Mevagissey Harbour

A high-level feasibility study

for

Mevagissey HARBOUR CORNWALL, UK

Nov 2022 | P02

by

Kovia CONSULTING

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Document history and status

Revision	Date	Status	File Ref	Author	Check	Review
P01	Sept 2022	Draft – client review	E000833	AN, PR, KM, MM	ATD	ATD
PO2	Nov 2022	Final – Client and EA comment included	E000833	AN, PR, KM, MM	ATD	ATD

Legal statement

About Kovia

Kovia is a Cornish word meaning "protect" and reflects the core value of our business to protect human health, communities, and the natural environment. The Kovia group of companies includes Kovia Ltd and Kovia Environmental Services Ltd. Kovia Ltd is an established statutory compliance inspection, testing and training provider specialising in asbestos, fire, legionella and energy efficiency services. Kovia Environmental Services Ltd specialises in all aspects of asbestos remediation and removal, demolition, maintenance and re-instatement works.

Kovia Consulting Ltd provides advice and research that draws on a deep understanding of several technical disciplines from earth, environmental and climate science; finance, economics and business management; sustainability; social research and development studies; education; engineering and construction.

Images through report from Kovia Consulting Ltd. Sept 2022.

Contents

Purpose

Appointment

Kovia Consulting Ltd (Kovia) were appointed by Mevagissey Harbour Trustees (MHT) on 28th June 2022 to undertake a high-level feasibility study and option appraisal of potential proposals to defend the harbour from the sea and adapt to the effects of Climate Change. This follows other effort by MHT, despite this issues of limited funding available to the charity, to consider climate change mitigation including commissioning research and studies on Climate Change and coastal flood protection.

Problem

Mevagissey is a fishing village approximately 6 miles south of St Austell in Cornwall. Mevagissey has a double enclosed harbour with inner and outer walls. The harbour walls act as breakwaters to provide protection and shelter to the harbour and vessels moored within. As well as protecting the harbour from storm surges, the breakwater also acts to dissipate the energy of the waves during storm events, reducing the damage that these storm waves can cause to the harbour, boats as well as lower lying homes and businesses surrounding Mevagissey Harbour. The inner harbour is well protected however the outer harbour remains open to swells and wave impact particularly from easterly gales. With the effects of wave energy and sea level change likely from Climate Change the harbour piers will require significant improvement. This may provide opportunities to include other features that may be beneficial to the harbour and environment. The work may also indicate an opportunity to address a wider Climate Change issues in the village including fluvial and surface water flooding.

Scope

This high-level study is a starting point, setting out evidence and a case for action. The initial sections set out the collated evidence and background (physical, environmental, social and economic as well as anticipated effects of Climate Change) to the main problem and defines needs and opportunities that can be met by a long list of options described later in the report. Opportunities have been drawn from consultations and case studies of similar situations.

The scope is limited to a 'high-level' as a result of the time and resource available at this time and an important aim and focus of effort has been to attempt to illustrate a way forward and guide for stages to follow. The work purposely aims to provide evidence and information to help with a strategic outline business case which would be needed to develop the options to address the main problem stated. The information here also would help inform a resilience plan for Mevagissey setting out all repair and renewal and a potential delivery framework to address all potential Climate Change impacts.

Physical and environmental setting

Overview of section

This section provides an overview of the physical and environmental setting of Mevagissey Harbour. This aims to provide a comprehensive set of information to highlight key issues, needs, considerations, and opportunities. More detailed survey and assessment would be required as part of any subsequent feasibility study and or outline business case. This information is also helpful indicating some potential considerations for any subsequent project development and planning applications.

This contains the following sub-sections:

- Geography
- Geology
- Coastal features and bathymetry
- Climate
- Wind and waves (current situation)
- Hydrology
- Flood risk
- Flood zones
- Coastal vulnerability
- Ecology - designated and protected areas
- Heritage and conservation
- Landscape

Key considerations for Mevagissey and any subsequent outline business case complete the section.

Physical geography

Mevagissey is a coastal village located on the South coast of Cornwall in southwest England at the head of the Cheesewarne valley and Mevagissey stream [2b]. See overleaf for a map of the village. Mevagissey is approximately 6 miles south of St Austell. Mevagissey has a double enclosed harbour with inner and outer walls. The harbour walls act as breakwaters to provide protection and shelter to the harbour at Mevagissey. As well as protecting the harbour from storm surges, the breakwater also acts to dissipate the energy of the waves during storm events, reducing the damage that these storm waves can cause to the harbour and boats, as well as low lying homes and businesses in Mevagissey. The inner harbour is well protected however the outer harbour remains open to swells and wave impact from easterly gales.

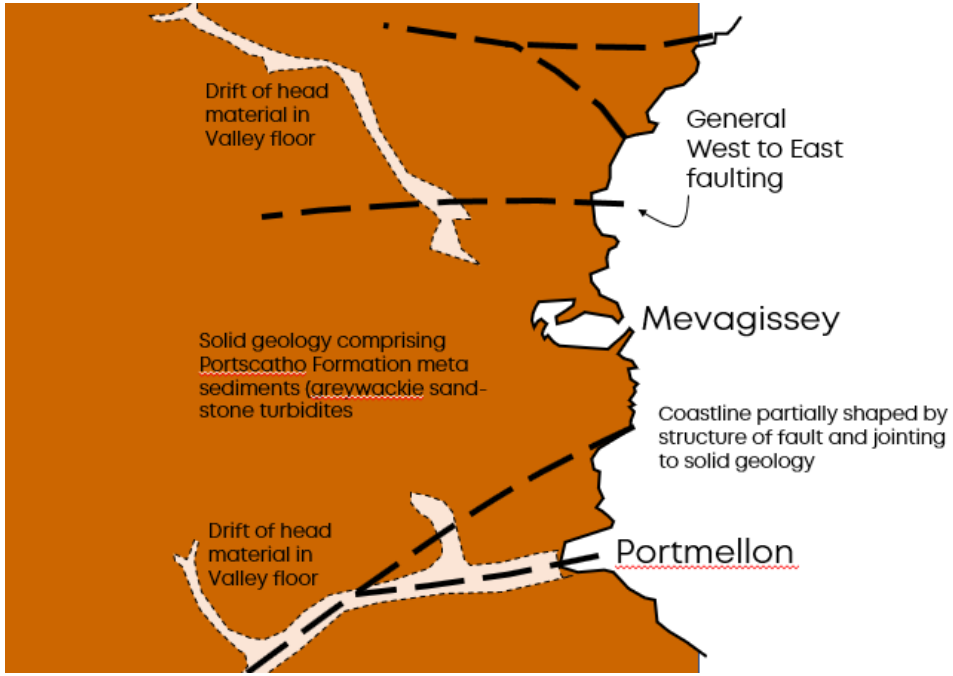
Location of Mevagissey

Source: Cornwall Council interactive map [15]

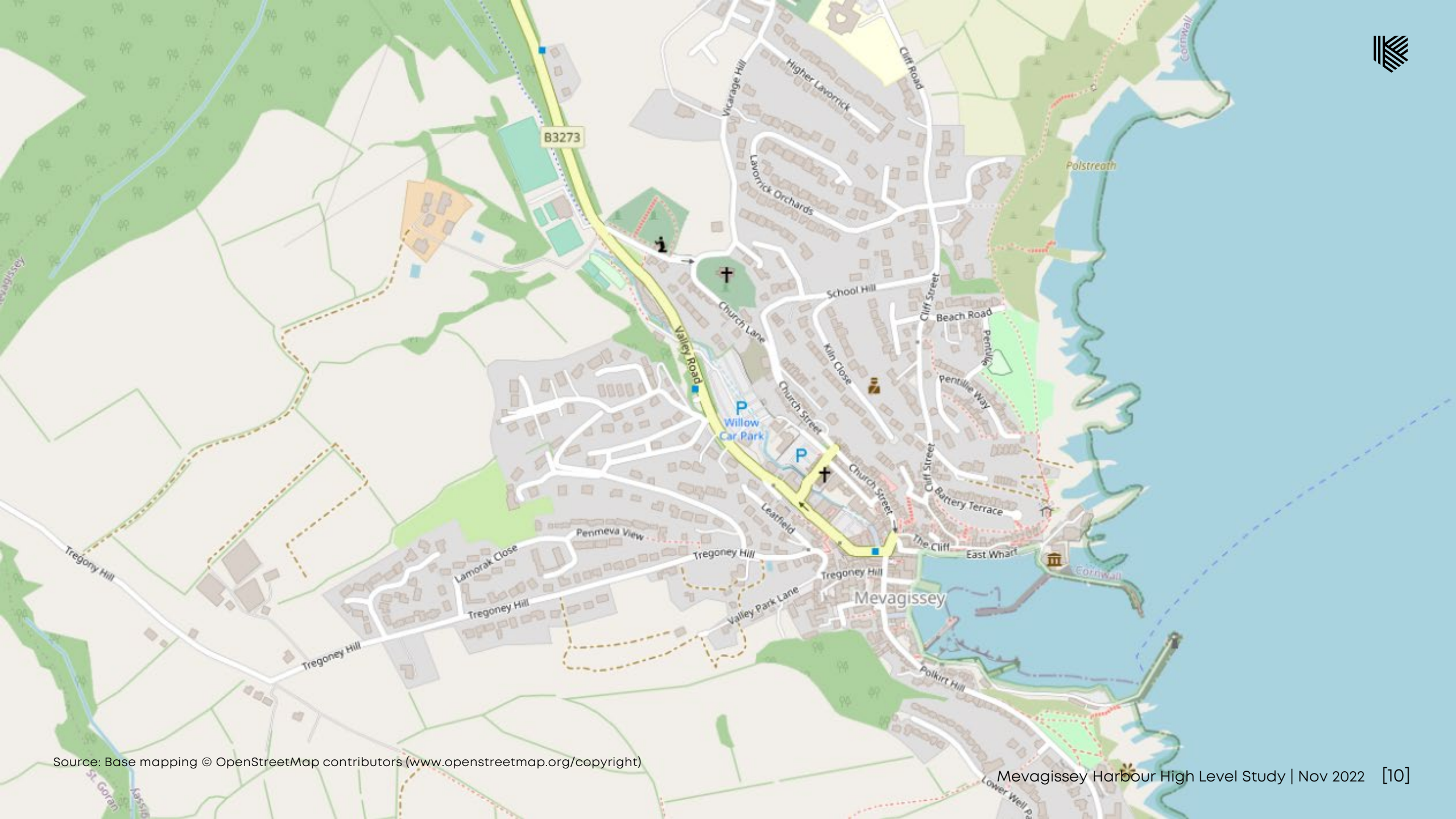
Geology

The Mevagissey coastline is predominantly made of fractured and jointed metamorphosed sedimentary rock such as sandstone and argillaceous rocks with some igneous rocks (both intrusive and interbedded) with re-entrants and bays in the area having softer sediments. [3,4] As a result, Mevagissey is less susceptible to coastal erosion than many parts of the southwest however there are broad faults to the north and south of Mevagissey providing lines of weakness for fluvial erosion resulting in the river running through the centre of the village as well as bays/inlets.

