6

adjacent beaches and sand dune systems. The key issue being that the St Ives Bay sand cell is considered to be a "closed" system and is not naturally replenished by new deposition coming into the bay area.

There is still some uncertainty about the level of direct impact but evidence that sand extraction has adversely impacted on local beaches and sand dunes has been supported by a number of studies and research projects[8]. It is now generally accepted, certainly within the HCCT team, that the large scale extraction of sand from the sand cell is not appropriate. Save our Sands campaigned vigorously to stop extraction dredging, and in 2011 came to a MOU agreement with ING Group to stop extraction dredging, and selling of sand, in favour of a return to sluicing.

This agreement was one factor which led, in 2015, to the installation of new sluicing gates on the Carnsew pool as part of the overall redevelopment of south quay area.

Since then, the Save our Sands group has been a key stakeholder in the discussion about the development of Hayle Harbour and have been an active member of both the Hayle Harbour Advisory Committee and the Hayle Coastal Communities Team project.

**Note: Constraints on extraction does not mean that dredging is prohibited**

The key objection raised by Save our Sands and other stakeholders was the process of extracting sand which was then sold in order to raise revenue. While this did fund dredging operations it also meant that sand was then permanently removed from the Hayle area and St Ives sand cell.

The consensus position adopted by HCCT has been to look for dredging options which do not remove sand from the sand cell.

As an alternative approach:

- Plough dredging and sluicing does not remove sand from the sand cell, since sand is transported out into the bay to be redeposited on nearby beaches.
- Mechanically dredged materials could be redeposited within the beach area and potentially used to enhance and reinstate the sand dune system – particularly in the area above Hayle beach. Indeed 20% of material dredged from 2008-2010 was used for dune replenishment.

The requirement to deposit sand above the high water mark is a restriction and has a significant cost impact. An option would be to apply to the Marine Management Organisation for an amendment to the existing conditions to allow sand to be dumped below the high water mark where it could be used to re-profile the Hayle and Porth Kidney beaches.

[8] http://www.sos-hayle.org.uk/downloads-information/investigation-of-beach.pdf

## 4.4 Constraints on sluicing

While sluicing is generally considered to be a benign activity, and a traditional method of removing sediment from within the harbour and channels, the potential reintroduction of sluicing does raise a number of issues that could have impacts on other aspects of the Hayle environment and ecology.

Reintroduction of sluicing will require investment in the sluice gates and some cost of operation. At present only the Carnsew Pool has a workable sluice gate and control system in place thanks to recent investment as part of the south quay redevelopment – this is discussed in more detail in section 6.3 below.

Aside of the investment needed the key constraints to sluicing which need to be considered are:

- The reduced volume of water within the tidal pools
- Frequency of operation of sluicing and its impact on intertidal habitats within the tidal pools
- Potential operational constraints caused by flood prevention measures

### 4.4.1 Volume of water within the tidal pools

Increased sedimentation within the tidal pools has reduced the volume of water which can be impounded and therefore used for sluicing purposes. The Copperhouse Pool in particular has become increasingly sediment bound.

As well as reducing the available water for sluicing the infill of the lagoons has had a number of other potentially negative impacts:

- Reducing the area of intertidal "mud" habitat for feeding birds which has been replaced by grasses
- Allowing people and dog walkers to access the intertidal habitats more easily which has in turn impacted on feeding and nesting birds
- Reducing the capacity of the lagoons to alleviate flooding when used as flood reservoirs

The HCCT has not looked in detail at this issue and the cost and impacts of any proposal to dredge within the lagoons is outside the scope of this report. It is noted however that the reduced volume of water will reduce the effectiveness of sluicing and for this reason, along with the habitat and flooding issues above, it may be considered necessary to dredge within the lagoons at a future stage.

### 4.4.2 Environmental constraints - impacts on inter-tidal habitats

Although originally build for the purpose of sluicing the tidal lagoons in Hayle have become important intertidal habitats in their own right, particularly for wading and migratory birdlife. Much of the Hayle Harbour area is SSSI designated while the Copperhouse pool and part of the Carnsew pool are important RSPB reserves providing valuable feeding grounds for a variety of seasonal and permanent species. See Figure 7 and Figure 8 below.

As well as their ecological importance the habitats around the harbour also provide important amenity space and value for Hayle residents and tourists.

The action of sluicing in itself is not expected to impact on wildlife, however the process of impounding water within the tidal lagoons would mean that high-water intertidal areas are exposed for shorter periods than would otherwise be the case, thereby reducing the time available for bird feeding. This impact would be felt most in the winter months, when the estuary is used by overwintering birds, which conversely is the time when sluicing is most needed. The extent to which this would actually affect visiting bird numbers and diversity is unclear but, in theory at least, it would have some impact.

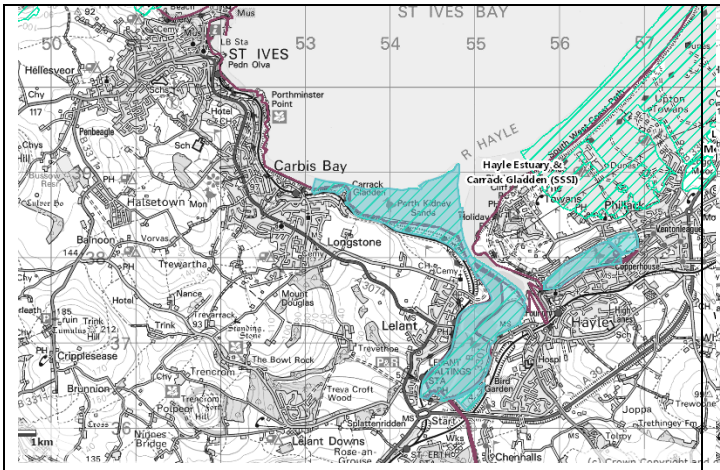



**Figure 7 - much of Hayle Harbour has an SSSI designation – the Hayle Estuary and Carrack Gladden SSSI (blue with green hatch) as well as further SSSI designations to the NE of Hayle - the Gwithian to Mexico Towans and Loggans Moor SSSIs (green hatch). Image courtesy DEFRA mapping service - http://magic.defra.gov.uk/**

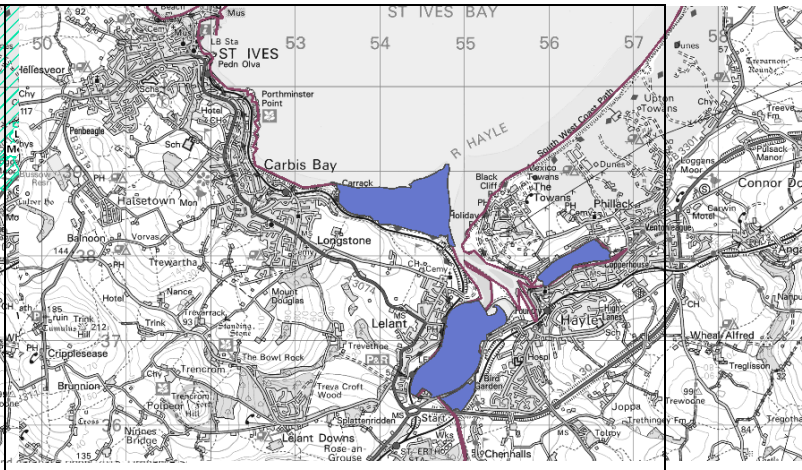



**Figure 8 – RSPB Reserves in Hayle covering part of Carnsew Pool and all of Copperhouse Pool. Image courtesy DEFRA mapping service - http://magic.defra.gov.uk/**

As a result of these concerns the RSPB and Natural England have suggested a restricted sluicing regime, at least to begin with while impacts are monitored, with sluicing restricted from the Carnsew pool to spring tide periods during the summer months from April to September. This seasonal limit will reduce the effectiveness of sluicing. HCCT have met with MP George Eustice, Natural England and the RSPB to discuss the operating limitation but for the time being, the limitation stands. It is proposed that sluicing activity during the operational summer months is monitored to evaluate impact on wildlife and explore whether the limit can be reduced or removed.

However, while getting sluicing started is paramount, it is almost certainly the case that restricted sluicing in summer months will be insufficient to effectively manage the harbour. This issue and the overall effectiveness of sluicing is discussed further in Section 6.3 below.

### 4.4.3 Flood defence constraints and dual use

The tidal lagoons also now form part of the flood defence system around the town. The Copperhouse pool in particular forms an important part of the towns flood elevation scheme, and to protect the town from the river Angarrack. The pool gate is therefore controlled by the Environment Agency (EA). In recent years, during periods of flood risk and heavy rainfall, the EA has restricted the level of tidal ingress thereby keeping tidal water levels in Copperhouse pool low and allowing more land-water to drain into the pool which acts as a drainage reservoir.

The Copperhouse Pool could still be used for sluicing purposes during periods of low flood risk. Such dual use would however require an agreement with the EA about who would manage and operate the sluice gates and whether this could be done locally under EA supervision. This in turn has raised concerns about risk management and liability.

It will take time and new agreements to change the use of the Copperhouse pool.

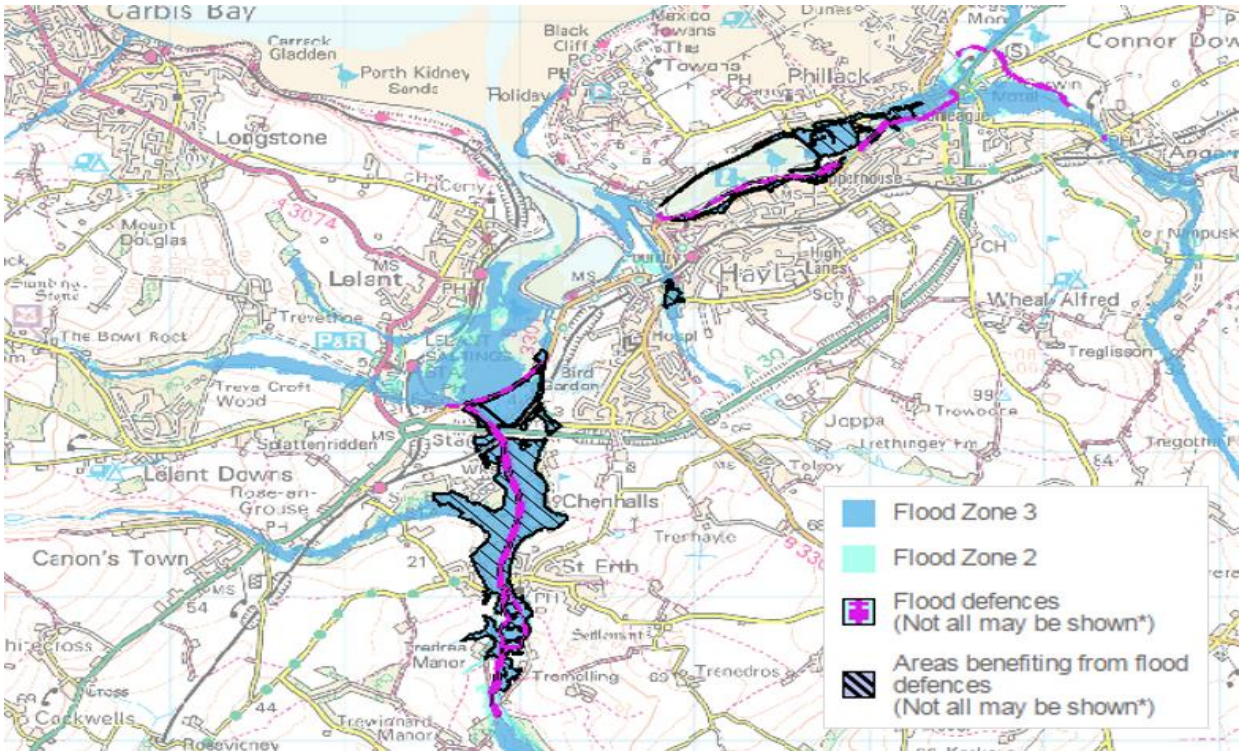



**Figure 9 – flood risk and associated protection infrastructure in and around Hayle Harbour. Image courtesy Environment Agency mapping service: [http://goo.gl/umrWcl](http://goo.gl/umrWcl)**

### 4.4.4 Marine planning and consent restrictions

The HCCT project has not looked in detail it the potential planning and consent issues around dredging, however it is understood that the Harbour Authority can conduct dredging within the harbour area – to clear channels and maintain water depths – provided that any dredged material is

either disposed of at a designated offshore dumping ground (of which there are none nearby) or is deposited above the high water mark.

This would allow material to be extracted and sold, which is not the HCCT proposal, or used to enhance the beach and sand dune systems in the bay area. While this could be good for dune replenishment, a more flexible licence would also allow material to be used for beach reprofiling. Although one further consideration is whether material dumped adjacent to the channel would simply be washed or wind-blown back into the channel. This has been the experience of Teignmouth.

Further work is therefore needed to identify and assess potential disposal sites, above high water, within the St Ives/Hayle sand cell area. An alternative would be to apply for a new licence or a change of conditions to allow sand to be deposited within the beach area below high water mark. As discussed in section 6.5, the ability to deposit material on the beach would significantly reduce mechanical dredging costs.

Further discussion is also needed with the MMO and other agencies to fully understand the current restrictions and regulatory framework.

| **Summary extract from Hayle Harbour Act 1989** |
| --- |
| '*Subject to the provisions of* [the Hayle Harbour Act 1989]*, the Company may from time to time deepen, dredge, scour, cleanse, alter and improve the foreshore and bed of the sea and blast any rock within the limits of the harbour and the channels and approaches thereto and may use, appropriate or dispose of the materials…*<br><br>*…Provided that no materials so dredged by them shall be deposited below the level of high water except in such places and in accordance with such conditions and restrictions as may be approved or prescribed by the Secretary of State.'*<br><br>*'The Company shall not exercise the powers under subsection (1) above upstream of the line marked "Limit of dredging" on the harbour land plan'.*<br><br>**Tidal Works** – *'"tidal works" means so much of the works as is on, under or over tidal waters or tidal lands below the level of high water'.*<br><br>*'A tidal work shall not be constructed, reconstructed, renewed, altered, replaced or re-laid except in accordance with plans and sections approved by the Secretary of State and subject to any conditions and restrictions imposed by him before the work is begun.'* |

# 5 Target: a safe working harbour – what could be achieved

From the discussion above it should be clear that a) something urgently needs to be done to address the issue of sedimentation and the operational safety of the harbour and b) there are a number of issues and constraints which need to be accommodated.

Taking a very practical and direct approach the HCCT has tried to look for potential solutions and approaches which could be deployed quickly within the existing constraints and would then form the basis of a working solution which could be extended and adapted over time. These potential solutions are presented in more detail in Section 6 below.

Before looking at potential solutions the HCCT team has spent some time, drawing on local knowledge and previous studies, to try to define what would be needed to provide safe operational harbour.

## 5.1 Access target depths and water levels

Older charts of the harbour area suggest that, when the harbour was in full operation, the water depth in the harbour and channel was significantly greater than today. The Buro Happold study identified the **1972** chart as the most relevant reference point for when the harbour was in full use with an active water management and sluicing regime in place. This shows 0.5m depth Chart Datum (CD) at the bar and a depth of circa 0m CD in the approach channel. In other words there was generally at least 0.5 m of water depth in the channel even at low tide.

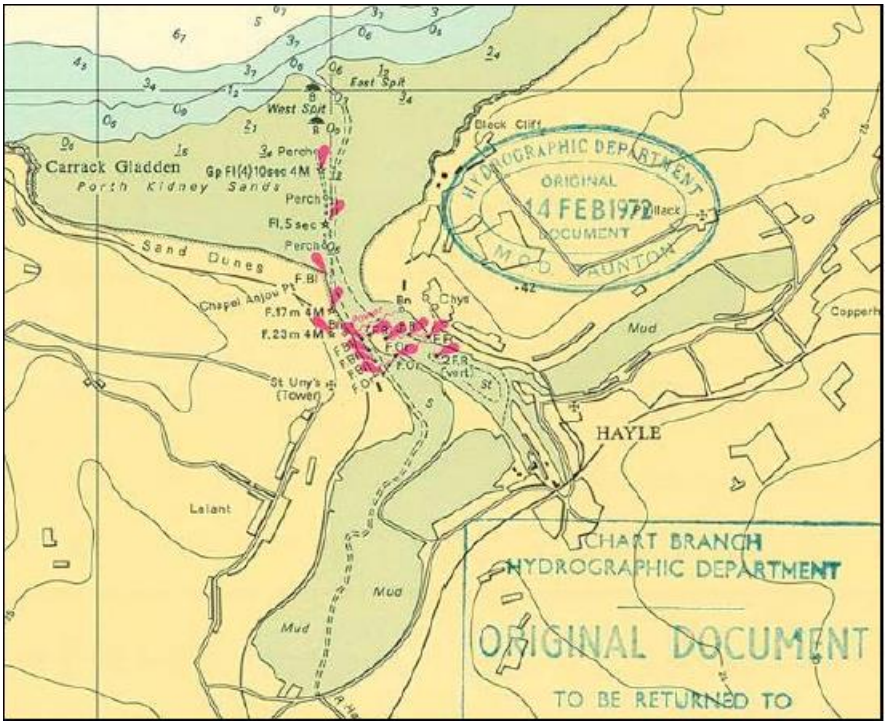



**Figure 10 1972 Chart showing water depths - Source Buro Happold report 2010**

By **2011,** when the last full survey was conducted by Shoreline Surveys Ltd (see Figure 11) on behalf of Hayle Harbour Authority, the depth at the bar and channel had reduced by at least 1.5 m and much of the channel was now at -1m to -2m CD i.e. dry above water at low tide. Since then the situation has deteriorated further and although a full survey has not been done, spot surveys suggest that the access channel has lost between 1.5 and 2m of water depth. The situation in the inner harbour is worse with, according to local knowledge, a loss in depth of at least 2m and further restrictions in channel areas.

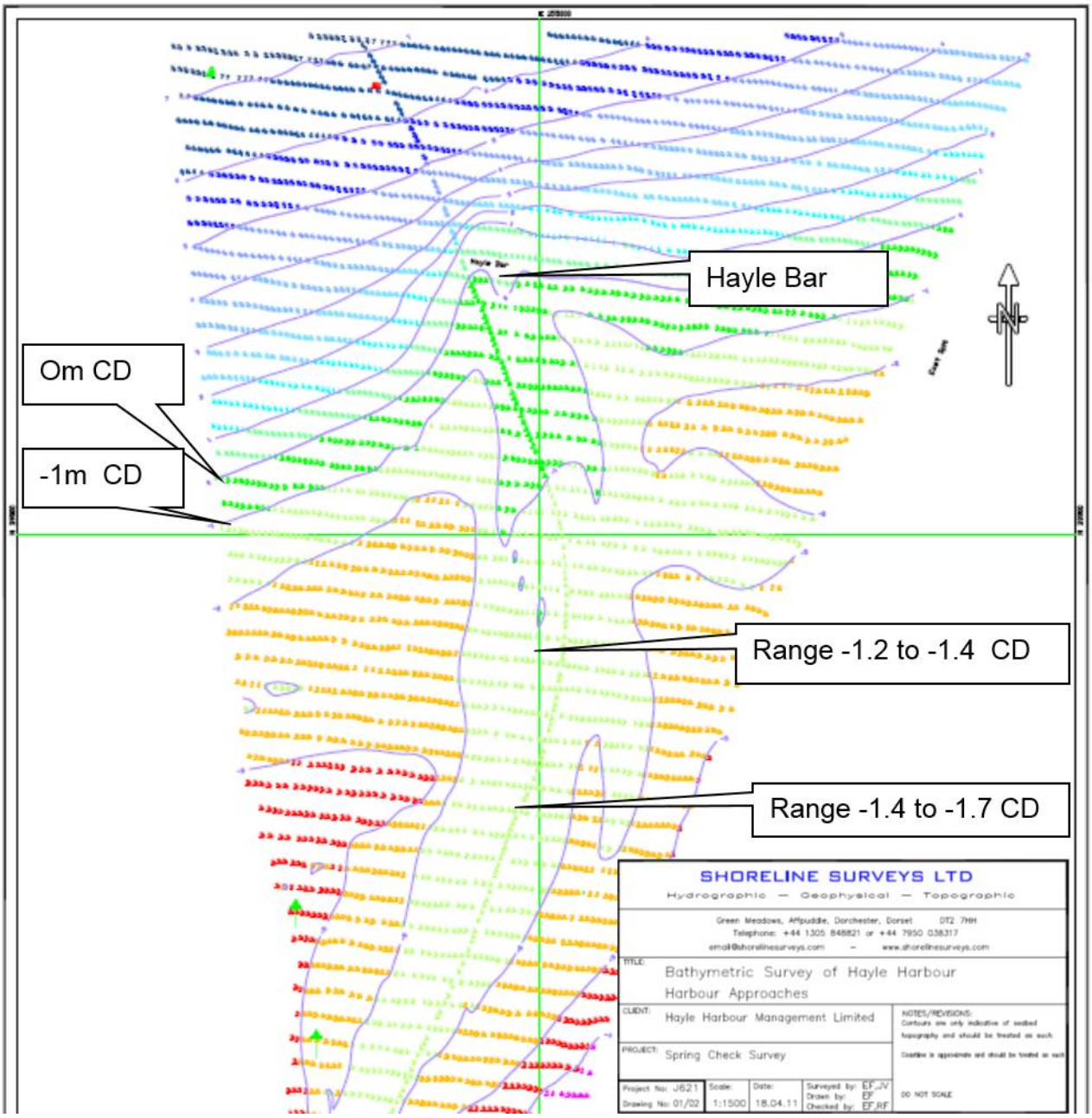



**Figure 11 Extract from Hayle Harbour Water Depth 2011 Survey Shoreline Surveys**

The estimated loss of between 1.5 and 2m water depth at the bar and approach channel is a reasonable benchmark which corresponds to anecdotal evidence from harbour users and to previous studies. It should be noted that these estimates our averages – and that the channel depth is seasonably variable – in fact variability and sediment dynamics are a key part of the problem.

The Buro Happold [9]study estimated that to recover the water depth to something like its 1972 position, and to create a 40-60m channel and a depth of +0.5m CD at the bar, would require the removal of circa 350,00, tonnes (193,000 m3) of material in the outer channel and bar area. In other words seven times the amount of material removed during ING's initial dredging from 2008-2010.

This figure seems high, and the goal of returning the harbour to its 1972 position may be overambitious, but in the absence of a full survey and a further estimate it is clear that whatever the final number a significant amount of material will have to be removed at the outset to reinstate a safe navigation channel.

Rather than try to set a specific water depth to be achieved the HCCT has instead set a number of targets based on the operability of the harbour. These targets are summarised in the table below:

| **Hayle Coastal Communities Team**<br>**Harbour Navigation and Access Target** |
|---|
| **1. Straighten the channel and reinstate navigation buoys** |
| **2. Allow a 2.5m draft access for ± 3 hours either side of high water** |
| **3. Create a mooring area of min. 3m water depth within the harbour** |
| 4. **Create and increase a turning area within the harbour** |

Achieving these targets would allow the Hayle Harbour to:

- Improve the safety and access for the fishing and leisure vessels currently using the harbour to protect the jobs and economic value of this commercial activity to Hayle and the wider Cornish economy
- Ensure that investment in the Marine Renewables Business Park is complemented by investment in the harbour to enable quayside access in keeping with the aim of the business park
- Improve the functionality of the harbour, encouraging growth in commercial and leisure activity such that the harbour can covers costs and benefit the local economy.

[9] Buro Happold – Dredging Protocol document 2010 section 2.4

## 5.2 What would be required to meet these targets?

The HCCT project has not had funding or resources to complete a new survey of the harbour and channel access, or to commission a full dredging study.

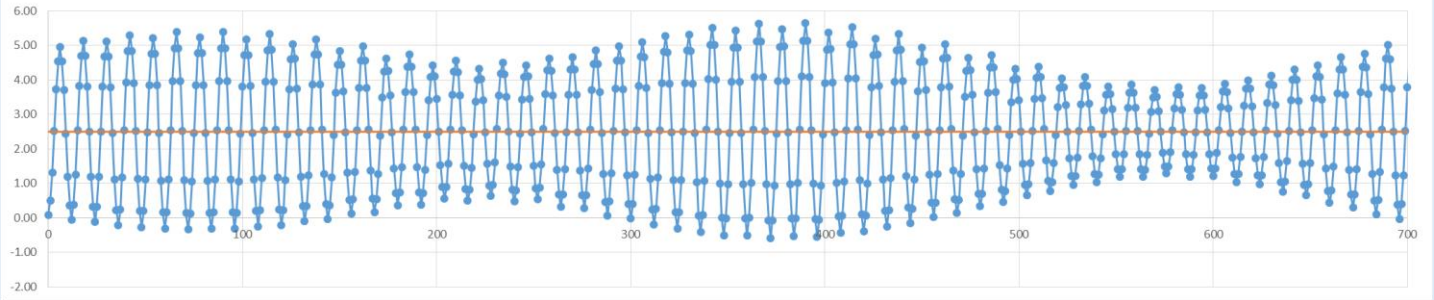
A "ready reckoning" estimate, based on the 2011 survey data, suggests that an **average 1m increase** in water depth at the bar and approach channel would meet the HCCT target to allow a 2.5m draft vessel to access the harbour at high water ± 3 Hours.