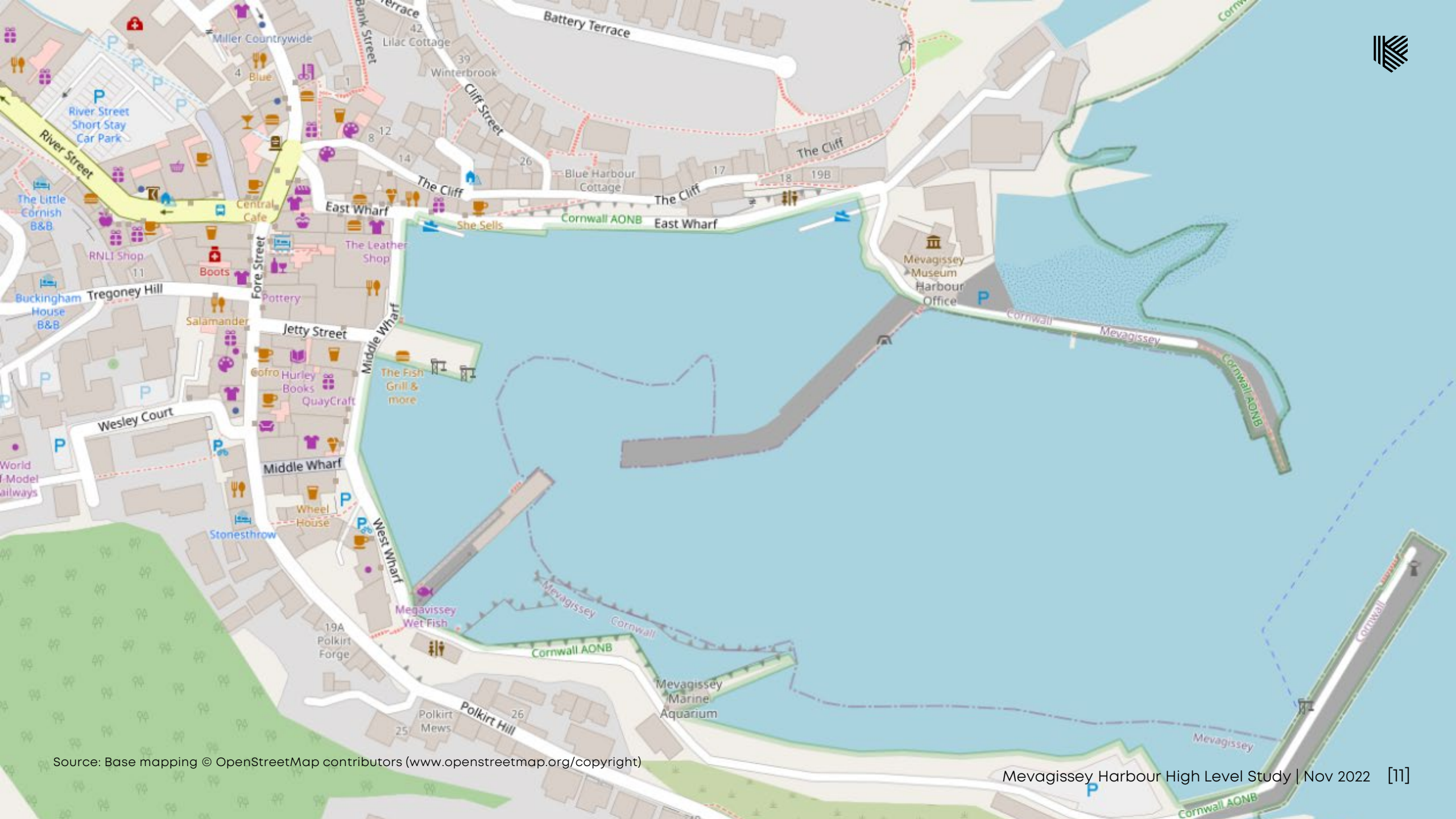
Solid and Drift Geology, Mevagissey



Source: Kovia, after Geological Survey of England and Wales 1:50,000 geological map, New Series Sheet number 353 (with 354), Mevagissey, Solid and Drift, 2000.



Source: Base mapping © OpenStreetMap contributors (www.openstreetmap.org/copyright)



Source: Base mapping © OpenStreetMap contributors (www.openstreetmap.org/copyright)

Coastal features and bathymetry

Mevagissey is low lying with the village situated approximately 3.5m above the average sea level (figure 2). The inner harbour is an intertidal mud flat which dries out at low water as it is 0-15m above the average sea level in the area. The outer harbour is shallow with a maximum depth within the outer piers of c.2 m (Figure 2).

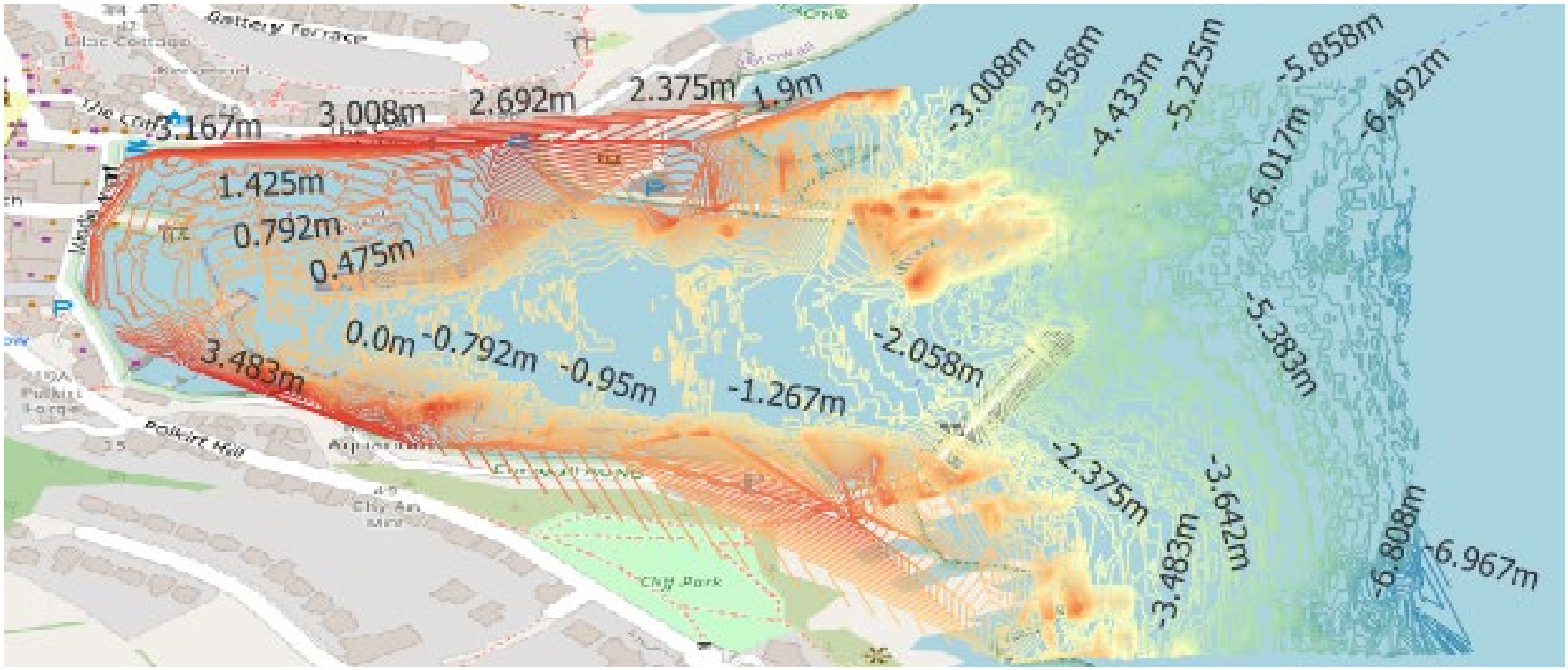
Climate

Based on the climate in St Austell the yearly average temperature in the region is recorded between 1991 and 2020 is 14.61 °C with an average annual rainfall of 1229.03 mm [11].

Wind and waves

The prevailing winds across the UK are often southwest. In the UK Atlantic depressions pass by resulting in the wind blowing south to southwest. As the depression moves away the wind will blow west or northwest [12]. The average wind annual wind speed in the Mevagissey area is 10 -15 knots from 1981 to 2010 [13]. This part of the coast is very sheltered from the dominant westerly Atlantic conditions; however, the bay is exposed to storms and waves that approach from the southeast resulting in wave heights of 4-5 m [5].

Elevation map of Mevagissey Harbour



Source: Base mapping © OpenStreetMap contributors (www.openstreetmap.org/copyright) overlain with LIDAR

Hydrology

The tidal range in the area surrounding Mevagissey is 3.5m [54] with generally weak residential currents [6]. The stream level ranges from 0.06m to 0.75m on average however the highest levels were seen at 2.15m in 2010 [7]. In 2020 the average annual mean sea level was 7200mm [8]. The central part of Mevagissey is in a high-risk zone for both tidal and fluvial flooding as a result of high tides, sea state and heavy rainfall [2b].

Coastal erosion

The national coastal erosion risk mapping (NCERM) provides erosion estimates. The data is categorised by probability. A map for the 95% probability of being exceeded is below. The coastline around Mevagissey have a 95% probability of suffering from erosion, even stretches of coastline that fall within the outer and inner harbour wall boundaries.

Source: Cornwall strategic flood risk assessment

Flood risk

Mevagissey is priority areas for flood risk management identified in the 2020 Local Flood Risk Management Strategy [15]. This notes that the flooding issues are fluvial, tidal, surface water and sewage and the town is described as being vulnerable to tidal flooding from severe storms and severe weather. It is noted that various culverts through the town may worsen fluvial flooding. Furthermore, the source estimates that approximately 230 properties are at risk of surface water flooding and that a Surface Water Management Plan is required for Mevagissey.

The strategic flood risk assessment by Cornwall Council provides flooding scenarios based on the extent of a 1 in 200 year extreme tide event. In 100 years time, the medium risk event will flood the village behind the harbour front.

Projections of a 1 in 200 year extreme tide event. The maps show a medium risk event in the present day, in 50 years time, and 100 years time respectively.

Source: Cornwall strategic flood risk assessment

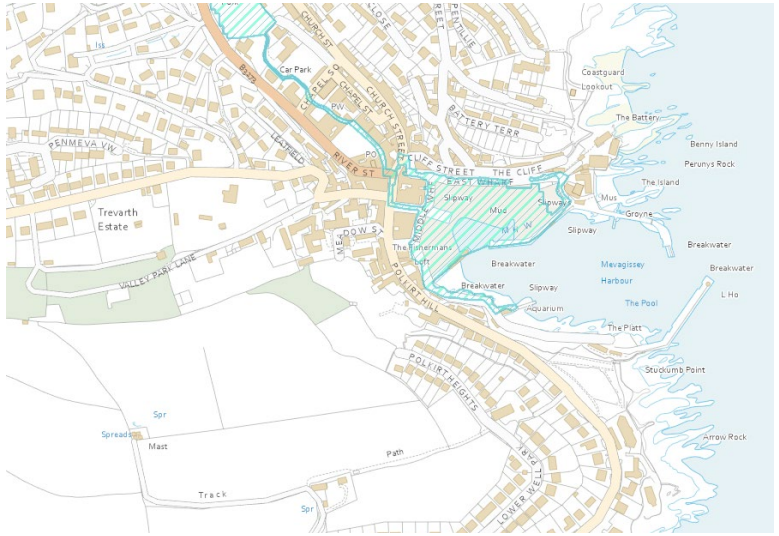
Flood zones

Mevagissey has distinctive flood zones throughout the centre of the village due to its coastal location and the Mevagissey stream (Figure 10) [15]. The areas in flood Zone 2 have a chance of flooding of 0.1% – 1% from rivers and a 0.1% – 0.5% chance of flooding from the sea in any year. Areas in flood Zone 3 have a 1% or greater chance of flooding in any year. This is increased in the 3B flooding Zone which is classified and a functional flood plain and has a greater than 5% chance of flooding in any year [37]. There are 70-80 buildings and the Quayside commerce, aquarium, slipways, car parking, public toilets all at risk from the tidal and fluvial flooding [49]. *Below is a diagram of flood zones across Mevagissey. Flood zone two is shown in yellow, three in pink and 3b in blue* {15].

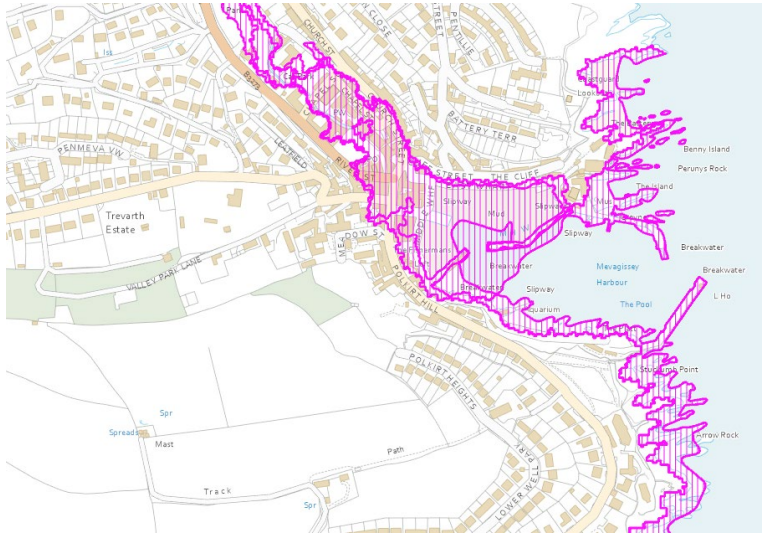
Coastal vulnerability

Planning applications are required to include coastal vulnerability assessments with a submission.