This estimate is consistent with the experience of existing vessels of a similar draft who currently, on average, expect to have access for around ± 2.2 hours either side of high water.

**Rough & ready reckoning estimate of dredging required to achieve access targets***

*This table contains very rough estimates based on average depths and volumes

| | **Current Access** | Lower Target | **HCCT Target Access** | "Back to 1972" Access estimate |
|---|---|---|---|---|
| Current avg channel depth (CD) | -1.7 m | -1.7 m | -1.7m | -1.7m |
| Dredging avg depth increase | No dredging | 0.5m | 1m | 1.7m |
| Approach Channel and Bar 30m channel dredging | | 30,000 m3 55,000 tonnes | 55,000 m3 100,000 tonnes | 100,000 m3 180,000 tonnes |
| Inner harbour dredging | | 28,000 m3 50,000 tonnes | 45,000 m3 80,000 tonnes | 55,000 m3 100,000 tonnes |
| **Expected access exceedance for a 2.5m draft vessel** | | | | |
| % time access meets access HW ± hours | 37% HW ± 2.2 hrs | 42% HW ± 2.5 hrs | 50% HW ± 3 hrs | 60% HW ± 3.6 hrs |
| % time at spring meets access HW ± hours | 42% HW ± 2.5 hrs | 42% HW ± 2.5 hours | 50% HW ± 3 hours | 58% HW ± 3.5 hrs |
| % time at neap meets access HW ± hours | 27% HW ± 1.6 hrs | 42% HW ± 2.5 hrs | 50% HW ± 3 hrs | 64% HW ± 3.9 hrs |




**HCCT target depth monthly tidal exceedance chart for 2.5m draft vessel**

# 6 Options and Proposed Solutions

Given the range of constraints identified in Section 3, set against the target harbour channel and water depth requirements identified by the HCCT in Section 4, it should be clear that getting an overall water management solution in place is going to be difficult and will require both funding and strong leadership from the port authority, Cornwall Council and local stakeholders.

Overall the solution needed involves:

- An **intensive campaign of remedial dredging** and channel reinforcement to lower water depths in the harbour area, approach channel and bat by circa 1m and straighten the channel – which will require the removal and redisposition of at least 100-180k tonnes of material and the repair/extension of the channel training wall.
- The implementation of an **ongoing water depth management** regime using a combination of sluicing, plough dredging and periodic mechanical dredging.

The work of the first phase of the HCCT has focused on the potential options for **on-going water depth management** for Hayle Harbour, and although the team has looked briefly at the requirements for the necessary remedial dredging, the focus has been to develop a realistic and sustainable approach to maintain the channel and water depths once harbour access and navigation has been restored.

An assessment and approach for up front capital dredging and channel straightening does need to be undertaken and this is one of the main work packages included in a proposed 2nd phase of HCCT work.

## 6.1 Input and experience from other UK ports

While looking at the potential solutions for ongoing water management (managing water depths in the harbour and channel and maintaining the channel) the HCCT project has drawn heavily of on the local knowledge of key local stakeholders and the experience of a number of other ports and harbours around the UK that face similar challenges to Hayle Harbour.

Their input has been invaluable partly because several ports – notably Teignmouth, Shoreham and Wells Harbour – have faced the same issues and come up with similar solutions to those being considered by Hayle.

The HCCT is very grateful for the information and practical advice that has been received to date from:

1 **Cowes Harbour Commission**, Barney Sollars, Marine Services Manager
2 **Teignmouth Harbour Commission**, Humphrey Vince, Harbour Assistant
3 **Shoreham Port**, James Gray, Assistant Harbour Master
4 **Bristol Port Company**, Jerry Stanford, Haven Master

5 **Well next-the-sea (Wells Harbour)**, Robert Smith Harbour Master
6 **Cornwall Ports** – Andy Brigden Cornwall Council Maritime Manager
7 **Newlyn** – Lucy Parsons, Board Member Harbour Commissioners
8 **Padstow** – Capt. R M Atkinson
9 **Yacht Harbour Association** – Libby Gordon, Executive


**Figure 12 – aerial view of the ports and harbours contacted regarding their use of plough dredging. Teignmouth is probably the most similar to Hayle, with predominantly sand sediment and a long access channel.**

## 6.2 Potential ongoing water depth management methods

The HCCT project has focused on four potential water management methods which could be used separately or in conjunction to effectively manage water depths and channels for Hayle.

These are:

### 1) Sluicing

Using the Carnsew pool and potentially the Copperhouse sluice pools, built for the purpose of flushing sediment out of the harbour by impounding water at high tide and releasing this on the ebb tide to flush out sediment

### 2) Plough dredging

Towing a bed levelling plough behind a dedicated work boat/tug or reconfigured fishing vessel to

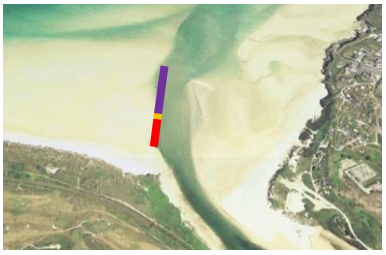
- drag sediment out of the channel
- disturb sediment into suspension

level peaks and troughs left by other methods eg mechanical dredging.

### 3) Mechanical dredging

Using excavation equipment (e.g. backhoe diggers, excavators, dumper trucks etc) to dig out and relocate sediment in the harbour area. Excavation equipment may be mounted on a work barge or working directly on the sand at low tide.

### 4) Training wall



Reinstating and extending the harbour's existing, but partially buried training wall located on the Porth Kidney Sands side of the channel. As well as helping to straighten and control the location of the access channel, the wall may well help improve the effectiveness of sluicing by accelerating water flowing out of the harbour and increasing self-scour of the sediment in the channel.

## 6.3 Option 1 - Sluicing

Sluicing works by retaining a head of water in a pool at high tide, then flushing loose sediment out to sea as the tide ebb flow peaks normally at circa HW+3hours. This has the effect of increasing and prolonging the ebb outflow velocity above 4m/s, at which speed sediment is removed in suspension from the harbour and channel.

The approach has a relatively low operational cost (assuming gates and pool walls are in good condition) and the energy used to flush sediment out of the harbour is essentially low carbon, renewable energy compared with diesel intensive dredging alternatives (this also represents a significant cost saving).

Sluicing in Hayle Harbour ceased in the 1970s but had been previously used for over 100 years since the installation of the gates at Copperhouse Pool in 1834. Sluicing at Hayle was the principal form of managing water levels in the harbour facilitating sufficient access and berthing for large vessels serving the foundry and then the coal fired power station at North Quay.

### 6.3.1 Carnsew Pool

The mitre sluice gates and sluice tunnels of the Carnsew Pool have been reinstated as part of the overall development of South Quay. The sluice is now functional, but requires some additional automation equipment and an associated power supply to be installed to allow effective remote operation of the system. This automation equipment is in the process of being installed at a total cost of circa £40-50k. This investment will now enable sluicing to be undertaken remotely and automatically as required.


**Figure 13 – Carnsew Pool sluice gates reinstated as part of the redevelopment at South Quay**

Due to environmental sensitivities at Carnsew pool (a SSSI and RSPB reserve) including potential impact on diving birds during the winter months, Natural England and the RSPB have requested that sluicing should only take place between the months of April and September inclusively. This seasonal limit will inevitably reduce the effectiveness of sluicing. HCCT have met with MP George Eustice,

Natural England and the RSPB to discuss the operating limitation but for the time being, the limitation stands. It is proposed that sluicing activity during the operational months is monitored to evaluate impact on wildlife and explore whether the limit can be reduced or removed.

### 6.3.2 Copperhouse Pool

The current gates at Copperhouse Pool were installed in 1981 with the capability for sluicing, but were retro-fitted after installation with plain, sliding bearings in place of rolling bearings to reduce maintenance costs. This means that the gates can no longer be opened with a pressure difference across them (as is essential for sluicing).

It is possible that the rolling bearings could be reinstated[10] as the stub axles are still in place. Operational protocol would need to be changed to enable HHAOL to control the gate positioning, but with the proviso that the EA could take control in the event of flood risk. The added complexity of the dual use of Copperhouse Pool has meant that this option has not been explored further at this stage.

### 6.3.3 Sluicing effectiveness

Not many ports around the UK still use sluicing as a primary form of water depth management, and its effectiveness is normally considered in conjunction with other forms of dredging.

The effectiveness of sluicing will depend on a number of factors:

- The **volume of water** impounded and velocity of water released – the Hayle tidal pools are large impoundments but have been infilled with sediment in recent years
- The **type of sediment** which effects the time that sediment is held in suspension and can therefore be flushed – mud type sediments tend to remain is suspension for longer compared to heavier sands. The Hayle sediment is mainly sand – see Buro Happold study.
- The **distance** over which sluicing is effective – the flushing actions tends to be localised. While the Hayle inner harbour is a few hundred meters the distance from sluice gates to open sea is circa 1300m
- Sluicing is far less effective on sediment which has been compacted but can be used to flush out sediment recent sediment or in **conjunction with dredging** activity

[10] http://www.hayle.net/council/documents/2006GrubbReportonSluiceGates-full.pdf

| Experience from other ports |
| --- |
| Jerry Stanford, Haven Master at Bristol Port was contacted as part of this study to discuss water level management – the port still uses occasional sluicing to clear their sea locks and the short access channel leading to them. Jerry explained that the method was effective for their requirements, but it should be noted that the sediment is mud rather than sand and the access channels are tens of metres in length rather than hundreds of metres.<br><br>Experience from Teignmouth, which does not use sluicing but does undertake plough dredging in conjunction with ebb tide and river flows, suggests that heavier sand sediments would likely be moved in suspension for at most a 3-400 hundred meters.<br><br>(With further study - this could be calculated for Hayle based on an analysis of sediment type and flow volume and velocity from the sluice gates) |

Given the above it is clear that sluicing is not a standalone solution for Hayle but must be considered in conjunction with other dredging measures. It is also to be expected that sluicing will be more effective within the inner harbour area, but may be less effective in the approach channel.

Given the current constraints, with only one sluicing pool available and only for a portion of the year, it is unlikely that sluicing will now present a full water level management option for the harbour. It is also not expected that that sluicing alone will be able to remove consolidated sediment from the harbour which has built up over the past 30 years.

Sluicing will be a valuable addition to the water management regime as a low cost and relatively low impact measure, it needs however to be commenced in conjunction with dredging activities. The inner harbour will also need to be dredged in order for sluicing to be effective.

### 6.3.4 Sluicing – recommended approach and estimated costs

The HCCT propose to operate a trial period of sluicing during the allowable months of April to September, in partnership with Natural England and the RSPB to evaluate impact on the Carnsew Pool habitat and wildlife.

Depending on the outcome of this trial, it is hoped that sluicing could then be extended to year round operation. Options and costs to reinstate sluicing from Copperhouse Pool should also be considered.

Other than the cost of managing the process of sluicing at Carnsew Pool, all other capital costs (hardware and infrastructure) are already accounted for. A rough estimate for the time and cost of managing the sluice is provided as a benchmark to support overall cost estimation:

Sluicing cost estimate: 52 weeks, 3 hours per week at £35/hour, plus some maintenance giving a rough total cost of **£7,600 per year for the Carnsew Sluice**

## 6.4 Option 2 - Plough dredging

Plough dredging involves trailing a plough (see Figure 14) behind a vessel on a regular basis to loosen and level seabed material.

Plough dredging has a number of water management effects:

- Dragging sediment from mid channel to the side
- Dragging sediment along and out of the channel into the open sea – although the ability to transport material is limited to short distances or over successive plough
- Disturbing compacted sediment into suspension (held in the water column) from where it can be more easily flushed by ebb tide, riverflow and/or sluicing
- Levelling and redistributing material after mechanical dredging

Because plough dredging redistributes material in the local area rather picking it up and disposing of it at another site, no FEPA license is required from the Marine Management Organisation.

HHAOL have also concluded that plough dredging could be commenced without the need for a capital dredging licence since it is less than ten years since the Harbour was last dredged (i.e. last dredging in 2012 by ING).


**Figure 14 (left) - Plough dredge and A-frame support fitting**

**Figure 15 (right) - Cowes Harbour Commission using multicat fitted with a box plough**

### 6.4.1 Effectiveness of plough dredging - learning from other ports and harbours

A number of port operators have been contacted in the preparation of this study to establish an estimate for the cost and effectiveness of carrying out plough dredging work. These include Teignmouth, Cowes, Shoreham and Bristol. Ports that regularly used plough dredging include

- **Cowes** Harbour Commission, Barney Sollars, Marine Services Manager
- **Teignmouth** Harbour Commission, Humphrey Vince, Harbour Assistant
- **Shoreham** Port, James Gray, Assistant Harbour Master,
- **Bristol** Port Company, Jerry Stanford, Haven Master


**Figure 16 – aerial view of the ports and harbours contacted regarding their use of plough dredging. Teignmouth is probably the most similar to Hayle, with predominantly sand sediment and a long access channel.**

All port and harbour operators explained that with sand and sediment only being redistributed in a highly localised way through plough dredging, there is a risk that large storm events can quickly reverse plough dredging work.

Several port operators, including Teignmouth, described a strategy of an annual campaign of mechanical or suction dredging, to clear the channel and establish water depths, and then the use of regular/daily plough dredging to maintain and "hold onto" the gains made against the incoming sediment.

Hence the all year round requirement and the recommendation to plough daily on ebb tides.

Port operators also emphasised the importance of having the right specification vessel, plough and crew. Modifying a fishing vessel to be used for plough dredging was discussed with the contacts, but most agreed that whilst it was possible, it would not be possible to fish with the plough dredging deck spread in place and this would have to be removed / installed each time to enable the vessel to do both tasks. A Damen 1405 or similar class tug with appropriate deckspace as used at Shoreham (Figure 17) seems to be the preferred option.

Most operators preferred to own their own plough dredging vessel, as a cheaper option for daily maintenance, but to contract in mechanical and suction/grab specialist dredging vessels for annual or capital dredging campaigns.


**Figure 17 – Damen 1405 tug used for plough dredging at Shoreham Habour**

| **Summary of key points made during interview with port operators** |
|---|
| **Frequency and time** – everyday, as much as 8 hours per day (Teignmouth), with every ebb tide<br>**Crew** – 2 personnel required (Cowes use 3, but described this as a labour intensive approach)<br>**Fuel consumption** – 45 litres per hour (Shoreham) for a 5.5m plough.<br>**Vessel specification** – ideally a twin screw, harbour tug recommended (e.g. a Damen 1405 – see Figure 17) with 1 tonne bollard pull per metre width of plough. Double plated with Hardox steel to cope with prop-wash sand blasting.<br>**Plough specification** – either a box (cheap) or toothed (performance) with a suggested width of 3 – 4 m. Expect to rebuild the plough twice a year for sand work at a cost of £3-4k (Teignmouth).<br>**Charge out rate to a another port**– rough quotes received for vessel charter £1,300-1,700 per day + mob/de-mob costs<br>**Effectiveness** – Shoreham and Teignmouth use plough dredging in conjunction with annual / biannual suction / grab dredging. Teignmouth use the Mannin grab dredger based in Padstow for this work. |

### 6.4.2 Recommended approach and estimated costs

Plough dredging could be a useful addition to the ongoing water depth management regime at Hayle but it has limitations and would be an expensive and ineffective method to reinstate the channel and harbour. There is also a doubt over whether a suitable vessel would be able to operate within the harbour/channel area except for a very limited period over high water.

It is therefore recommended that plough dredging be considered as an ongoing option once the harbour/channel have been reinstated and that plough dredging be considered as a supplement to sluicing and periodic mechanical dredging.

Three costs options have been considered:

- Chartering in a plough dredge vessel – for periodic and ad hoc works, costs £1300 per day plus mobilisation
- Modifying an existing (fishing/commercial) vessel for part time plough dredging with a smaller plough – cost £10-15k. Note: doubts have been raised about how effective this would be.
- Acquiring a dedicated 2nd hand Damen 1405 Tug or similar class vessel for which costs could vary widely (£100k-600k) with an average of capital cost of £350k.

| **Rough Calculation Cost Estimate for Full Time Plough Dredging Operation**<br>**Based on full time operation 250 days @6hr/day - 1500hrs per year** | |
|---|---|
| **Contract Vessel** | **Own vessel** |
| **Typical contract cost**<br>A contract vessel and crew benchmark Teignmouth would be circa £1300/day<br>**Circa annual cost £350k**<br>**Lower cost contractor?** A lower cost contractor could be found – possibly a local fisherman. Contractor would have to have the appropriate vessel, crew and be prepared for near full time operation.<br>Potentially this could compete with the own vessel option – needs to be validated during procurement. | Based on acquiring a Damen 1405 Class Tug at a capex circa £350k<br>Crew Costs - **£60- 80k** (2 crew full employment)<br>Fuel Costs - **£21k**<br>(6 hours a day at 30 litres per hour (reduced pro rata for narrower plough) gives 180 litres fuel per day. 180 litres of fuel at £0.5/litre (Hayle Habour - £600/tonne) gives **£90/day.)**<br>Vessel maintenance **– £10k**<br>Insurance TBC<br>Plough maint/replacement **- £8k**<br>Vessel depreciation/capital cost at 10% **- £35k**<br>**Total £155k per annum** |

## 6.5 Option 3 - Mechanical dredging

Using excavation equipment (e.g. backhoe diggers, excavators, dumper trucks etc) to dig out and relocate sediment in the harbour area. Excavation equipment may be mounted on a work barge or working directly on the sand at low tide.

Mechanical dredging has a number of key advantages over sluicing and plough dredging:

- It is relatively fast process to shift significant tonnes (or volume) of material
- Material dredges can then be removed from the area of the harbour or channel
- Dredging can be targeted at specific pinch points

One potential disadvantage of mechanical dredging is that it can create an uneven channel with holes and low points in places. However in conjunction with sluicing and regular plough dredging this can be addressed.

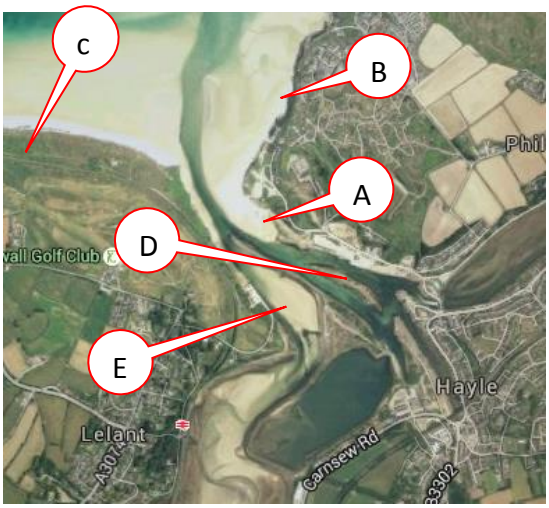



**Figure 18 (left) – mechanical dredging in the Hayle access channel in 2010.**

**Figure 19 (right) – potential sites for redistribution of dredged material**

### 6.5.1 Wells-next-the-Sea mechanical dredging

A key limitation to mechanical dredging with a digger excavator is access to the channel and the digger limited reach. Other ports have overcome this by using innovative solutions.

As part of this study, the Port and Harbour of Wells-next-the-Sea (Wells Harbour) in Norfolk was contacted. Wells Harbour has a similar challenge and some of the same market drivers as Hayle (see case study Appendix 2). Wells Harbour operate a mechanical dredging regime using the Kari Hege a 20m 'spud leg' barge and a long reach backhoe excavator (see Figure 20). Wells harbour master, Robert Smith, described the dredging procedure as 'side swipe', explaining that sediment is dredged

from the channel and then deposited directly onto the bank in a single motion rather than depositing on the deck and moving again.

The Kari Hege was built specially for the task by Goodchild Marine and is operated by Wells Harbour for 250-300 days a year at a cost of £120,000 per year including fuel, crew, and vessel maintenance costs.

**Figure 20 – the Kari Hege operated by Wells-next-the-Sea, Norfolk.**

The accurate nature of mechanical dredging by excavator from the seabed or a vessel makes it a potentially good fit (over suction dredging) with environmentally sensitive locations such as Hayle harbour. Wells Harbour is similarly surrounded by the North Norfolk SSSI and the dredging activity has been used to actively support and enhance habitats in the area in partnership with Natural England.

It is proposed that mechanical dredging work could be carried out by local contractors with valuable local knowledge and low mobilisation costs as has been done in the past. Standard land based excavation equipment and a dumper truck would be used at low tide and from the bank for shoreline work at higher tides.

It is estimated that increasing depth in the 300m by 20m channel to the south of the Cockle Bank by 1.0 m would take approx. 40 days (0.4m$^3$ bucket, 90 loads per hour, 4 hours per day – tide limited).

### 6.5.2 Recommended approach and estimated costs

Mechanical dredging using a digger/dump truck combination is the quickest and most cost effective method to remove significant volumes of material. Therefore HCCT propose to use mechanical dredging as a main method of material extraction to reinstate access to the harbour and to provide ongoing periodic maintenance as required.

This activity could be undertaken at low tide with equipment on the seabed as has been previously used at Hayle (see Figure 18) or by operating an excavator from a barge (see Figure 20). The excavated material could be deposited on the dunes at the north western end of North Quay (point A in Figure 19) or at the point where the Wave Hub cable transits the beach – helping to reinstate the area. Alternatively, the material could be relocated directly to the sides of the channel in which the equipment is operating – e.g. to the Cockle Bank (D) and Carnsew Beach(E).

The access limitation of mechanical dredging to reach all areas of the channel may mean that a barge of vessel based grab dredger, such as the Padstow based Mannin, may also be required for specific areas.

The HCCT project has contacted a number of plant operators and contractors to obtain rough costs estimates for budgeting purposes.

The key factors to be considered are:

- The volume of material to be removed – tonnes and m3
- The efficiency of mechanical operations – excavator and truck – tonnes per day/week
- The cost per day/week of plant and operations

<table>
<tr><th colspan="2">Rough Calculation Cost Estimate for Mechanical Dredging Operation<br><br>Digger and dump truck operations</th></tr>
<tr><th>Choice of plant - Input from contractors</th><th>Indicative Costs</th></tr>
<tr><td>The HCCT project contacted 6 plant hire and equipment operators to discuss the requirements for excavators and indicative costs.<br><br>There are a variety of digger options:<br>• a standard 13.5-15 tonne excavator was recommended and is price competitive<br>• a larger 25-35 excavator unit with a longer reach of 18-22m, may be more cost effective.<br><br>Excavators would be supported by a dump truck of tractor trailer to form an “operating unit”<br><br>Additional costs to move and dispose of materials have not been assessed other than dumping on the nearby beach and dunes – above the high water mark.</td><td>Daily hire costs (including operator but exc. fuel) ranged from £285-600 per day depending on the spec with most quotes around £300-350.<br><br>Larger units were more expensive with one quote of £600 per day.<br><br>Dumper or tractor trailer costs ranged around £300 per day<br><br>Note: All contractors emphasized that long term contracts and total tonnage/cubic metre contracts would be more cost efficient.<br><br>As an average we used an operating unit cost (excavator and dumper/tractor) of £650 per day - £3250 per week - plus fuel of circa £250 per week for an average unit cost of £3500 per week.</td></tr>
</table>

**Digger/dump operation efficiency**

For budgeting purposes it has been assumed that in normal efficient working from a stable platform an experienced digger operator ought to be able to perform over 90 bucket moves per hour. At circa 0.4m3 per bucket that would give a rate of 36m3 or 65 tonnes per hour ("efficient equivalent").

Tidal dredging operations however have a number of constraints; tidal restrictions, access to site, time taken to position and reposition the digger, time waiting for the dump truck to unload sand (possibly some distance up the beach) and return to the digger.

Given these restrictions it is estimated that a digger/truck unit operation in the channel area might achieve **4 hours of efficient equivalent** operation per day – removing circa **1300 tonnes per week**. The rest of the time would be spent repositioning the digger, spreading and reprofiling dumped material and awaiting the dump truck.

Operating in the harbour area is likely to be more efficient, with shorter distances to travel and the potential for some "side swipe" single motion operations. This gives an e**stimated 5 hours of efficient equivalent** operations per day or **1600 tonnes per week**.

**Alternative Approach – Larger excavator and two dumpers**

**Note:** The above estimates are for rough budgeting purposes only. After detailed operational planning it may be found that a larger excavator, with a larger reach and bucket size, is more cost effective, or that a combination of larger and smaller excavators working on different sections of the channel is the optimum combination.

It may also be found that having two dumpers per excavator is more effective – especially if deposited material has to be moved some distance from the channel.

A larger **25-25 tonne** excavator, operating alongside two 20 tonne dumpers, would cost in the region of £1200 per day or £6000 per week, but, with a larger bucket capacity and more efficient working loads, could potentially shift **3000 tonnes** per week.

It may be also possible to attach a chain and plough directly to the excavator, or to a pair of dumpers, to enact plough dredging and channel levelling.