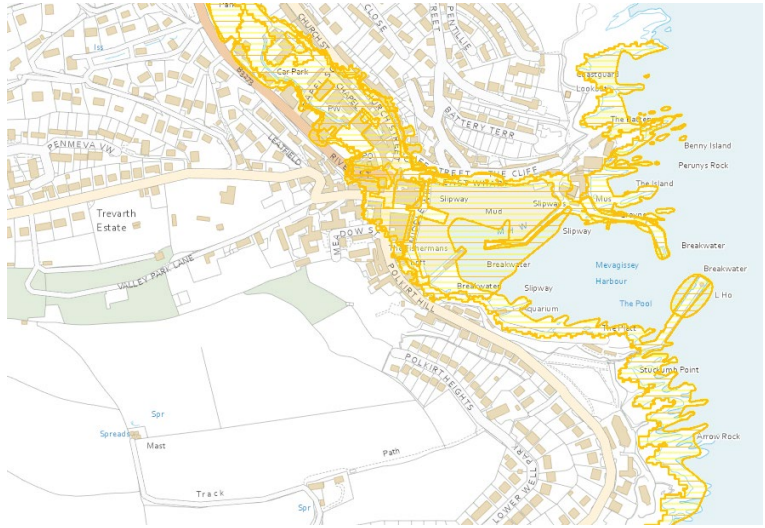
Flood Zone 3b Functional Floodplain comprises land where water has to flow or be stored in times of flood.



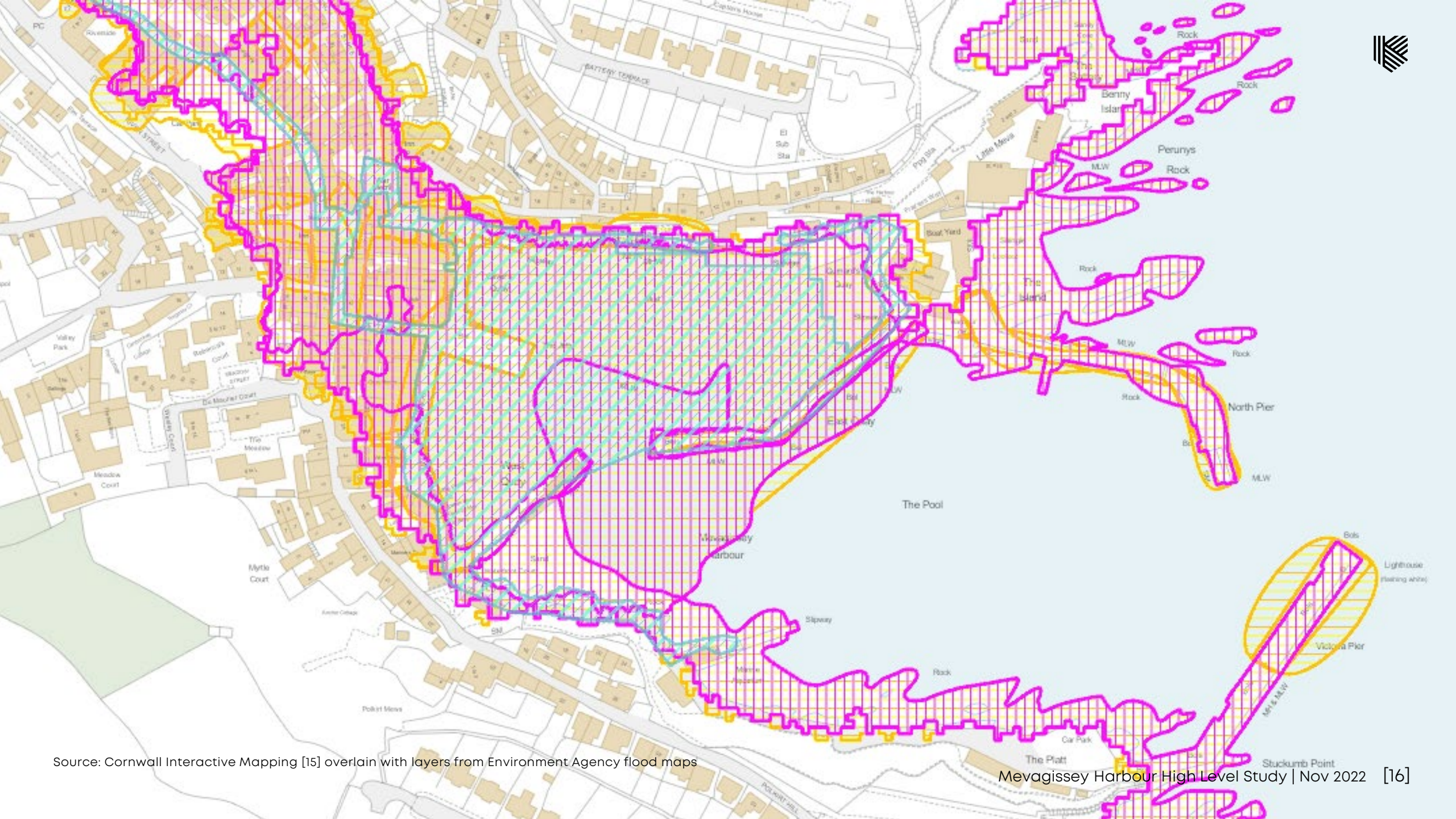
Flood Zone 3. Planning constraint 1 in 100 year fluvial, 1 in 200 year tidal flood zone, assuming no defences.



Flood Zone 2. Planning constraint 1 in 1,000 year fluvial and tidal flood zone.



Source: Cornwall Interactive Mapping [15] overlain with layers from Environment Agency flood maps



Source: Cornwall Interactive Mapping [15] overlain with layers from Environment Agency flood maps

Ecological setting – designated and protected areas

Mevagissey is included in both land based and marine protected conservation areas due to the wide variety of species and potential habitats. Examples of coastal and marine biodiversity in Mevagissey:

- A small fleet of fisherman catch a large variety of fish. This mainly consists of mackerel, pollock, bass and squid but they have also been known to catch brill, cod, plaice, whiting, monkfish, sole and turbot [2a].
- Sightings of large marine mammals off the coast with seals often spotted near to the harbour [2a].
- The intertidal rocky coastline provides rockpool habitats to a variety of species [2a]

Statutory sites:

Sites of special scientific interest (SSSI) within 2km of the site

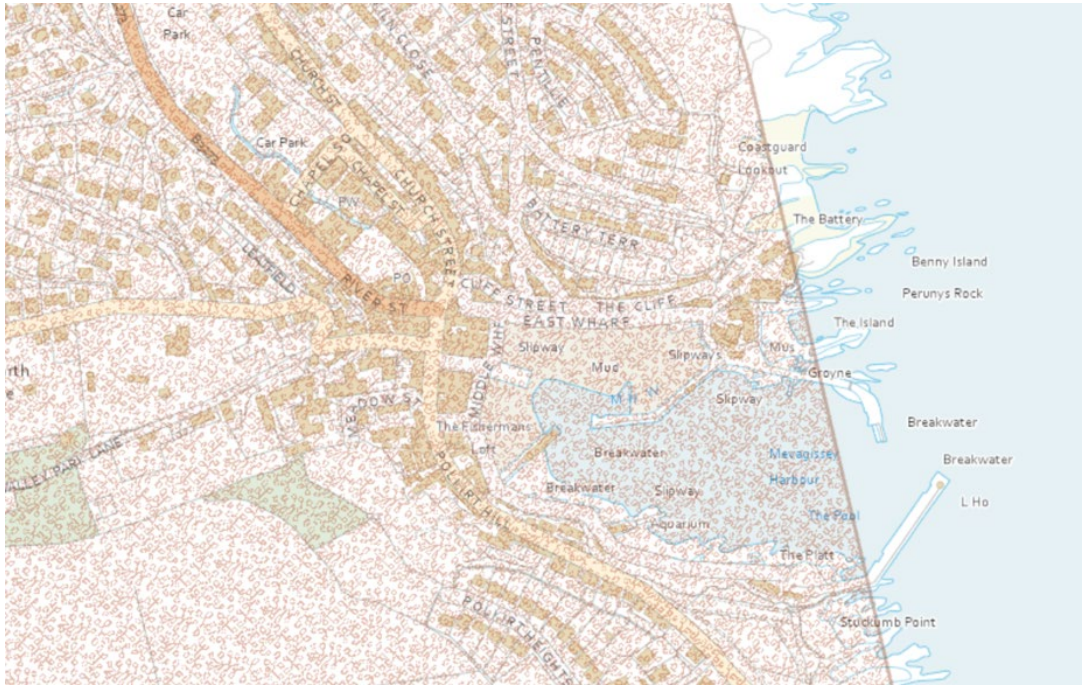
There is a geological SSSI along the coastline from Cuckoo Rock to Turbot Point SSSI. This designation is due to the felsic volcanic pillow lavas being exposed and the cliffs behind Great Perhaver beach having fossil rich detached block of Ordovician quartzite [5]. This is approximately 2-3 miles from Mevagissey and the impacts of any construction and pollution this causes in Mevagissey may have consider the impacts on the species in this SSSI [28].

Special areas of conservation (SAC) within 2km of the site

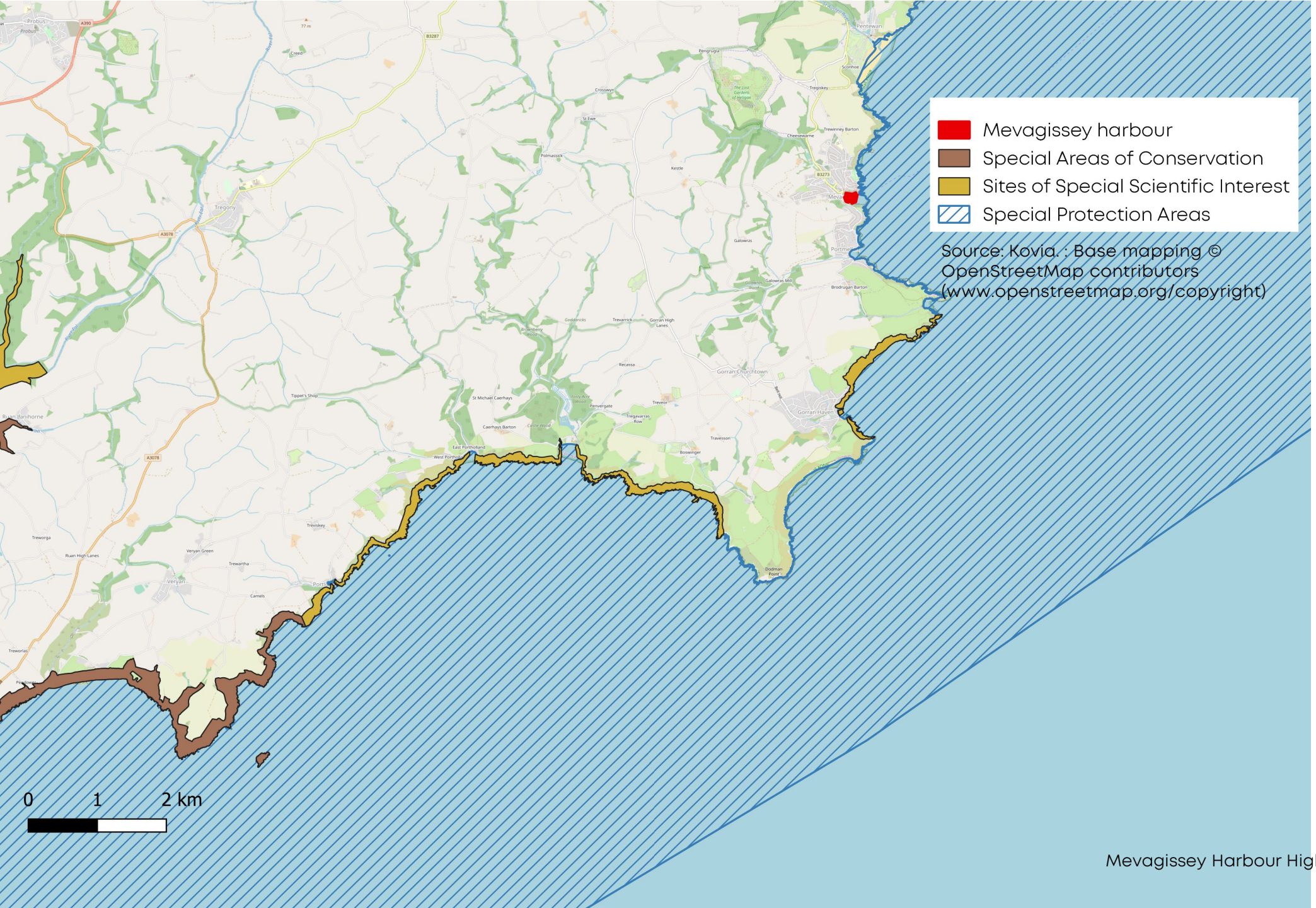
Mevagissey is included within the 6,362.83 ha Fal and Helford SAC [15,38]. Within this area there are key habitats and species that are protected. A key characteristic protected habitat within Mevagissey is the harbour mudflats which is the potential habitat for many important species such as amphipods, polychaete worms, bivalve molluscs and the sea cucumber *Paraleptopentacta elongata* (previously *Leptopentacta elongate*) [38].