**A full operational and contract management plan will be needed**

- Mechanical operations will require careful planning and more management time and supervision to ensure effectiveness and efficiency.
- Choice of appropriate plant and an experienced operator is critical
- Choice of plant may vary during different periods of operations including use of (more expensive) larger long reach diggers and potential need for two dump trucks per digger
- Efficient use of tidal downtime will be important

- Distance and access to dump sites will be important
- Securing a change to dredging conditions from the MMO to enable sand to be deposited directly on the beach below low water will significantly reduce dredging costs
- The type of contract will be important. All contractors suggested that long term contracts and contracts based on a per tonnage or volume basis are more cost effective.

## 6.6 Option 4 - Extending the channel training wall

The training wall in the narrows at the entrance to the harbour helps to maintain the existing channel and acts as a venturi for sluiced water, accelerating flow and associated sediment scouring effect. Maintaining a straighter channel and controlling its width will help to make the sluicing and dredging activity more accurate and hence more cost effective.

The west side of the channel has historically had a wall in place constructed by rock dump and gabions. The west side training wall and channel mark have now become overtopped with sand as the channel has shifted eastwards and the line of the training walling is partially hidden. Proposals have been made to extend the existing training wall.

A longer wall would also help to straighten the channel and stop the channel location meandering as it transits the beach between Hayle beach and Porth Kidney Sands improving safety and water depths.

There has never been a training wall on the west side of the channel, however the option to look at a west side training wall was recommended by the Bates study of 1983 and could be considered.

**Figure 21 – training wall to straighten and maintain the access channel - the existing 115m training wall (in red), the length and position of the proposed 20m extension (in amber) amber and a further 200m extension provided for illustrative scale**

### 6.6.1 Recommended approach and estimated costs

As a short term priority the existing training wall needs to be reinstated and assessed for repairs. Ideally this should be done in conjunction with the start of sluicing operations to ensure that sluicing is effective. Costs to reinstate the existing training wall are unknown and will depend on the amount of maintenance required.

The existing training wall could then be extended using either rock armour, steel sheet pile, gabions or an alternative approach such as gabions constructed from recycled tractor tyres.

A study to consider whether an additional training wall on the east side of the channel would be beneficial and viable should be undertaken.

**Alternative approach to revetment wall construction**

While traditional rock armour revetment, steel sheet pile and gabion construction are well established there are a number of alternatives available which could be considered.

The HCCT have identified a Cornish company who are producing gabions constructed from recycled tractor tyres and fibre optic cables. An initial estimate for the cost of undertaking a 20 m trial extension of the existing wall using this tractor tyre concept is £25k.

HCCT have done some positive trial testing of the tractor tyre concept at Plymouth University's COAST laboratory to demonstrate that the proposed gabion structure will survive the significant wave climate experienced at Porth Kidney Sands and Hayle Beach. HCCT have also identified some currently unused rock revetment material in the harbour which could be used to re-establish the existing wall and potentially extend the wall.

# 7 Overall approach and recommended actions

The review of options presented above and the experience from other ports and harbours suggests that there is no single solution for water depth management at Hayle Harbour and that a combined approach will be needed.

### 7.1.1 Remedial Works to reinstate navigation and access

The immediate priority for the harbour is to reinstate the channel and to dredge the inner harbour area so that sluicing can be effective. The remedial works to get the harbour back to the point where it is fully operational and can then be maintained with an ongoing basis is likely to take two or possibly three years.

Overall the key objectives would be to:

- Restore navigational access – reinstating port and starbord navigational buoys
- Strainghten and enhance the approach channel
- Increase depth in approach channel by 1m average
- Clear inner harbour and increase depth by average of 2m
- Achieve access target of HW+- 3 hours for 2.5m draft vessel

The remedial works plan will involve the removal and dumping of circa 180,000 tonnes of material from both the access channel and the inner harbour. It is suggested that the harbour authorities plan to achieve this over a three year period with the bulk of material being removed by mechanical digger operations which is the quickest and cheapest method to remove material.

Additional grab dredging – potentially using Padstow based MV Mannin – and plough dredging may also be required for hard to reach areas of the channel/harbour and for channel levelling purposes.

The total costs of a 3 year Harbour reinstatement programme is estimated to be in the order of £460k assuming that the bulk of actvity can be carried out by mechanical dredging. **Note this cost estimate does not include additional costs that may be incurred to dump material a significant distance from the channel for replenishment purposes.**

Additional capital costs to repair and extend the training wall and upgrade the Copperhouse Sluice gates have been very roughly estimated at £270k but these costs, and their effectiveness, need to be properly evaluated.

A rough plan to restore the harbour access and navigation is outlined in the table below. As noted in Section 6.5.2 a full operational and procurement plan will be needed.

| Key objectives | Specific targets/actions |
|---|---|
| **Year 1 Summary Plan – Reinstate channel and begin remedial works** | |
| **Reinstate and straighten the channel.**<br>**Commence sluicing from the Carnsew pool**<br>Clear the inner harbour channel so that sluicing can commence.<br>Begin remedial dredging in channel and inner harbour<br>Identify and secure necessary permissions for sand dumping including:<br>• Dune replenishment area<br>• Beach reprofiling (below high water)*<br>• Build up the Cockle Bank*<br>(*this will very likely require a licence from MMO) | Reinstate the existing training wall and carry out repairs as needed.<br>Commence channel and inner harbour dredging.<br>Target circa:<br>• 30000t from channel<br>• 20000t from the inner harbour<br>Commence summer sluicing from the Carnsew pool and evaluate effectiveness. |
| **Year 2 Summary Plan – Establish Navigational Access** | |
| **Aim to have clear channel access to reinstate navigational access - port and starboard channel buoys.**<br>Dredge 30m (min) channel to increase water depth by average 1m<br>Dredge inner harbour to increase water depth by an average of 2 m<br>Evaluate sluicing effectiveness and impacts | Combination of mechanocal dredging plus specific grab and plough dredgiung as required.<br>Target circa<br>• 50000t from approach channel<br>• 40000t from inner harbour<br>Extend existing training wall<br>Extend year round sluicing from Carnsew pool |
| **Year 3 Summary Plan – Complete Remedial Works** | |
| **Complete remedial works**<br>30m channel in place, increased depth by 1 m | Complete remedial dredging of approach channel and harbour. |

| | |
|---|---|
| Access HW+-3 for 2.5m draft vessel<br><br>Turning space and clear harbour | Target circa<br>• 20000t in approach channel<br>• 20000t in inner harbour<br>Possible:<br>• Further extension of training wall<br>• New training wall on east side<br>• Sheet pile Cockle Bank to retain sediment and create additional mooring |
| **Year 4 Summary Plan – Commence ongoing maintenance operation** | |
| **Implement ongoing maintenance regime**<br><br>Monitor and manage water depths<br><br>Evaluate sluicing effectiveness and impacts<br><br>Monitor sand dune replinishment effectiveness<br><br>Evaluate options to begin additional sluicing from Copperhouse Pool | Measure channel depths<br><br>Conduct mechanical dredging as required<br><br>Contract Plough Dredging and Grab Dredger as needed<br><br>Estimate 20000t per annum |

### 7.1.2 Ongoing harbour water depth maintenance

Once the harbour navigation and acess in reinstated the intention is to maintain the water depth and channels as a stable level, thereby preventing further buildup and compacting of sediment.

It is hoped that much of this can be achieved by the regular use of sluicing, initially from the Carnsew Pool but later also from the Copperhouse Pool. An increase in vessel usage – especially larger vessels will also assist.

It is likely however that additional regular harbour dredging will be also be required. It is hard to estimate this but the Buro Happold 2010 study suggested 20000 tonnes as an espected annual dredging requirement.

It is likely that much of this can be achieved by mechanical dredging at specific sites but additional plough dredging and grab dredging may also be required.

The annual costs of onging maintenance is estimated to be in the order of £100k per annum. This includes the provision for 20 fays of additional plough dredging at a chater rate of £1300 per day.

## 7.2 Summary of costs - remedial & ongoing water depth maintenance

| Harbour works and on-going water depth management 5 year cost plan (very rough estimates) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Remedial works and reinstatement | | | | | | On-going water depth management | | | |
| | | | Year 1 -2016/17 | | Year 2 - 2017/18 | | Year 1 -2016/17 | | Year 4 - 19/2020 | | Year 5 21/22 | |
| Type of works | Target | unit | Summer Apr/Sept | Winter Oct-March | Summer Apr/Sept | Winter Oct-March | Summer Apr/Sept | Winter Oct-March | Summer Apr/Sept | Winter Oct-March | Summer Apr/Sept | Winter Oct-March |
| **Remedial Hartbour and Channel Dredging** | | | | | | | | | | | | |
| **Year 1 Reinstate Channel Works** | | | | | | | | | | | | |
| Channel Material Removal | 30000 | tonnes | £84,000 | | | | | | | | | |
| Harbour Material Removal | 20000 | tonnes | £45,000 | | | | | | | | | |
| | | | | | | | | | | | | |
| **Year 2 Establish Navigational Access** | | | | | | | | | | | | |
| Channel Material Removal | 50000 | tonnes | | | £140,000 | | | | | | | |
| Harbour Material Removal | 40000 | tonnes | | | £90,000 | | | | | | | |
| | | | | | | | | | | | | |
| **Year 3 Complete Remedial Works** | | | | | | | | | | | | |
| Channel Material Removal | 20000 | tonnes | | | | | £56,000 | | | | | |
| Harbour Material Removal | 20000 | tonnes | | | | | £45,000 | | | | | |
| | | | | | | | | | | | | |
| **Remedial works and channel reinstatment total costs** | | | | | | | | | | | | |
| **Total Tonnage** | | **180000** | **50000** | | **90000** | | **40000** | | | | | |
| **Total Costs** | | **£460,000** | **£129,000** | | **£230,000** | | **£101,000** | | | | | |
| **Additional Capital Costs - to be evaluated** | | | | | | | | | | | | |
| **Training Wall Repair Works** | | | £20,000 | | | | | | | | | |
| **Training Wall Trial Extension - 20m** | 20 | m Extension | | | £20,000 | | | | | | | |
| **Training Wall Full Extension 200m** | 200 | m extension | | | | | £150,000 | | | | | |
| **Reinstate Copperhpuse Sluice Gate** | | | | | | | | | £80,000 | | | |
| **On-going Water Depth Management** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Sluicing Operations - Carnsew | | | £3,800 | | £3,800 | £3,800 | £3,800 | £3,800 | £3,800 | £3,800 | £3,800 | £3,800 |
| Sluicing operations Copperhouse | | | | | | | | | £3,800 | £3,800 | £3,800 | £3,800 |
| | | | | | | | | | | | | |
| Ongoing Dredging (mechanical) | 20000 | tonnes | | | | | | | £56,000 | | £56,000 | |
| Plough/grab Dredger Charter Option | 20 | days per year | | | | | | | £26,000 | | £26,000 | |
| | | | | | | | | | | | | |
| **Ongoing Water Depth Management** | | | | | | | | | | | | |
| | | **Year** | **£3,800** | | **£7,600** | | **£7,600** | | **£97,200** | | **£97,200** | |

# 8 Business and economic case for investment

It should be very clear that the value of Hayle Harbour to the town and local community, and to the wider economy in Cornwall, is far greater than the limited revenues and income received by the harbour today – either directly from harbour users or in the form of contributions from the harbour owners and small UNESCO grant funding.

There is also a strong case that the significant investments that have been made to date to improve the harbour infrastructure, develop Wave Hub and complete the Marine Renewable Energy Business Park – which have helped to position Cornwall at the forefront of the marine energy and "bluetech" industries - can only be fully realised if there continues to be a fully operational harbour.

The HCCT project has therefore sought to develop a strong economic and business case for continued investment in Hayle Harbour based on:

1. Securing and preserving the also and jobs related to the existing economic activity within the port (fishing, leisure and tourism) and the revenue that this generates for port operations
2. Extending and enhancing the current activity – especially in the area of marine leisure and yachting.
3. Developing new area of business, especially in the areas of marine energy, marine sciences and the wider marine industries "bluetech"/"blue economy" opportunities

While it is recognised that in the short term, Hayle Harbour will continue to need additional funding – especially to carry out the remedial works identified in Section 7 above and to implement an ongoing programme of water depth management - it is very possible that in the medium term a busy and industries port, providing higher value services to its customers, will be able to deliver a sustainable financial and business model.

The challenge however is for the port to get itself on the right commercial footing, protecting its existing customers and revenue, and to be able to offer new customers a higher value and enhanced service. Without stating the obvious a fundamental service offer by the port is access to water, and so the quayside, navigation channels and water depths are a critical part of that customer offer. Taking the Ongoing Water Depth Management costs as a target the challenge for the port is to find an **additional £100k of sustainable income**.

The following section outlines potential sources of new business as well as those existing areas of business that need to be protected. Much of the new business identified will be contingent on improved water levels and safe access.

In compiling this analysis the HCCT project has spoken to a number of existing port users as well as a number of marine operations and marine energy companies that could potentially use the port. Their comments and views have been extremely positive and our reference below.