Special protection area

From Falmouth to St Austell Bay there is a 259 km^2 Special Protection Area (SPA). This includes the coastline around Mevagissey however it does not include the harbour. These areas are designated to protect bird species that rely on the intertidal and subtidal marine environment [27].



Fal and Helford Special Area of Conservation. The brown zone on the map represents the Zone influence natura 2000 [15].

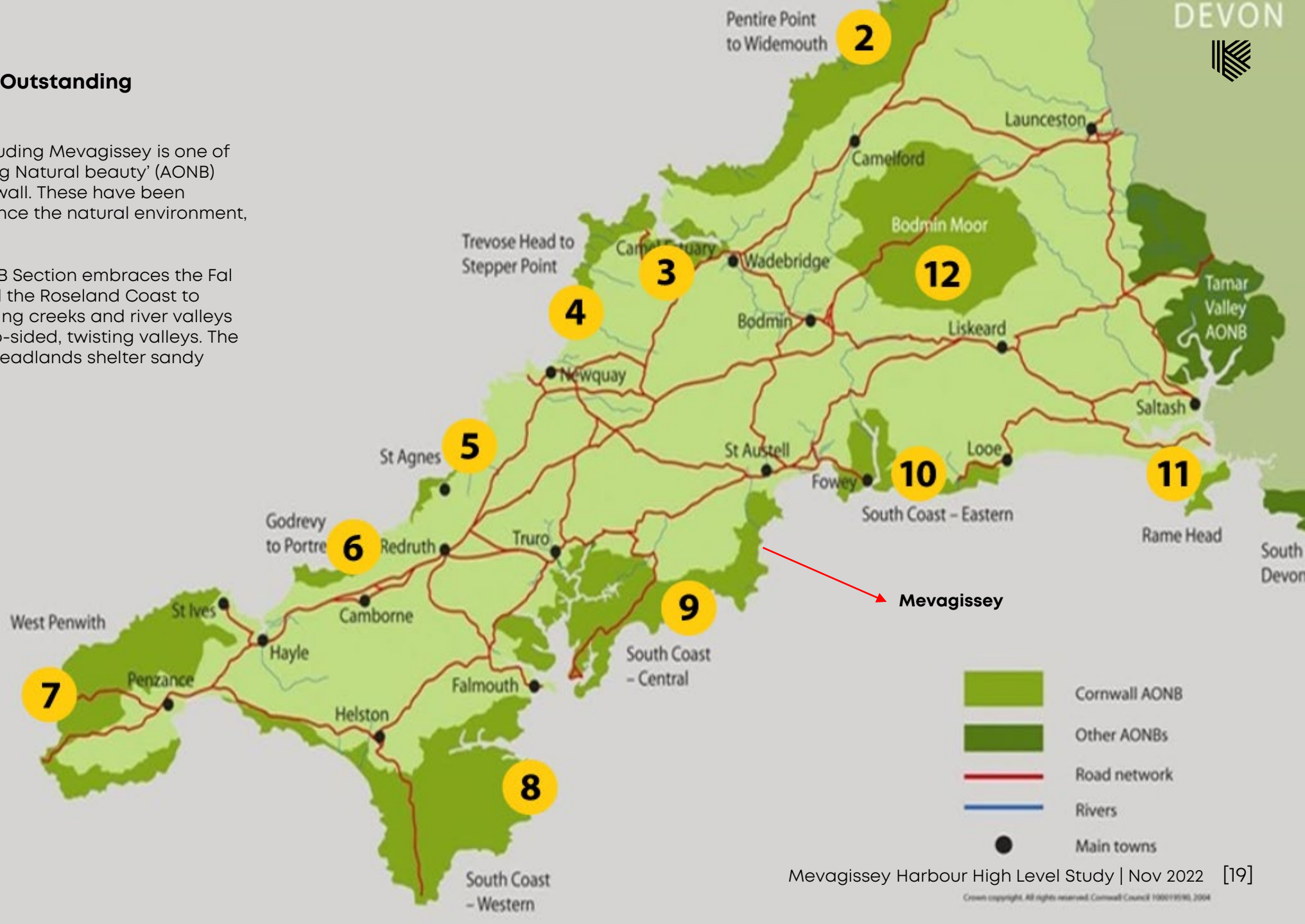


Map showing the statutory designations around in proximity to Mevagissey harbour

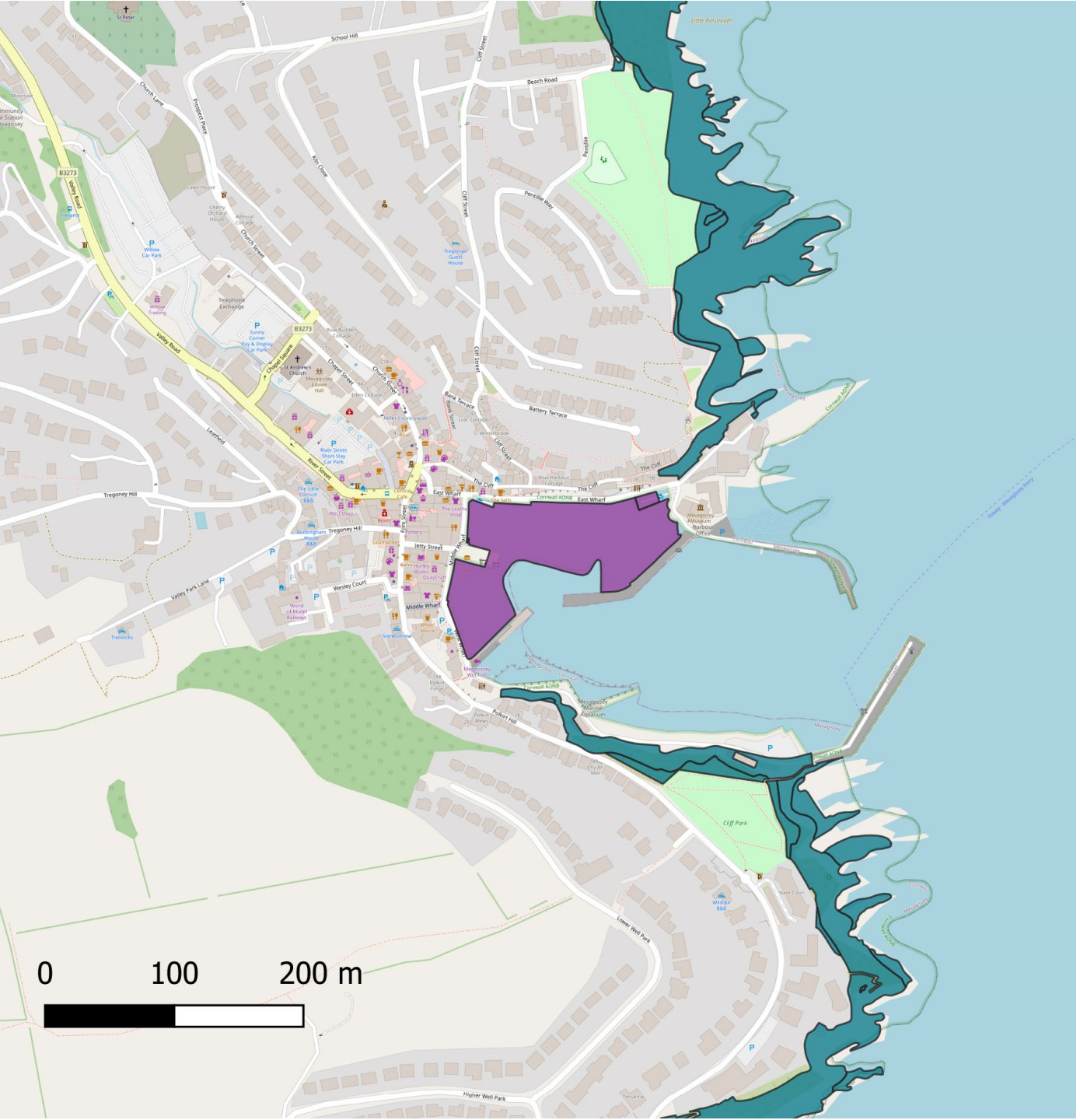
Cornwall's local Areas of Outstanding Natural Beauty

The area surrounding and including Mevagissey is one of the many 'Areas of Outstanding Natural beauty' (AONB) along the south coast of Cornwall. These have been designed to protect and enhance the natural environment, businesses and culture [29].

The South Coast- Central AONB Section embraces the Fal Ria; including Mylor, Feock and the Roseland Coast to Porthpean. There are intertwining creeks and river valleys amongst a landscape of steep-sided, twisting valleys. The area has low rocky cliffs and headlands shelter sandy beaches.



Source: Cornwall AONB



Priority habitats

UK BAP (Biodiversity Action Plan) priority habitats are a selection of semi-natural habitats that have been identified as being the most threatened. Conservation action is required to protect and enhance the statutory designated habitats.

Mevagissey Harbour has two priority habitats within the pier walls. The inner pier encloses intertidal mudflats. The outer harbour has maritime cliffs and slopes which continue round the coast outside the harbour. The grey area of the of the seafloor is a rock platform [10].

Legend

- Maritime cliff and slope
- Mudflats

Source: Kovia. Base mapping © OpenStreetMap contributors (www.openstreetmap.org/copyright)

Heritage and conservation

Mevagissey is a heritage village and much of the centre is included in the Mevagissey Conservation Area (ref. DCO101) with associated restrictions to development.

While there are no Scheduled Monuments, Mevagissey has a high density of historical buildings with more than 100 Grade II and Grade II* listed, including the harbour and piers (Grade II* listed) [14]. Many of the historical buildings throughout the village are of medieval origin with others of post medieval and modern origin [15].

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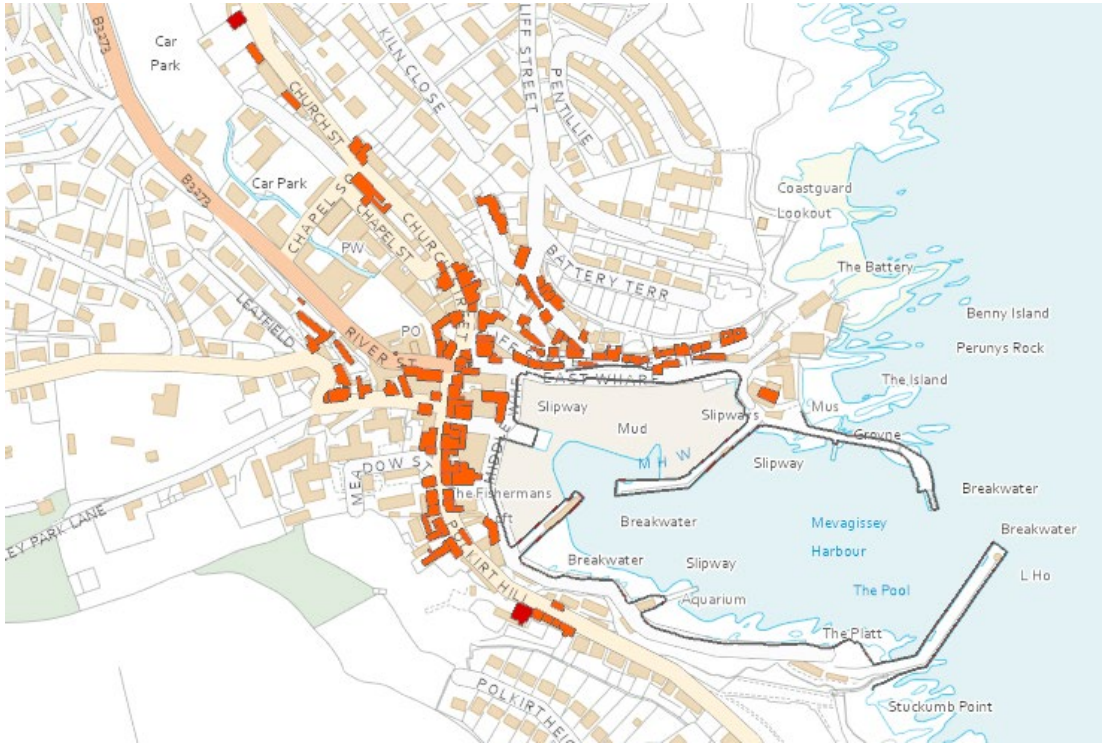
Conservation area

Source: Cornwall Interactive Mapping [15}

Harbour piers and quays

The records for the harbour piers and quays (Entry number 1210773, first listed 11 March 1974) notes that they are “stone-built piers and quays forming inner and outer harbours. The inner piers were built between 1770 and 1773 and the outer piers built in the 1860s.” The two Grade II* buildings are shown in a darker red colour in the diagram below.

Grade II and Grade II* listed structures

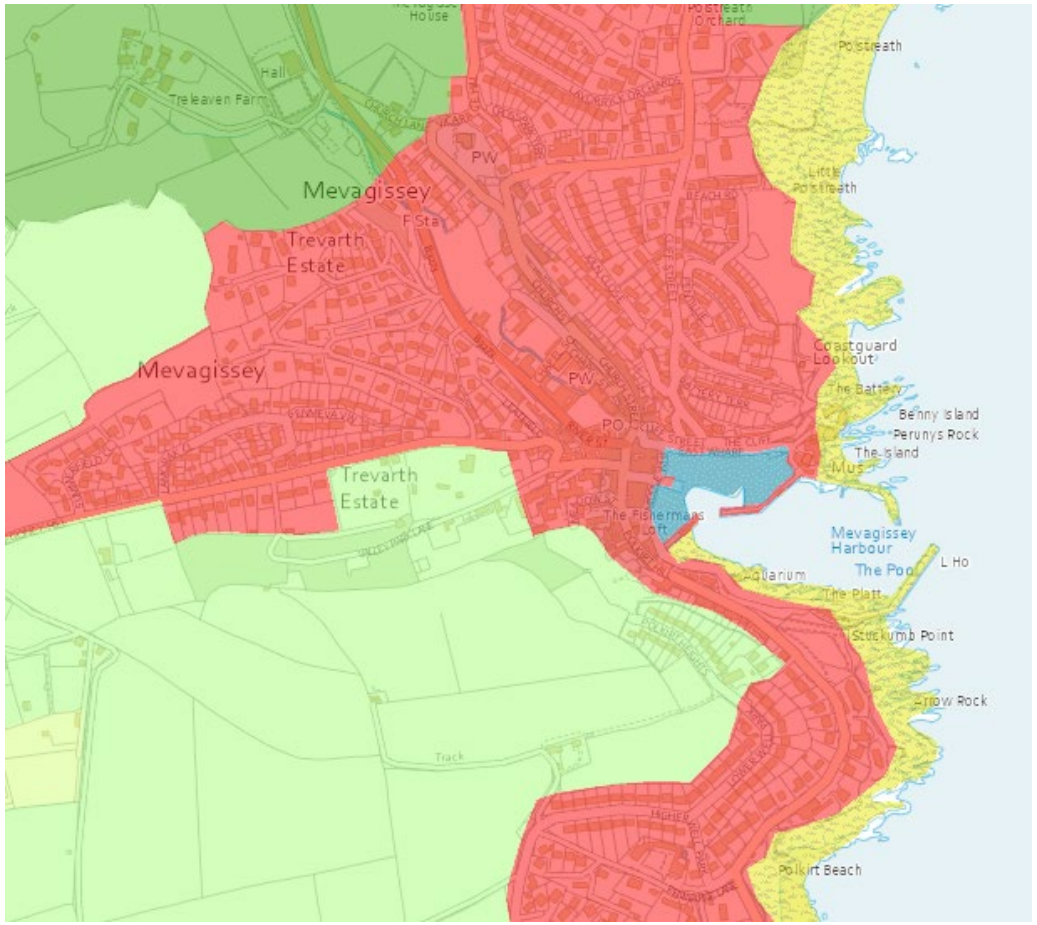


Source: Cornwall Interactive Mapping [15}

Landscape

The historic landscape characterisation of classifies Mevagissey and Portmellon as a joint settlement area (red) surrounded by prehistoric Medieval and post Medieval farmland (green). The inner harbour (blue) is noted to potentially contain important archaeological remains either at the surface or buried. The coastline (yellow) is “coastal rough ground” [15].

The historic landscape character map of Mevagissey



Source : Cornwall Interactive Mapping [15}

Key considerations for Mevagissey

- The harbour walls act as a breakwater to provide protection and shelter to the harbour at Mevagissey. The breakwater also acts to dissipate the energy of the waves during storm events, reducing the damage that these storm waves can cause to the harbour, boats, homes and businesses in Mevagissey (Technical studies described later highlight the importance of the harbour and the damage should it fail).

- Mevagissey is less susceptible to coastal erosion however there are coastal faults to the north and south of Mevagissey which may have resulted bays/inlets in the land and a point of weakness exploited by the river.

- Mevagissey is low lying, sitting approximately 3.5m above the average sea level which makes it susceptible to flooding from storm surges as well as complications from fluvial flooding. This part of the coast is very sheltered from the dominant westerly Atlantic conditions; however, the bay is exposed to infrequent storms and waves that approach from the southeast resulting in wave heights of 4-5 m.

- Mevagissey is priority areas for flood risk management identified in the 2020 Local Flood Risk Management Strategy. The central part of Mevagissey is in a high-risk zone for both tidal and fluvial flooding as a result of high tides, sea state and heavy rainfall. Approximately 230 properties are at risk of surface water flooding and that a Surface Water Management Plan is required for Mevagissey. There are 70-80 buildings and the Quayside commerce, aquarium, slipways, car parking, public toilets all at risk from the tidal and fluvial flooding.

- There are a range of land designations within 2km of Mevagissey harbour. These include:
    - Cuckoo Rock to Turbot Point SSI
    - Fal and Helford SAC
    - Falmouth to St Austell Bay SPA
    - Cornwall South Coast- Central AONB.

- There are also two priority habitats at Mevagissey. The Harbour mudflats, important species such as amphipods, polychaete worms, bivalve molluscs and sea cucumber, and the maritime cliffs and slopes.

- Mevagissey is a heritage village and conservation Area with more than 100 Grade II and II* listed buildings many of which would be damaged by flooding.

- Mevagissey and its wider environment is likely to be highly sensitive to development and require careful consideration and may require Environmental Impact Assessment to assess significant effects on at least ecology (marine and terrestrial), heritage and landscape (as well as community – see following section).

Socio-economic setting

Overview of section

This section provides an overview of some of the socio-economic setting of Mevagissey Harbour. This aims to provide a comprehensive set of information to highlight key issues, needs, considerations, and opportunities. More detailed survey and assessment would be required as part of any subsequent feasibility study.

This contains the following sub-sections:

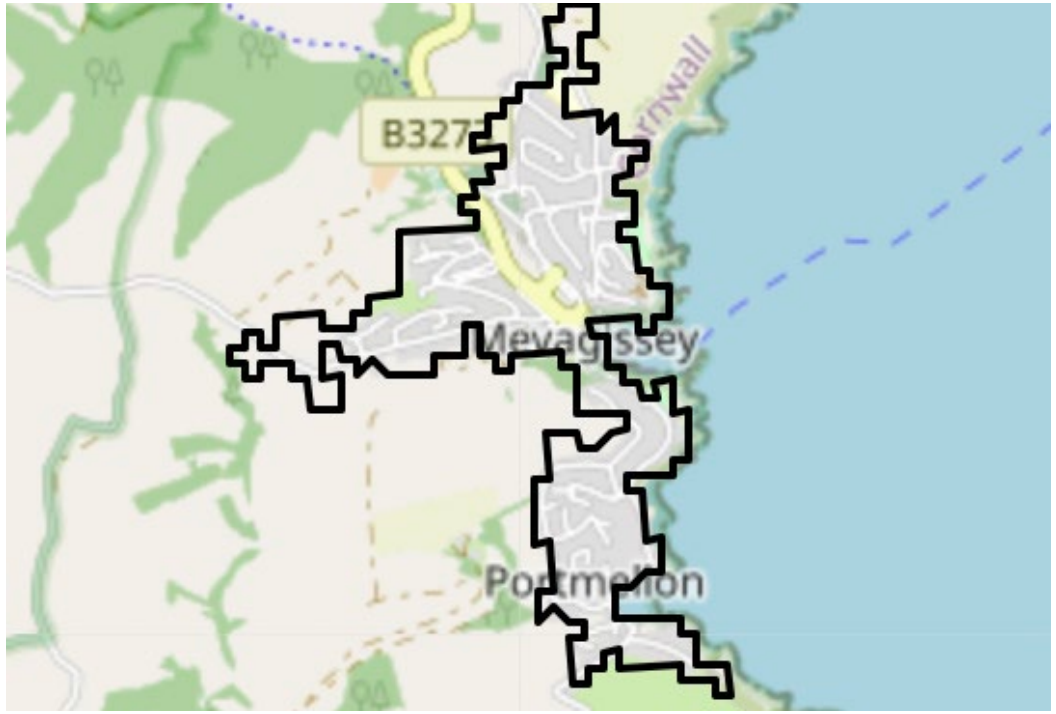
- Population
- Demographic structure
- Employment
- Visitor economy
- Businesses
- Deprivation

Key considerations for Mevagissey and an outline business case complete the section.

Population

In the Mevagissey built-up area there were 2,117 usual residents at the time of the 2011 census. The 'built up area' of Mevagissey (below) has an area of 92ha and a density of 23 persons / ha which is high considering the average for south-west of 2.2 persons / ha. There are 990 households in this same area with an average household size of 2.14 persons – this is perhaps a lower population density than expected reflecting potentially more retired people, fewer working families and more 'household spaces with no usual residents'. Indeed, the census identifies that 43% of households have no adults in employment and no dependent children (compared with 29% for England).

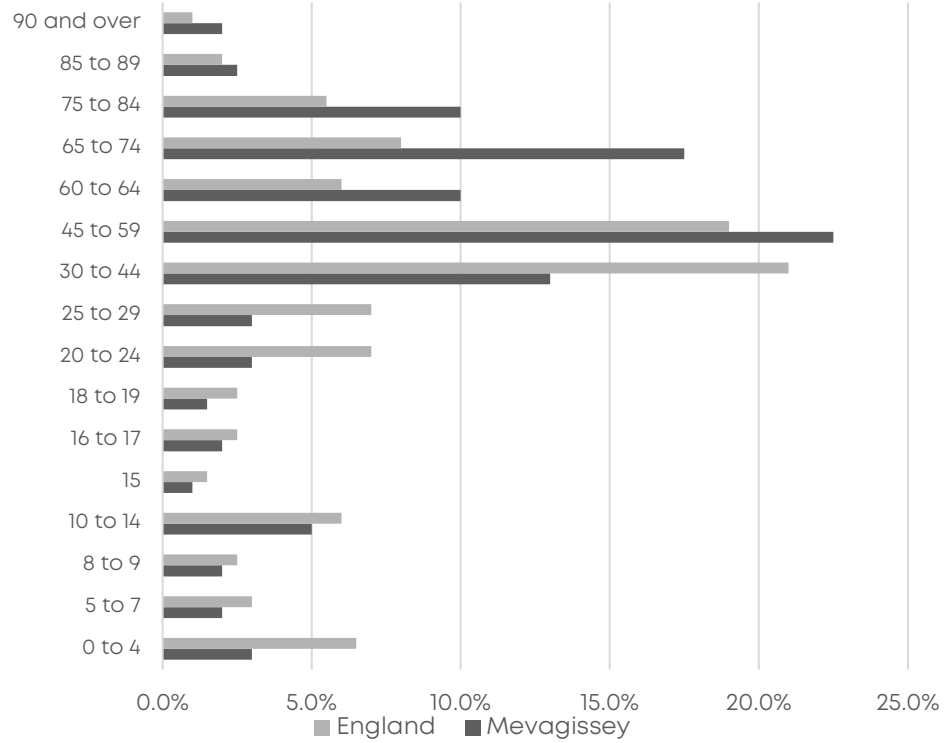
ONS, NOMIS Mevagissey built up area



Source: Mevagissey Local Area Report, ONS 2020

Relative to the average for England Mevagissey has a significantly higher overall proportion of its population of retirement or close to retirement age [17].

Age structure, Mevagissey and England



Source: Mevagissey Local Area Report, ONS 2020

Employment

In the built-up area of Mevagissey 60.7% of residents of working age (16 to 74 yrs) are in active employment which is significantly lower than southwest and English average (70.3% and 69.9% respectively) and potentially reflects that 26.7% are retired compared with English average of 13.7%. There is a large proportion of working age population that are self-employed (23.8% compared with English average of 9.8%). Unemployment is around regional and national levels.

Mevagissey's workforce (All usual residents aged 16 to 74 in employment) recorded a higher-than-average proportion of people working within the "Agriculture, forestry and fishing" industry with 44 people employed representing 5% compared with 0.8% for England. Mevagissey's workforce also recorded a higher than average "Accommodation and food service activities" with 122 people employed representing 13.9% compared with 5.6% for England. [17]. Of those that are employees only 23.8% are in full time employment compared with 38.6% across England. This may reflect a greater proportion of seasonal employment and an overall larger number of people whose livelihoods rely on local tourist sector. This is also reflected in the occupations of working age residents with a high proportion working in skilled trades occupations' (20.7%). While there are a number that are directors / managers this may reflect shop owners and self-employed.