## 8.1 Current Hayle Harbour business model and revenues

The harbour is currently operating at a operational loss. Current income is principally from harbour dues, parking and slipway charges and some lease arrangements paid by small fishing vessels and water sports users.

**Note: a number of contributors have commented that the current charging tariff for berths and moorings is quite low. On the other hand the harbour itself provides quite limited services – no real amenities, showers toilets etc – plus the navigational constraints.**

So the HCCT is mindful that there is a limit to what exiting users will pay for the existing level of harbour amenities and navigational constraints.

**Table 1 - Current operating revenue and costs (rough figures)**

| Item | **Amount** (annual) |
|---|---|
| **Revenue** | £45k |
| **Operational costs** | -£110k |
| **Current Balance** | **-£65k** |
| **Heritage levy income from new buildings (TBC)** | **£80k** |
| **Expected Balance** | **£15k** |

In the short term the current loss is intended to be covered by development work planned by harbour owner Corinthian which will provide a new source of income from a heritage levy placed on all new buildings in the harbour area. (two buildings currently provide heritage levy income including £6k from the South Quay ASDA).

Once fully developed, it is estimated that this will provide an additional operating income of approximately £80k, covering the current loss.

## 8.2 Near term 3-5 year increase of Hayle Harbour Revenue

In order to evaluate the various sources of current and future income, local and national organisations and individuals representing fishing, marine renewable energy and marine operations, leisure and water sports were contacted for their views on the current challenges and potential for Hayle.

From the comments received it is anticipated that the harbour could increase its revenue in the short term from existing port users, an increase in visitors, and new revenue from the current customers of Wave Hub plus new business generated by the Marine Renewables Business Park. This increase could generate a target operating revenue of at least £220k by 2020/21 – which would therefore meet the increased additional costs of undertaking the ongoing water depth management.

| Table 2 –existing and potential future sources of income by 2020/21 | **Amount** (annual) |
|---|---|
| **Current operating revenue** | £45k |
| **Heritage levy income** | £80k |
| **Additional near term potential revenue sources** | |
| Fishing (not expected to grow – could be conservative) | £0k |
| Marine renewable energy and marine operations – Wave Hub customers | £54k |
| Leisure sailing – increase in yacht mooring fees, visitors and berths | £13k |
| Water sports and tourism – small increased revenue | £3k |
| Marine science, research and technology innovation – attracted by the Marine Renewables Business Park and R&D&I hub – could be very conservative | £15k |
| **Near term operating revenue total** | **£220k** |
| **Current operating costs** | **£110k** |
| **Additional Ongoing Water depth management costs** | **£100k** |
| **New operating costs** | **£210k** |
| **New Operating profit (Loss)** | **£10k** |

This forecast is viewed as a conservative estimate. No new revenue is included from fishing or existing commercial users. Commercial discussions with Wave Hub customers are ongoing, and could generate higher revenues for a greater level of service, and the Marine Renewables Business Park could generate additional harbour revenue especially if it is used by vessels conducting marine research on behalf of Plymouth and Exeter Universities. There is also the opportunity to use the harbour itself for prototype and equipment testing ("dunk" testing) for additional fees.

Additional revenue per annum could be made up from an increase in activity and a modest increase in harbour fees. A 10% year on year growth across these areas would provide a breakeven point in 9-10 years although this will imply increase in operational costs as facilities are upgraded to cater for new areas of activity.

The Wells Harbour case study (See Appendix 2) give a good example of what can be achieved and the unexpected benefits and opportunities of a fully working port. Against this positive view is the risk that without remedial dredging and channel straightening work the existing Hayle Harbour revenue will be under threat.

# 9 By sector – the business case for investing in Hayle Harbour

## 9.1 Fishing

Fishing is the principle area of commercial activity in Hayle at present, with over £300k of shellfish and fish landed through the harbour each year. Shellfish represents the majority of this catch at over 80% with 13% pelagic fish (principally mackerel) and 5% demersal fish (bottom feeding fish). Much of the catch is shipped to Spain and France where the market price is higher, although there is also a small local market.

There are 28 registered fishing vessels in Hayle over which mostly operate during the spring, summer and autumn months although some operate year round. Vessels are typically relatively small 5 to 10m potting (lobster) boats with some seasonal hand lining boats.

**Figure 22 – typical small fishing boats moored at South Quay**

Pressure from European quotas, declining stocks and international competition have made commercial fishing in Cornwall challenging and created a slow decline in volume. Despite this decline in volume, the weight for weight value of Cornish fish and shellfish continues to rise[11] above average in recognition of the national and international reputation for quality. The hard work of Cornwall's resourceful and adaptive fisherman, championing of local produce by local restaurants and export opportunities mean that fishing is still a valuable part of the Cornish economy to be protected and where possible enhanced. In 2013, the Cornish Fish Producers Organisation Ltd recorded a landed

[11] http://www.cornwallgoodseafoodguide.org.uk/cornish-fishing/the-cornish-fishing-industry-today.php

value of £36.6m[12]. This regional trend is echoed in Hayle, although as can be seen from Figure 23, there has been a steady decline over the past four years, although not to a point below 2010. In order to protect and retain commercial fishing in Hayle, fisherman require safer access and longer operating windows, both of which would be improved through the measures outlined in section 6.

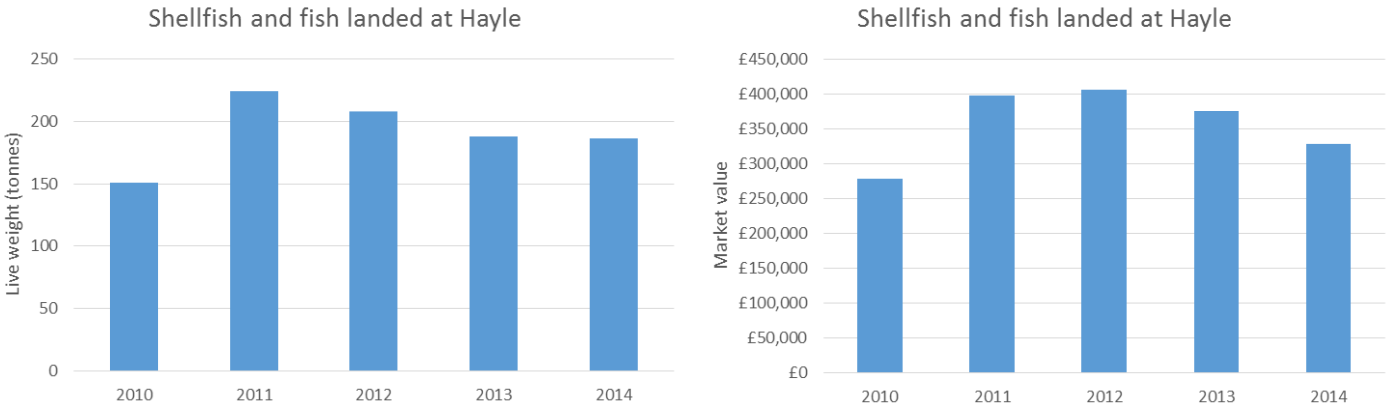



**Figure 23 – weight and value of fish landed at Hayle over the past 5 years.**

In the preparation of this study, we contacted local fisherman Lech Kwiatkowski. Lech is a member of the Hayle Fisherman Association, but provided comment as an individual and a representative commercial fisherman. Lech is a shellfish fisherman, principally potting for lobster, although he also been contracted to carry out survey work. Lech operates all year round except for 2 months in the winter and explained that he can get his 1m draft boat in and out of the harbour for an average of +/- 2 hours 40 mins either side of mean high tide.

Lech observed that this is steadily declining and that the last two winters have seen significant reductions in the operating window, putting pressure on fisherman to push the edges of the available time envelope.

Lech's main concern with Hayle Harbour is improving the safety of sand bar at the entrance to the access channel – he explained that the current arrangement posed a loss of life threat to all fisherman in small vessels such as his. In summer 2015, a Hayle fisherman lost all the windows in his wheel house when waves broke over the boat whilst crossing the sandbar. Lech pointed out that whilst the sand bar will always exist even with significant dredging, by reinstating the training wall and a deeper, straighter access channel, safety could be significantly improved as boats would be able exit and enter the harbour perpendicular to the wave fronts.

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https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/358342/UK_Sea_Fisheries_Statistics_2013_online_version.pdf

Lech explained that he didn't see a threat/conflict of interest from increased traffic brought about by increased leisure sailing or marine operations activity and that he and his colleagues would welcome the benefits this would bring to the harbour.

Lech explained that he thought improved access and water levels at Hayle would in the first instance protect existing fishing activity at its current level and may encourage future increased activity with visiting handline fisherman.

### 9.1.1 Impact on business case

It is assumed that commercial fishing industry at Hayle will be protected from further decline rather than increased through the proposed harbour works.

## 9.2 Marine renewable energy and marine operations

The marine renewable energy sector represents a potentially significant opportunity for Cornwall – as recognised in the *Cornwall & Isles of Scilly Marine Renewables Roadmap 2015 – 2025*:

http://www.marinerenewables.org.uk/images/2783_marine_renewables_roadmap_email3.pdf

In recognition of this opportunity, national and local government has made significant investment in infrastructure and the supply chain in Cornwall and the wider South West England required to take a stake in this emerging market. Perhaps the largest portion of this investment to date has been in Hayle through the Wave Hub (£30m) facility off the coast from Hayle and the Marine Renewables Business Park (£24m) established to support companies operating at Wave Hub. Other assets in Cornwall and the wider South West include the scale wave energy FaBTest facility in Falmouth Bay, the Dynamic Marine Component (DMaC) test facility in Falmouth and Plymouth Universities state of the art COAST wave basin and laboratories.

The location of Wave Hub was selected as the best fit with a number of key criteria including the availability of a strong grid connection and the wave energy resource. However, Hayle Harbour was cited in the documents prepared during the design phase of Wave Hub:

'***It is assumed that Hayle Harbour will be able to provide a support base for activities involving workboat type vessels*** *e.g. ROV inspections, Waverider buoy changes/maintenance/environmental monitor maintenance. It has good access by road, adequate quay space with area where mobile cranes capable of approximately 16te can operate.* ***Whilst vessels with a draught up to 3 metres are limited by tidal conditions to entry/exit 3 hours either side of high water, it is not considered that this impacts in any significant way on the support requirements****. There is a limitation on the maximum draught of vessels using the harbour of 3 metres. The 'working' draught is approximately 2.3 metres.*'

*Abbot Risk Consulting Ltd, December 2004*

Activity at the Wave Hub site and specifically the marine operations requirement is a key driver for the target specification for Hayle Harbour as laid out in Section 5. Large workboat vessels and intensive operation and maintenance activity for prototype devices installed at Wave Hub mean that the harbour must be made deeper and more readily accessible in order to play a role in serving the Wave Hub site. Bringing Hayle up to the right specification will mean that marine operations companies can work reduce fuel costs and transit times compared to other regional ports in addition to making the most of shorter weather windows.

Whilst Wave Hub is the most immediate driver for increased marine operations at Hayle, more general offshore construction on the North Coast of Cornwall and the Isles of Scilly as well as potential for increased marine and offshore renewable energy activity in the Bristol Channel and South Wales is likely to help Hayle to establish a long term place as part of the marine operations infrastructure on the North Coast of Cornwall.

In addition to direct consultation with Wave Hub Ltd, a number of wave energy device developers and marine operations companies were contacted in the preparation of this study. Most of these companies are local to Cornwall but have already established themselves as global leaders in the sector and are already exporting to the rest of the UK and overseas.

The first installation at Wave Hub was by Seatricity's Oceanus device, deployed in summer 2014 and again in summer 2015. The device was installed by Seatricity's own Ocean Enterprise aluminium catamaran workboat.

**Figure 24 – Seatricity's Oceanus 2 device being installed at Wave Hub in summer 2014 by the Ocean Enterprise**

The 2014 installation and associated operations were run out of Padstow due to the limited access and turning circle in Hayle harbour, but a workable arrangement was found for the summer 2015 activity and Seatricity have since made a temporary base at Hayle for their work at Wave Hub.

The next significant period of activity at Wave Hub will be the CEFOW project, run by Finnish utility company Fortum using Finnish WEC technology from developer Wello Oy. The Wello device was initially tested at the European Marine Energy Centre (EMEC) in Orkney, but will be tested as an array of devices at Wave Hub in 2016. Marine operations will be carried out by the marine operations company that installed and maintained the Wello device at EMEC - Orkney (Scotland) based Green Marine.


**Figure 25 – Wello Oy device installed at EMEC in Scotland**

### 9.2.1 Feedback and requirements from the marine energy sector

| **Wave Energy Companies contacted as part of the HCCT Project study** | |
|---|---|
| **Wave energy device developers** | **Marine operations and supply chain** |
| **Wave Hub Ltd** – Julius Besterman<br>**Seatricity** - Andy Bristow,<br>**Fortum and Wello Oy** – Mikko Huumo,<br>**Carnegie Wave Energy Ltd** – Tim Sawyer | **Green Marine** – Jason Schofield, MD<br>**Coastal Science Ltd** - Phil Shepard<br>**Marine Towage Services** – Steve Bendall,<br>**Mojo Maritime** – Matt Hodson, Business<br>**Keynvor Morlift** (KML) – Diccon Rogers,<br>**Wind and Wave Workboats** – Peter Scrivener,<br>**Falmouth Divers & MOR group Chair**– Steve Roue |

**Typical Marine Energy Workboats**

Figure 26 – examples of vessels expected to operate at Wave Hub during installation and operation and maintenance phases of wave energy device deployment. Left – Green Marine's Green Isle Damen Multi Cat 2712 – 27.7m length and 2.85m draught. Right – KML's Severn Sea support vessel - 30m length and 2.5m draught.

### 9.2.2 Summary of industry requirements

Companies contacted were also asked to explain what harbour facilities they would like to see installed as part of the medium and long term development of Hayle. The table below provides a summary list of requirements both for vessels and broader harbour services.

An important point made by several companies is that while navigation and quayside infrastructure are the fundamental service provided by the harbour, Hayle Harbour also needs to consider the additional services that it can provide or host.

| **Type of activity expected to operate from Hayle** |
|---|
| • Work boat (see Figure 26) activity including:<br>  ○ 18-35m (LOA) multi-cats, tugs, support vessels<br>  ○ 1.5-2.8m draught<br>• Principally operation and maintenance activity including reactive, fast response work. Larger installation tasks more likely to be operated out of Falmouth<br>• Potentially some smaller "Balance of Plant" installation –mooring, electricals etc.<br>• Crew transfer to larger vessels<br>• Site and asset inspection including support for PR and marketing visits<br>• Associated marine science and research activity<br>• Potential asset retrieval and storage for smaller wave energy devices |
| **Minimum or essential Harbour Services** |
| • Channel and water depths to enable safe access of workboats HW±3 hours<br>• Load bearing seabed at berths to enable vessels to be loaded whilst on NAABSA berths<br>• Temporary, maintenance berthing for WECs in Hayle Harbour – specification highly variable<br>• Navigational marks and lights installed to current standards<br>• Good quayside personnel access for all sizes of vessels at various states of tide<br>• Good and safe ladders, brows, slipway, pontoons etc.<br>• Quays with firm and quantifiable standing area for cranes, lorry and heavy vehicle<br>• Wet berths |
| **Additional services that would be expected** |
| • Craneage – or availability to contract in<br>• Bunkering, good electricity and water supplies and refuse disposal<br>• 24h port security and lighting to working areas<br>• Toilets and Showers with controlled access for authorised users<br>• Pilotage<br>• Good supply chain support – engineering, consumables, chandlery etc.<br>• Dry stack storage for RIBs, etc. |

### 9.2.3 Industry feedback and views on Hayle Harbour and its importance to the sector

Feedback from marine operations companies and wave energy technology developers was universally supportive of the need to invest in Hayle Harbour to improve access and water depths for the purpose of serving the Wave Hub facility and marine operation activity more broadly.

| **Selection of comments made by Marine Energy and Marine Operations companies** |
|---|
| Hayle was cited by many companies as having a strong position within the wider Cornwall port infrastructure offering benefits including the shortest run to Wave Hub site, which will reduce fuel costs and increase operating windows; reducing the need to transit Lands' End and hence improved safety (challenging passage due to weather and heavy shipping constraints). |
| 'Having Hayle as a fully functioning port would be a massive benefit to us and all commercial marine operators in the area with huge savings in safety, fuel and labour cost by not having to transit to Newlyn or Padstow. It will also enable short weather windows to be maximised and will be very beneficial when the North Coast is workable but when the Lands' End area is impassable. Hayle could also be a good port to supply the Isles of Scilly with cargo that needs transhipping on vessels other than the scheduled services such as when we need to transport our construction materials.'<br><br>'Hayle Port is an important asset for the whole area and should not be left to become a historical reminder of its former glory.'<br><br>Steve Roue, Falmouth Divers |
| *'Hayle was historically an important commercial port facility on the North Cornish coast until the decline of traditional mineral extraction industries in Cornwall. With the development of new market demands in marine renewable energy, and extensive national planning for strategic energy developments on the North coast of the SW UK peninsula, S Wales and the Bristol Channel, dredging Hayle Harbour provides the opportunity to make Hayle competitive again and give Cornwall direct coastal port access to this internationally significant sea area.'*<br><br>Diccon Rogers, KML |
| *'As a vessel operator in offshore wind it is clear that there is massive cost pressure on the operations and maintenance of offshore renewable assets. The viability of wave assets being deployed off the North Coast will be questioned without a viable North coast port due to the increased costs of vessels having to mobilise from the South Coast for maintenance. A viable North coast port will maximise the wave deployment opportunities around the Cornish coast.'*<br><br>Peter Scriven, Wind and Wave Workboats |
| "A properly dredged harbour would be an excellent facility, and place of refuge on a pretty exposed piece of coast, with obvious commercial benefits."<br><br>Phil Shepard Coastal Science Ltd |

*'Seatricity Ltd has already committed to Hayle as a harbour of choice for our workboat operations at WaveHub but it has not been without its challenges and problems. We support any proposals to develop the port access and infrastructure and are confident that the investment will be rewarded - not least in our own plans to focus our business more locally.'*

Andy Bristow, Seatricity

### 9.2.4 Future growth of marine energy and regional impact

Whilst marine renewable energy is billed as a future growth industry in the UK and globally, it has had a challenging and start and is not yet commercial. As a result, it is hard to predict the timing of uptake and what technology will succeed. This makes forecasting growth and associated harbour revenue for Hayle Harbour challenging. The following forecast has been made by the *South West Marine Energy Park's (SWMEP) Outlook and statement of ambition to 2030*[13] and echoed in the *Cornwall & Isles of Scilly Marine Renewables Roadmap 2015 – 2025*:


**Figure 27 – forecast deployment of wave energy technology in the South West as forecast by the South West Marine Energy Park. The vast majority of this deployed capacity will happen in Cornwall.**

[13] https://www.regensw.co.uk/blog/2015/05/south-west-england-sets-out-its-marine-energy-ambition/

### 9.2.5 Impact on business case

It is assumed that marine operations activity in Hayle Harbour will increase in the near future and that with the fully funded CEFOW project at Wave Hub already underway, Hayle will miss out on new business from marine operation company Green Marine if water levels can't be improved.

Wave Hub currently has four berth holders, of one project (the CEFOW) project is underway and two further companies are actively pursuing funding for future work – Seatricity and Carnegie Wave Energy Ltd.

These projects hope to install multi-megawatt wave energy arrays with a total budget of approx. £18m for a 3 MW project as planned for the CEFOW project (EUR24.5m). Of this total project spend, approx. 6% or £1.08m is likely to be spend on operation and maintenance activity over a 4 year project. Of this £195k/year, it is anticipated that a marine operations company might expect to pay 5% of that directly to a harbour for services and facilities representing a £13,500 increase in annual harbour revenue.

**If all four Wave Hub berths are operational, four significant marine operations vessels would be operating out of the harbour representing a potential new income of £54,000. Additional port charges would have to be matched by additional levels of service and subject to commercial negotiation with marine energy companies and their marine contractors.**

## 9.3 Leisure sailing

Hayle currently has very limited leisure sailing activity, but plenty of opportunity to develop this new area of business due to its strategic position between the harbours of Padstow and Penzance/Newlyn. Whilst the harbours of Portreath, Newquay and St Ives are all on the route between these two points, all three are at capacity and offer minimal shelter compared to Hayle. Hayle would sit almost exactly between Padstow and Newlyn, 60 km sailing from each providing a day sailing stopping point and point of refuge for boats transiting Lands' End.

It is not envisaged that Hayle would develop a marina facility in the near term, but could provide simple facilities including water, power, harbour side access, fuel bunding, and wash facilities, improved over time as custom increases.

As part of this study, we consulted Gus Lewis (Legal and Government Affairs Manager) at the Royal Yachting Association (RYA). Gus reiterated the value of having a stopping point between Padstow and Penzance/Newlyn summary and explained that in the south and south west of the UK, if you built facilities for leisure sailors, in their experience they are always used. Gus explained that providing half tide access (average high tide +/- 3 hours) was a good benchmark timing requirement for leisure sailors.

Gus identified the planned footbridge between South Quay and Penpool Terrace as being a barrier to future leisure sailors as this would limit access to this key area of the harbour for masted vessels. An alternative approach proposed by HHAOL and the HCCT would be install a sea lock between the end of South Quay and East Quay. This is a longer term plan and would require significant investment, but would provide wet berthing and marina facilities for all vessels as well as pedestrian access between Penpool Terrace and South Quay.

Harbour fees are currently fairly low compared to other regional harbours at 45% of berthing fees at Falmouth for daily charges and annual and whilst this reflects the level of facilities at Hayle, there is clearly scope to increase this as facilities are improved.

**Figure 28 – typical small motor vessels (~5m) currently berthed at Hayle. Image courtesy http://www.simplystives.co.uk/**

### 9.3.1 Impact on business case

It is anticipated that revenue from leisure sailing activity at Hayle could be increased through increased harbour dues and traffic resulting from improved access, water depths and facilities.

Assuming a 20% increase in harbour dues over the next five years (to £42/m per annum), the following mix of registered and visiting pleasure vessels would increase harbour revenue by

| Item | **Approx. amount** (annual) |
|---|---|
| **25 at 5m** | £7,400 |
| **5 at 10m** | £1,900 |
| **1 at 15m** | £800 |
| **Visiting leisure vessels** | £3,000 |
| **Total** | **£13,100** |

## 9.4 Water sports and tourism

Hayle harbour has a thriving water sports and tourism sector which, whilst it doesn't currently represent a significant income to Hayle Harbour is a key part of the town's USP and the lifestyle it offers to current and prospective residents. Hayle currently hosts established clubs and business from the following disciplines:

| | |
|---|---|
| Canoeing - Hayle Canoe Club - 100 members of which 50-60 are active<br>Jet skiing – Cornwall Jetskier Club<br>Water skiing<br>Stand-up paddle boarding - Ocean High<br>SCUBA | Surf life saving<br>Surfing<br>Zapcat racing and trial experiences<br>Kite surfing - Ocean High and Kernow Kitesurf Club<br>Gig rowing – Hayle Pilot Gig Club |

As part of this study, we interviewed local Hayle Canoe Club member and HCCT member Rob Jewell. Rob explained that in addition to the water sports, the varied inshore water environment offered by Hayle harbour also makes for great potential as a training venue for military and rescue services. In the past, the harbour has been used as a training venue for Manchester Fire Service and US forces training with jet skis. This varied environment also makes the harbour a great training ground for canoers, stand-up paddle boarders and more.


**Figure 29 – Canoers training in Hayle Harbour's varied water environments. Photo : Rob Jewell/Hayle Canoe Club**

Rob explained that water levels in the harbour create a challenge even for canoers who cannot use the access channel at low springs. The Canoe club and a number of other clubs pay a small fee (approx. £1,500) to the HHAOL for the lease of a small area of harbour land area for their club lockup and cabin. This could be improved with water and power and particularly shower facilities and rates increased accordingly. The Hayle Lido facility has been explored in the past as a potential location for created improved, shared use facilities.

Rob also highlighted a past proposal discussed amongst water sports club operators in the area to create a Penwith Extreme Sports Centre of Excellence (PESCE) to operate as a cooperative between these various groups. This arrangement would better support sharing of facilities and also provide a central point for engaging with tourists wishing to pay for hire, club services, tours, training etc.

It is anticipated that improved facilities and longer leases on club facilities would enable local clubs to leverage further funding from organisation like Sport England and the British Canoe Union.

### 9.4.1 Impact on business case

It is estimated that revenue from water sports clubs through leased land and slipway fees constitutes approximately £6k. It is assumed that this could be improved by 50% over the next five years as facilities and harbour access are improved.

## 9.5 Marine science research and "bluetech" technology development

In the past decade the level of marine engineering and marine science research has increased significantly in Cornwall and off the North Cornish coast in particular. The formation of PRIMaRE – Partnership for Research in Marine Energy – has put the south west universities and especially Exeter and Plymouth University at the forefront of marine innovation. Plymouth Marine Laboratories, Falmouth Marine School and others are also active.