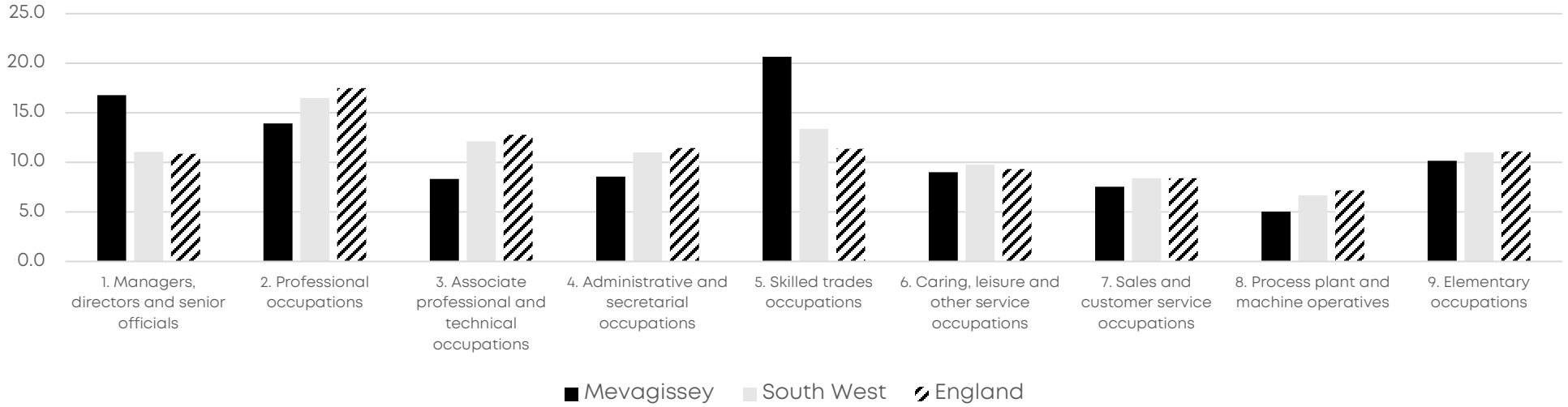
Fishing industry and harbour facilities

The harbour lands an excess of £2.5 million gross value of fish per annum (2019) and is the second busiest harbour in Cornwall after Newlyn [20].

Mevagissey has a long history of boatbuilding and repair (along with neighbouring Portmellon and Pentewan) that offers hardstanding and maintenance facilities for gigs, working and leisure boats [21]. While the inner harbour dries the outer harbour allows access at different levels of tide. The fleet comprises: "trawlers. scallopers, ringnetters, gill netters, potters and hand liners, catching and landing a huge variety of species…" and "…most of the boats are "day boats" they spend less than 24 hours at sea, so fish caught and landed are fresh and of prime quality. The largest boats that work from the harbour are 13 metres, and the smallest 5 metres, employing as many as 3 persons per boat or single-handed" [21]. In 2017 there were 72 registered vessels operating from Mevagissey which increased from 66 in 2012 [2b]. Recent (Aug 2022) list of registered and licenced vessels lists 45 of 10m and under overall length registered to the home port of Mevagissey and three of over 10m in length (FY470 Imogen, FH76 Galwad-Y-Mor and FY10 Celtic Dawn). [57]

Reportedly there are 60 permanent moorings for pleasure vessels and 30 seasonal moorings. There is a slipway which is available for public use [6]

Working age (16 to 74yrs) occupations Mevagissey, the South-West and England



Source: Mevagissey Local Area Report, ONS 2020

Visitor economy

The village is classified as an Area of Outstanding Natural Beauty (AONB) making Mevagissey a major tourist attraction during the summer months. Furthermore, to the north of Mevagissey is The Lost Gardens of Heligan, a large garden estate which also makes the village an attractive spot for tourists, with up to 300,000 annual visitors coming into the village for Feast Week and a recorded 77,000 visitors to the waterfront museum in 2019 [2a, 18].

A small aquarium is located in the former RNLI boat house.

Mevagissey 2011 census data indicates a greater proportion of households, c.300 (24.6%) with no usual residents compared with the English average of 4.3% which is potentially an indicator of second homes and a significant proportion of people who visit the area regularly [17].

The Southwest national coastal path goes through Mevagissey village. The route takes walkers from the coast into the harbour past The East and West Quay towards the South Pier before re-joining the coast [10]. Mevagissey is the overnight stop on the SW coastal path 52-day itinerary route [45]. It is also the start/end of the Mevagissey, Heligan & the Prehistoric Tin Stream train making it a key walking destination [46].

The Southwest Coastal Path (dark red line) through Mevagissey

Source: Magic Map, Defra 2022

Businesses

With reference to page 12, it is evident that there are many independent food and drink businesses clustered around the harbour along with other retail including independent gift and toys centred on the tourist trade. A survey of local retail businesses (n=25) undertaken as part of the development of the Parish Neighbourhood Development Plan [see Annex 5 of source 2a] reported that:

- Mevagissey businesses tend to employ local people (two thirds reported between 76% to 100% from Mevagissey)
- Almost half (48%) the businesses have been operating in Mevagissey for over 20 years. A further 16% have been operating here for over 10 years
- 40% of (businesses) are self employed
- Businesses that responded (n=25) reflected hospitality and tourist sector and included in retail (26%), tourism (26%), B&B (35%), and Hotels and food (13%).

In many parts of the of the harbour buildings can be up to three stories and above and include both commercial space with homes above within heritage structures. This unique composition should be examined and further considered in any detailed impact assessment of the benefit of flood protection.

Deprivation

Mevagissey harbour falls within Cornwall 041A LSOA. In 2019, this LSOA ranked 10,956 out of 32,844 LSOAs in England in terms of multiple deprivation, where 1 is the most deprived. This is amongst the 40% most deprived areas.

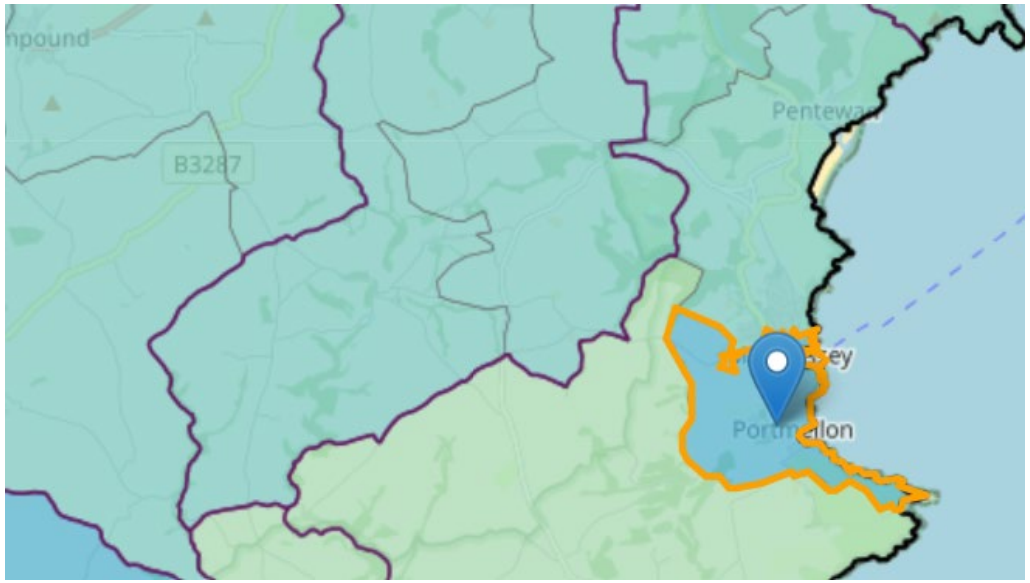
Employment deprivation

This measure illustrates the proportion of the working age population that is involuntarily excluded from the labour market. This includes people who would like to work but are unable to do so due to unemployment, sickness or disability, or caring responsibilities. In 2019, Mevagissey's LSOA is ranked 9,774 out of 32,1844 and is among the 30% most employment deprived in the country. It is noted that this ranking has improved since 2015 ranking of 7,925.

Living environment deprivation domain

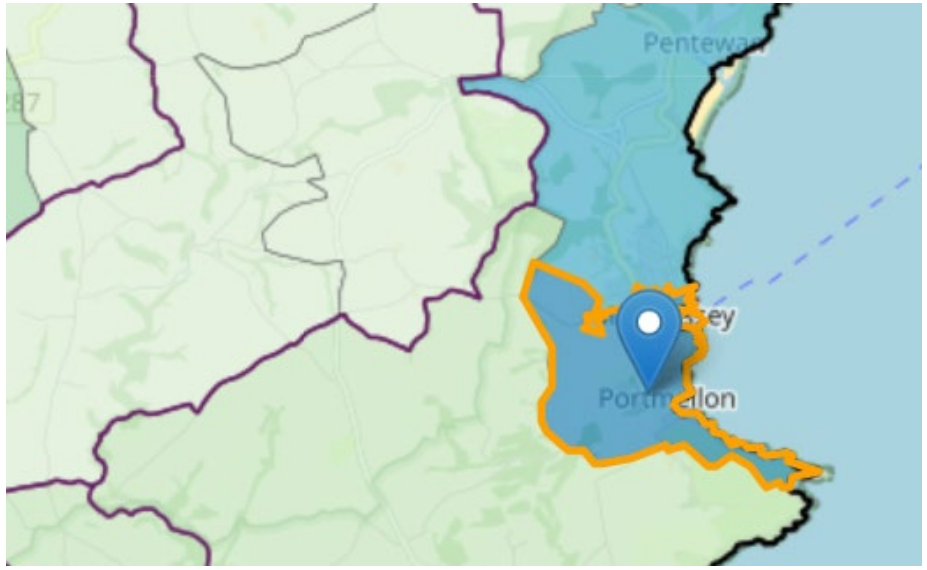
In 2019, this LSOA ranked 310 out of 32,844 in England. This is amongst the 10% most deprived neighbourhoods in the country relating to this measure which mainly reflects the overall poor quality of housing and may indicate those without central heating. Their position has worsened since 2015 where they ranked 388. Many other LSOAs in the region are within the 10% most deprived.

The index for multiple deprivation- Cornwall 041A LSOA



Source: Index of multiple deprivation

The index for employment deprivation- Cornwall 041A LSOA



The index for living environment deprivation- Cornwall 041A LSOA

Key considerations for Mevagissey

- Demographically, relative to the average for England Mevagissey has a higher overall proportion of its population of retirement or close to retirement age. Access to local services and shopping will be important for some who may be less mobile.

- For the 'built-up area' of Mevagissey in 2011, 60.7% of residents of working age (16 to 74 yrs) are in active employment (c.10% lower than regional and national average) and this is largely dependent on tourism which can be seasonal and relatively low paid. Approximately 70% of businesses that replied to a recent survey in Mevagissey are involved in the hospitality sector and a high
- proportion of workforce self-employed (c.23%).

- Available surveys of businesses and residents indicate a high proportion of those that work in the village live in the village. Mevagissey's workforce (all usual residents aged 16 to 74 in employment) recorded a higher-than-average proportion of people working within the "Agriculture, forestry and fishing" industry.

- In 2017 there were 72 registered fishing vessels operating from Mevagissey (home registered port) which increased from 66 in 2012 and is important within Cornwall as it lands an excess of £2.5 million gross value of fish per annum (2019) it is the second busiest harbour in Cornwall after Newlyn. The harbour is used by fishing vessels along with other uses including 60 permanent moorings for pleasure vessels and 30 seasonal moorings. There is a slipway which is available for public use.

- Mevagissey includes areas that are ranked within the top 30% for employment deprivation and top 10% for living environment deprivation. Access to employment and quality homes are issues for residents.

- The profile of employment and businesses in Mevagissey indicates it is not "average village" and has a strong reliance on sectors and activities that may be vulnerable and be affected by flooding and the wider effects of climate change. Previous economic appraisals {esp. ref. 6] of the potential effects of unconstrained flooding and Climate Change assume affected businesses to relocate over time – however – the above suggests the community would be less resilient and have a significant socio-economic impact.

Climate change and future risks

Overview of section

This section provides an overview of available information relating to Climate Change including information from a recent report produced for the Harbour by Marine-i and partners [26] which specifically examined potential future high-water levels at Mevagissey Harbour to inform future need for defence and reflects the Harbour's desire to comprehend the scale of the issue. This has been supplemented with information on preferred scenario for appraisal (the RCP8.5 projection on MSL anomaly up to 2100).

Key considerations for Mevagissey and an outline business case complete the section.

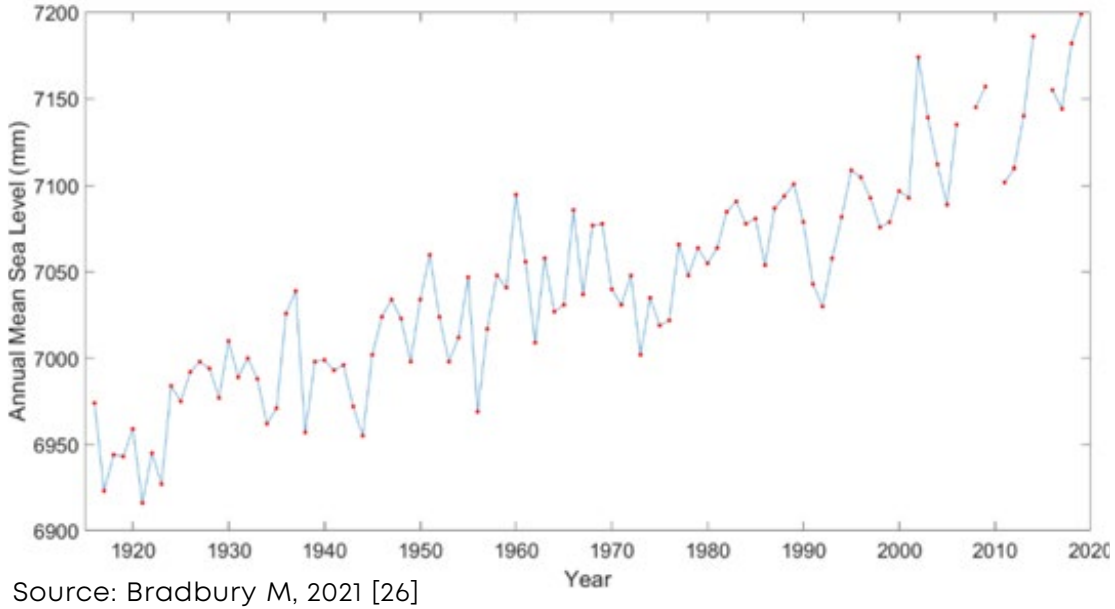
Climate change

Over the last 100 years, Climate Change has been seen to cause a rise in global sea levels. The sea level at Newlyn (Closest Tide gauge to Mevagissey) has risen by around 25cm in 100 years (see below).

An intermediate scenario (therefore more likely situation) suggested by the International Panel on Climate Change (IPCC) suggest that the sea level in Mevagissey Harbour would have risen by 7.5cm which is 1/3 of the increase seen over the last 100 years, between 2022 and 2037 [19,26]. By 2100 the sea level rise at Mevagissey is predicted to be in the order of 40-60 cm [26].

While it is uncertain as to exactly how global warming is going to affect the frequency and intensity of storms it is noted that even current storm frequency and intensity in combination with low (atmospheric) pressure events and sea level rise will result in higher water levels at these times. For example, the report [26] is predicts that the strongest storm in the next 10 years will create a storm surge 0.4 m higher than those seen in the strongest storm in 2018. This is significant.

Annual mean sea level at Newlyn tide gauge (mm)

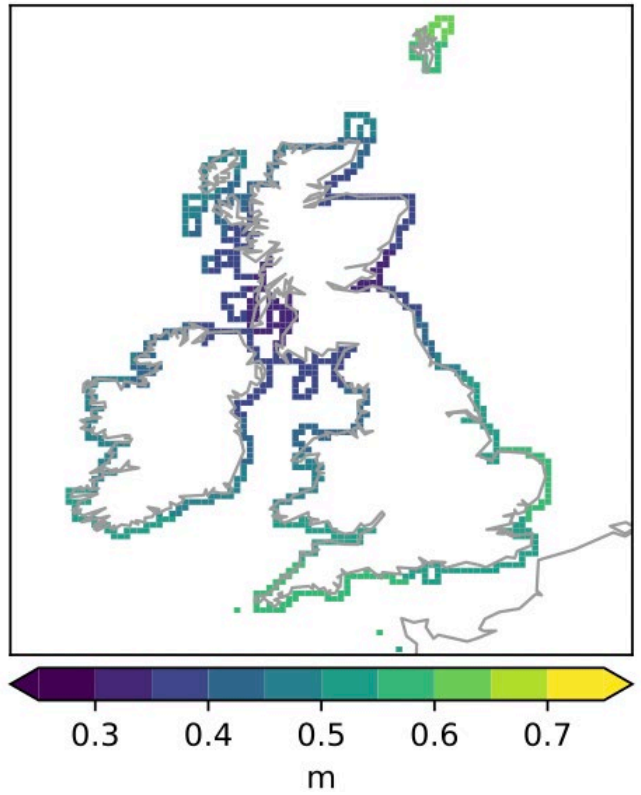


Source: Bradbury M, 2021 [26]

Future storms combined with rising sea levels will result in an increased amount of overtopping of the piers in Mevagissey and increase the coastal flood risk to the village.

In addition, the report notes the predicted growth of future storm surges will increase the structural load on the pier walls causing additional damage to the already ageing infrastructure [26]. This will result in a further increase in the amount and scale of repairs needed to maintain the piers in the future.

Intermediate spatial change in tidal range along the UK and Irish coast



Source: Hudson et al, 2015 [50]

Climate change and Mevagissey harbour

The potential impact of climate change on the harbour have been considered by MHT. In *mitigation* of the causes of climate change MHT are seeking to ensure that in its activities that it is not a significant emitter of greenhouse gases. To this aim some work has investigated:

- Vessel decarbonisation which was suggested [26] to be more likely achieved by electrification (battery) before hydrogen-power. MHT may need to consider charging facilities and other actions to enable a low carbon transition.
- Given the resource, access to the grid and proximity to shipping makes the area off-shore of Mevagissey less favourable to floating offshore wind farms.
- A review of the potential for solar PV is discussed later in the "available technical appraisals" section. This notes that the Harbour now have green (75%) and low carbon electricity.

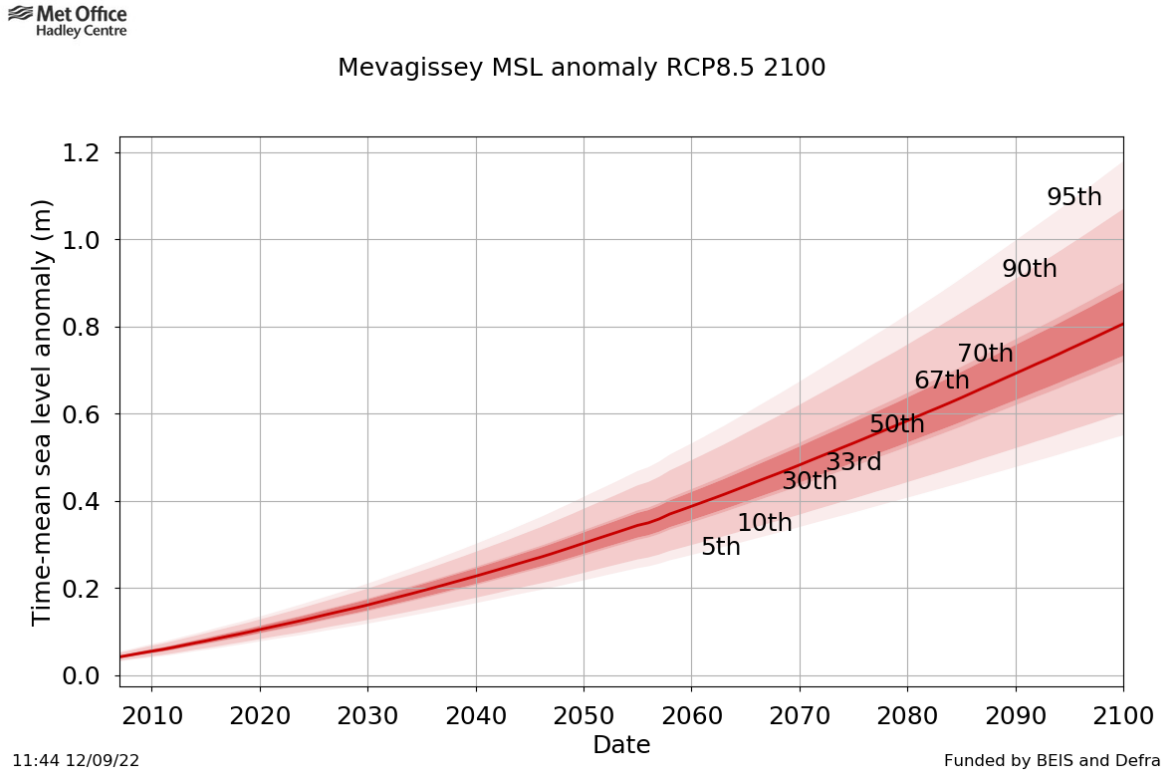
In order to *adapt* to the predicted effects of Climate Change MHT recognise the need to ensure the harbour is maintained to a high standard and a key reason for this high-level study is to identify a means to begin to take steps to protect Mevagissey to future risks and improve its resilience considering:

- evidence that storm surges are increasing in frequency and intensity due to the warming of the seas.
- In the last 100 years there has been a 25cm rise in annual water levels at Newlyn. The "most likely" prediction (RCP 4.5) for future sea level increases at Mevagissey are for a 70mm increase by 2035, 170mm by 2050 and 470mm by 2100. Critically, the plausible RCP8.5 scenario (see diagram) needs to form the basis of any assessment. At the 95th percentile this indicates in excess of 1m Sea Level Rise at Mevagissey is possible by 2100. This is of course a less likely outcome than the more modest projections produced under RCP 4.5, but it's still very plausible (and is not the most conservative projection) and needs to form the upper bound of the range of potential Sea Level Rise which needs to be considered in technical appraisals and business case*.

This will require a review of the capacity of existing protection and either alterations or new structures to accommodate the change.

It was noted that in any solutions there may be opportunities to have other beneficial effects. 'Green' solutions to protecting the harbour could be considered where structures include means to enhance biodiversity within reefs and other introduced habitats where appropriate.

Sea level increase (m) for 2019-2100, for Mevagissey harbour, under emission pathway RCP 8.5.



Source: Met Office

** EA guidance on both scheme appraisal and flood risk assessments is that the UKCP18 scenario recommended for use is RCP8.5 using values taken at the 70th and 95th percentiles to form a band with central and upper-case boundaries, to enable sensitivity testing.*