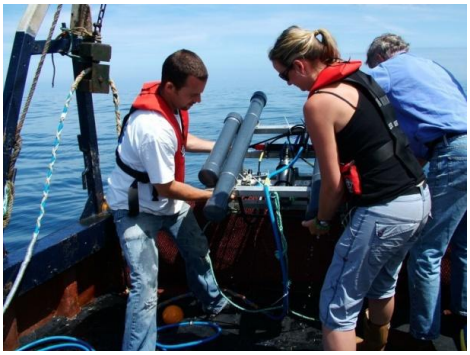
Figure 30 below, taken from a PRIMaRE presentation, shows just some of the research activity that has recently been undertaken in the areas around St Ives Bay and the Wave Hub site.


**Figure 30 Examples of recent research projects around the Wave Hub Site**

Many of these research projects involve at sea deployments and monitoring either using the universities own vessels or contracted vessels e.g Atlantic Diver.

The new facilities at the Marine Renewable Energy Business Park will create an ideal base to operate and manage research projects and should encourage more deployments out of Hayle.

Hayle is therefore in an ideal position to link with activity in Falmouth and Plymouth as part of a wider research and innovation network, and to become a research centre in its own right.



### 9.5.1 Impact on business case

For Hayle Harbour this could create an important new source of revenue including providing berths and mooring services, slip and quayside access, equipment storage and amenities. Plus all the other services required by a working vessel.

As a conservative figure this could provide £10-15k of additional annual revenue

# 10 Job creation and economic case for investing in Hayle Harbour

Predicting the wider economic impact of the uplift in all the areas of business summarised above is a complex task.

However a review of the Cornwall and Isles of Scilly economic development strategy highlights the importance of marine energy and the wider development of marine industries for the Cornish Economy.

In 2015, Regen SW undertook the economic review for Wave Hub which looked at the potential economic value and job creation which could be generated by the marine energy sector in Cornwall.

The study identified that, under a positive growth scenario, by 2025 the wave energy sector could deliver for Cornwall

- Over £100m of expenditure generating
- £47m GVA gross
- And creating 230 high value Cornish jobs.

This scenario projection is based on the successful deployment of demonstration projects at Wave Hub and the anticipated follow on of commercial projects consistent with the projections made in the South West Marine Energy Park Statement of Ambition Analysis.

The Cornwall and Isles of Scilly Marine Renewable Energy Roadmap[14] has a very similar deployment figure with a higher job ambition to create 700 jobs in the wider marine energy sector including wind, wave, tidal and research by 2025. Many of these jobs would be expected to be created around the main Cornish ports including Falmouth and Hayle.

The investment of £24million to establish the Marine Renewable Energy Business Park at Hayle is expected to create 120 Cornish jobs by 2020.

The recent proposal to create a Marine Industry Enterprise Zone based around Hayle and Falmouth was strongly supported by the C&IoS LEP, Cornwall Council and by the marine industry because of the potential to create new high value jobs, support research and innovation and attract inward investment.

It is not possible to say precisely the extent to which the depth of water in Hayle Harbour will have a direct impact on the success of these investments. It is however clear that the availability of a safe operational harbour on the North Cornish coat has been identified by the industry to be an essential enabler to develop marine energy projects in the Celtic Sea area.

[14] Cornwall and Isles of Scilly Marine Renewable Energy Roadmap 2015

## 10.1 Job creation and job protection opportunities

Focusing directly on the harbour and marine activities that are dependent on harbour waterside access; with 28 registered fishing vessels, some commercial boat users, marine leisure and some marine engineering activity it is estimated that the total jobs that are currently supported by the harbour is in the order of 30-40 Full Time Equivalents (FTE's).

For a small town like Hayle however the protection of these jobs is vitally important and so any further loss of harbour access would be extremely detrimental.

In addition to the protection of existing jobs it is conservatively estimated that a commercially run and fully operation harbour could support an additional 30 jobs by 2020 and 70 jobs by 2025. This estimate is a small subset of the jobs that may be ultimately dependent on the harbour and, as the Wells case study below highlights, ignores the many unforeseen opportunities that a working port will generate.

This estimate is made up of the following opportunities:

| **Hayle Harbour Job Creation Opportunities (rough estimate)** | | | |
|---|---|---|---|
| Current jobs directly associated with harbour and marine activities dependent on the harbour | 30-40 | | |
| **New Job Creation opportunities assuming a fully operational and commercially run harbour** | **2020** | **2025** | **2030** |
| Additional fishing and associated activities – including expansion of fish landings | 5 | 10 | 5 |
| Marine Leisure and tourism – increased visiting yachts, tourism and tourist related expenditure in and around the harbour area | 5 | 10 | 15 |
| New vessel and marine services – chandlery, marine engineering, vessel servicing | 10 | 5 | 5 |
| Marine Energy operations and maintenance based on deployments at Wave Hub and future commercial projects including marine operations, engineering and maintenance<br>***Note – this is a subset of the 120 jobs it is expected the Hayle Marine Renewables Business Park will create*** | 10 | 15 | 15 |
| **Total New jobs created in period** | **30** | **40** | **40** |
| **Cumulative new jobs created** | **30** | **70** | **110** |
| **Total jobs supported by harbour including existing jobs** | **60** | **100** | **140** |

# 11 Next steps for the HCCT Project

This first phase has focused on the issues related to harbour navigation and access, with the aim to identify practical and acceptable solutions to restore and maintain water depth and safe navigation within the harbour and its channels, and to develop a business case to support investment.

The work to date has been at a relatively high level and has identified a number of issues and further areas of work which will need to be completed. In moving forwards it will be important for the HCCT team to work closely with The Hayle Harbour Authority and owners Corinthian, Cornwall Council and the Cornwall and IoS LEP. It is envisaged that any next phase activities will be delivered in partnership with those bodies.

A suggested (initial) list of next phase activities are listed in the table below.

| **Suggested further areas of work to be undertaken in Phase 2 of the HCCT project** |
|---|
| 1. Dissemination, communication and feedback on the Phase 1 project and its recommendations |
| 2. A further analysis of the Harbour and Channel water depths to confirm the waterlevels and volume of materials to be removed. Potentially requiring a full survey (to update the last 2011 survey) or at least further spot surveys. |
| 3. Further analysis and confirmation of the rough cost estimates contained in this report – which will require engagement with potential suppliers, and leading to the development of a procurement strategy and approach |
| 4. A review of dredging planning and regulatory restrictions, including engagement with MMO, Natural England and other stakeholders<br>5. Identification of areas within the sand cell which could form the basis of a replenishment/remediation strategy |
| 6. Potentially (pending outcome of 4&5) a need to take forward additional planning/marine licence applications and any necessary environmental EIAs etc |
| 7. Development of a full operational plan for remedial works and ongoing water depth management |
| 8. Further analysis and consultation on the options for sluicing including:<br>– An operational plan for Carnsew Pool<br>– Agreement on 2016/17 sluicing operations<br>– Exploration of the potential, constraints and costs of operating Copperhouse Pool |
| 9. Development of a full business case and project proposal to secure funding for both remedial works and ongoing water depth management measures |
| 10. Further definition of additional facilities and services which Halye Harbour could provide to its customers – including marine energy developers |

# Appendix 1 People Contracted or Interviewed as part of study

| | |
|---|---|
| 1 Cowes Harbour Commission, Barney Sollars, Marine Services Manager | 17 Cornwall Council - Andy Brigden, Maritime Manager |
| 2 Teignmouth Harbour Commission, Humphrey Vince, Harbour Assistant | 18 Wave Hub Ltd – Julius Besterm (marine operations manager) and and Helen Wilson-Prowse |
| 3 Shoreham Port, James Gray, Assistant Harbour Master, | 19 Wells-next-the-Sea, Robert Smith, Harbour Master |
| 4 Bristol Port Company, Jerry Stanford, Haven Master | 20 Rob Jewell – canoe club and water sports representative |
| 5 IFCA – pointed me to local MMO office | 21 RYA – Gus Lewis |
| 6 MMO – Garry Dando and Katie James | 22 Yacht Harbour Association – Libby Gordon, Executive |
| 7 Local commercial fisherman – Lech Kwiatkowski | 23 Seatricity - Andy Bristow |
| 8 MTS – Steve Bendall | 24 KML – Diccon Rogers, Director |
| 9 Green Marine – Jason Schofield, Managing Director | 25 Wello Oy – Patrik Sundblom, Marine Operations Manager |
| 10 Wave Hub – Julius Besterman, Helen Wilson Prowse | 26 Wind and Wave Workboats – Peter Scrivener, Managing Director |
| 11 Hayle Harbour Authority Operation Ltd – Peter Haddock | 27 Falmouth Divers – Steve Roue, Operations Director |
| 12 CIB Lello Plant hire – Chris Lello | 28 Coastal Science Lt – Phil Shepherd |
| 13 Acland Plant hire – Gerald Warrington | 29 Carnegie Wave Energy Ltd – Tim Sawyer, UK CEO |
| 14 JLD Plant Hire – Sam Ward | 30 Mojo Maritime – Matt Hodson, Business Development Manager |
| 15 Plantforce | 31 Fortum Corporation – Mikko Huumo, Manager, R&D Growth Projects |
| 16 MJ Church | |

Cornwall Council owns a number of ports - Newquay Harbour, Truro, St. Ives, Penzance, Bude, Penryn, Portreath, Prince of Wales Pier (Falmouth), Portscatho, Portwrinkle with additional maritime infrastructure located within Saltash, Downderry and Fowey. Within these operations there are facilities for cargo handling, laid up shipping, fishing vessels, leisure moorings, visitors and licensed passenger pleasure craft.

# Appendix 2 Wells-Next-The-Sea Case Study

Wells-next-the-Sea (Wells) is a small port town on the North Norfolk Coast with a population of just over 2000 people. As part of the HCCT project, we contacted Robert Smith, Harbour Master at the Port and Harbour of Wells (Wells Harbour) to discuss their approach to dredging as recorded and also to discuss the harbour's engagement with the offshore renewable energy sector and specifically the 317MW, 88 turbine, Sheringham Shoal offshore wind farm owned and operated by Scira Offshore Energy Ltd.


**Figure 31 – the map above (courtesy Renewable UK UKWED[15]) shows the Sheringham Shoal offshore wind farm (blue dot and marked) as well as potential projects with consent for construction (green dots).**

During the construction phase of Sheringham Shoal (2012), Wells Harbour recognised the opportunity for the harbour to act as an operations base for the farm which sits approx. 20km offshore from Wells and potential further wind farms in the future (see Figure 31 below). In order to serve the wind farm, the Wells harbour and the local community recognised that investment was needed to ensure the harbour was fit for purpose as a marine operations base.

Ensuring the harbour is fit for purpose has involved the development of the Outer Harbour – a purpose built facility with pontoons to provide berthing for the marine operations vessels operating at Sheringham Shoal. Essential activity has also included a new dredging regime (as discussed) to maintain the access channel out to open sea at the depth required for the marine operations vessels.

[15] http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/index.cfm/maplarge/1

**Figure 32 – (left) crew transfer vessels at the outer harbour, (right) the dredged outer harbour showing the pontoon infrastructure.**


**Figure 33 – aerial view of Wells-next-the-Sea showing the Outer Harbour, adjacent to the town's main holiday park and campsite.**

A local town councillor started a petition to support a dredging application license submitted by Wells Harbour Commissioners, recognising the potential for economic growth and opportunity presented by the new wind farm. The petition was signed by 1259 people in two weeks.

The organiser of the petition, Wells Town Councillor Mike Gates gave the following reasons for their support of the activity:

*"This is a vote that Wells needs jobs, and jobs with real prospects. Wind energy developments offer us that but only if our Port is open for business. Tourism and rich retirees do bring jobs but cleaning,*

*seasonal catering, care-work and gardening take you only so far. Our children and young families need better opportunities to keep our community alive. Youngsters need careers, and the wind energy industry offers work and training in engineering, marine skills, project management, communications and a host of better paid occupations. We must be a working Port, not just a playground. It's fantastic that so many people from Wells and beyond, agree with this".*

It should be clearly stated that offshore wind is now an established industry in the UK and worldwide, whereas wave energy is right at the beginning of the technology and project development process. This means that the opportunity for Hayle in wave energy is currently smaller and certainly less clear than it was for Wells in offshore wind, with the risk that wave energy may still be a way off commercial reality. However, the reward for being a first mover would be to establish Hayle as a key part of the wave energy project infrastructure in what is one of the UK's prime sites for deploying this new technology.

It was clear from our discussions with Wells Harbour Master, Robert Smith that the economic impact on the town from their engagement with Sheringham Shoal has been extremely positive. Robert estimated as many as 80 new, high-value jobs in the town and many more indirect jobs in existing services and industries (groceries, B&Bs, taxis, etc), stating that it had transformed the town and provided great prospects for youngsters growing up in the area. He also cited as much as a 300% increase in the turnover of the harbour. Robert highlighted that they hadn't imagined what and how many 'spin-off' benefits there were going to be when they started out on the new developments.