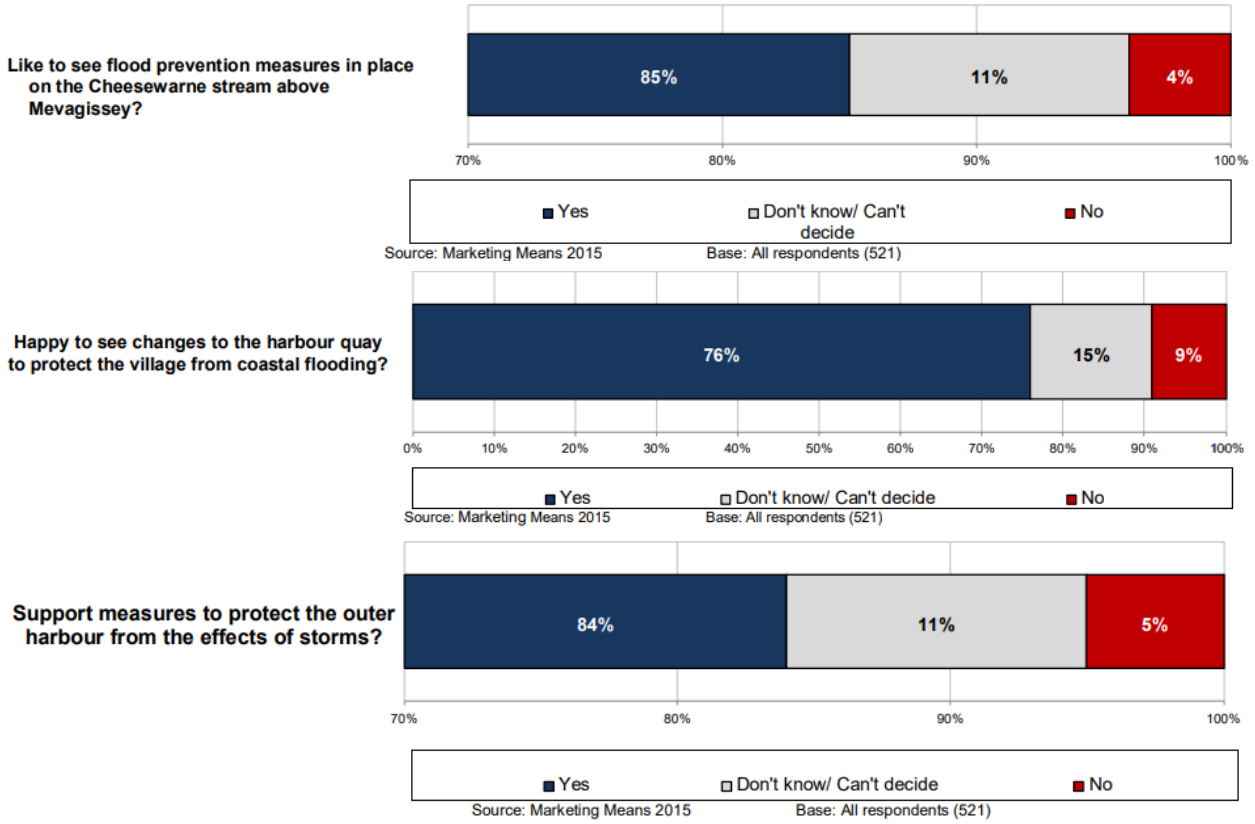
Key considerations for Mevagissey

- Over the last 100 years climate change has caused a rise in global sea level. The sea level at Newlyn (Closest Tide gauge to Mevagissey) has risen by around 25cm in 100 years.
- The 'most likely' prediction for future sea level increases at Mevagissey are for a 70mm increase by 2035, 170mm by 2050 and 470mm by 2100. Critically, the plausible RCP8.5 scenario (see diagram) needs to form the basis of any technical assessment and business case. At the 95th percentile this indicates in excess of 1m Sea Level Rise at Mevagissey is possible by 2100 (the range is range from approx. 0.6m to 1.2m). There is evidence that storm surges are increasing in frequency and intensity due to the warming of the seas. The available report [26] predicts that the strongest storm in the next 10 years will create a storm surge 0.4 m higher than those seen in the strongest storm in 2018.
- In addition to various actions to mitigate the causes of climate change, MHT aim to ensure actions to adapt to future change are taken including regular maintenance of existing structures. However, this will require a review of the capacity of existing protection and potentially either alterations or new structures to accommodate the change and improve Mevagissey's resilience (such a study is underway – see next steps section). Such structures may provide other benefits such as biodiversity (and potential economic opportunities).

Fluvial and surface water flooding and other effects of climate change on Mevagissey are not described in this section as focussed on marine effects but are also clearly relevant. Consultations with regulatory organisations described later highlight value a wholistic approach and may be a fruitful means to ensure action.

It should be noted that the survey of residents (n=521) undertaken in 2015 as part of the development of the Parish Neighbourhood Plan [Annex 6 of source 2a] only a small proportion indicated (within the top five priorities of only 17% of residents) that capital investment in flood prevention schemes was an 'important issue' (see response to Q22). These views may have changed since this time (after some recent flood events). However, the responses to specific questions indicate a sound majority in favour of flood protection measures and are reproduced opposite.

Mevagissey resident opinions on flood protection, 2015



Source: Annex 6 Residents Survey, Mevagissey Parish NDP, 2018 [2a]

Key events

Overview of section

This section provides an overview of some key events in the history of the Harbour:

- Early history;
- Harbour assessments and works; and
- Recent events.

This is not exhaustive but illustrates the dynamic growth of the harbour and events over time.

Mevagissey c. 1960. From Pearse (1963) *The Ports and Harbours of Cornwall* Published H.E.Warne Ltd

Early history

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1313
The towns of St Meva and St Issy were first recorded as a hamlet [23]

1430 to 1480
The medieval quay pier was established by the lord of manor to protect fishing boats [1, 21]

1740
Original pier noted in survey of St Austell Bay [1]

1774
Mevagissey Harbour Trust formed to construct harbour [6]

1775
A new pier, which is the current inner pier, built on the medieval quay under an act of parliament costing £4,235 [1,21]

1885
Construction of the outer pier started after the passing of the Harbour act in 1885. It took 2 years to complete and cost between £20,000 and £30,300 [1,21]

1888
Outer breakwaters completed [6]

1891
A Blizzard destroyed much of the new pier. The piers were fixed in 1897 with the addition of a lifeboat house and slip allowing the lifeboat to be launched no matter the tidal state [1].

1869-1930
Mevagissey harbour had an operating lifeboat station [1]

1988
Outer Harbour given charitable status [21]

Source: Kovia

Harbour assessments and works

1944
Repair to south pier foundation costing £18,500 [6]

1955
Repair to South Pier Pressure Grouting costing costing £6,800 [6]

1956
Repair to South Pier Pressure Grouting costing £18,000 [6]

1956
Repair to South Pier missing granite setts costing £400 [6]

1976
Repair to South Pier due to the poor condition of the bottom of the harbour side wall costing £39,000 [6]

1985
North pier maintenance with the instillation of a concrete apron and steel sheet piling [22]
Maintenance to South Pier involving the construction of reinforced concrete protection wall and ties laid through the pier to protect the masonry walls costing a £567,946 [a] [6].

1998
South Pier strengthened significantly costing £1,029,864 with the addition of a concrete apron to the pier [b] [6,22].

2007
Areas repaired and patched up costing £112,881 [c] [6,22].
On the North Pier steel bars were inserted add strength he North pier and these works costing £0.5m and were paid for by the Environment Agency [51].

2011
Visual inspection of Inner and outer piers by Royal Haskoning. The overall condition of the piers was assessed as Fair with no major damage and only localised areas of deterioration resulting in a residual life of up to 30 years. However, some areas of the North Pier assessment showed poor areas resulting in residual life of approximately 5 - 10 years of this pier. Additional damage could be made during extreme storm events making the outer piers more vulnerable [6]. The piers were assessed to provide shelter for boats and flood protection to the village.

2011
The SMP2 was adopted in 2011 and defined a 'hold the line' policy for Mevagissey, following consultation with stakeholders and communities.

2017
High resolution multibeam sonar and laser survey of North and South Piers in 2017 by CMS-Geotech (see section 1.5)

2019
The Harbour surface was replaced from Waterfront Centre to the Compound due to the poor condition of the access to the outer harbour [18].

2021
Repairs on damage to the end of the piling, located near the rock structure off the coast on the offshore side of the South pier of damage costing £150,000 (per comms. AT Mevagissey Harbour Master).

Source: Kovia

Recent events

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2010
Mevagissey floods due to gale force winds resulting in 100's of homes flooding [25].

October 2012
Flooding across Cornwall particularly effecting Mevagissey due to gale force winds and storm surge coinciding with high tides. Some businesses and houses were flooded [47]

December 2012
Flooding caused by a series of spring tides coinciding with gale force winds, storm surges particularly effecting the south coast including Mevagissey. Approximately 12 building flooded [47].

February 2014
Mevagissey flooded after high tide coincided with storm causing a total of 20 properties to flood [48]

February 2017
The quayside is overtopped and Mevagissey is flooded caused by high tides coinciding with storm surges. [24].

May 2021
The Environment Agency introduced new technology for the flood warning system used in Mevagissey. Residence in the area at risk from flooding receive a will be automatically registered and alerted to flooding risk through monitoring of rain fall in the area. In Mevagissey over 160 properties will be auto registered and alerted to flooding risk of the Mevagissey stream. However, the warnings will be triggered by weather, river or sea conditions which are known to cause flooding [35].

Source: Kovia

Available technical assessments

Overview of section

This section provides a summary of the findings of technical assessments (prepared by third parties) and work undertaken at Mevagissey Harbour.

This subsection provides a sequential treatment of the following provided information:

- Feb 2011 Royal Haskoning (Shoreline Management Plan – PDZ4 / MA08).
- July 2012 Royal Haskoning (Mevagissey, Portreath and Newquay Harbours Study), for Cornwall Council, Final project 9W3930, ref: 303478/Exeter.
- Nov 2017 Sonar and laser breakwater inspection survey – preliminary analysis (2017) by CMS Geotech for Mevagissey Harbour Trustees. Report number 2017-MEVA1. Date November 2017.
- Jan 2018 Mevagissey Harbour North and South Pier Repair and Rock Armour Works (2018) for Mevagissey Harbour / EA 09/01/2018 a report by Keynvor Morlift Ltd with Sea Wide Services Ltd provided a review of necessary marine civil engineering works for void repair and repair to rock armour (Ref: KML-10-229-MH).
- Mar 2018 Repairs to piers. Internal File Note of meeting with EA.
- July 2018 Marine-i Electrical consumption and renewable energy options (2021) ORE Catapult/ Marine-i project (Neil Farrington) 12/08/2021 (V2) for Mevagissey Harbour.
- April 2018 to August 2021 Studies of fluvial flood risk in Mevagissey by Mott McDonald for the Environment Agency.

Key considerations for Mevagissey and any outline business case complete the section.

February 2011 Royal Haskoning Report: *Shoreline Management Plan Review* for area PDZ4 / MA08 [3]

Chapter 4 of the report that is publicly available provides a review of management proposals for Policy Development Zone 4 (PDZ4), Black Head to Zone Point and also covers Management Area 8 (MA8). The specific policy unit (PU) that relates to Mevagissey is PU8.4.

It notes that:

- Cliffs are relatively resistant slate and most designated as Heritage Coast. Flooding and erosion in discrete locations should affect policy
- Well documented flood risk at Mevagissey and "will become increasingly severe with time as sea levels rise." While significant erosion was not predicted "flood risk which affects large parts of the conservation area and would impact upon numerous listed buildings (45+) is therefore the priority…" and "…the detailed approach to flood risk will require more detailed options to be appraised"
- "…the preferred plan at Mevagissey would be to employ a hold the line approach together with an option to realign the defences (including the harbour structures) as necessary – this could be either landward or seaward realignment – in all probability a detailed strategy at Mevagissey may require a combination of both."

In relation to recent work it noted:

- "Significant amounts of money (£5M) have been spent on the Victoria Pier recently. The Victoria Pier, although essentially a harbour structure, provides a significant amount of shelter from the wave climate during southeasterly storm conditions, reducing wave set-up effects within the harbour and therefore providing a flood defence benefit.
- "Emergency works were carried out upon the other outer harbour arm, the north Pier, in 2008. This structure also provides shelter from the wave climate, but to a lesser extent."

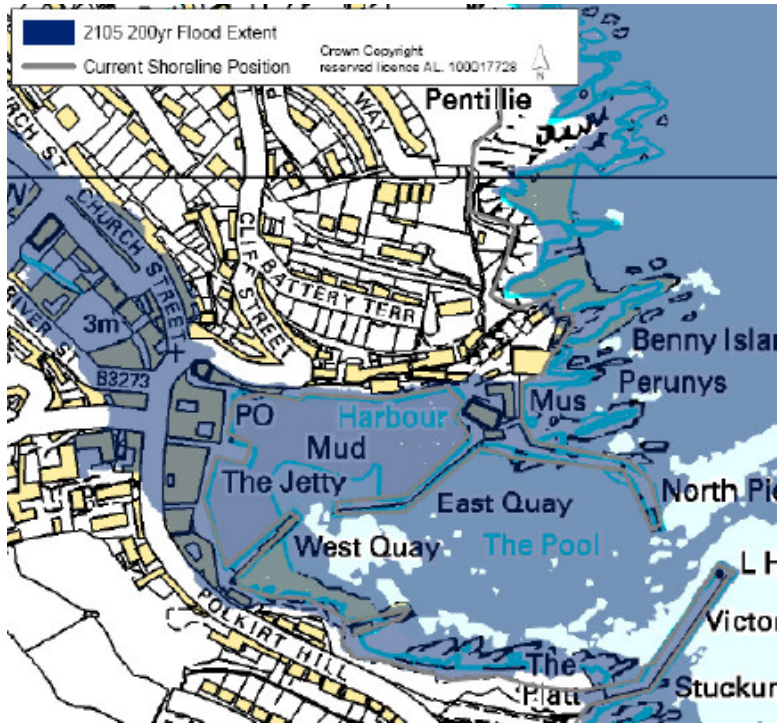
Regarding proposed actions it noted:

- "There is a commitment to invest further funding into the assessment of both tidal and fluvial flood risks at Mevagissey in the coming years.*
- "Any such assessment should consider Managed Realignment options, including changes to the harbour structure arrangements, and must link in to the Land Use Planning system. The pre-feasibility study for Mevagissey has also confirmed that assessment requires further tidal monitoring support from the Coastal Monitoring Programme to inform options and risks."

The review provides recommendations for shoreline planning policy and for PU8.4 Mevagissey this comprised (summary table page 20):

- "Hold the Line" / "Managed realignment" from 2025 until 2055 then to 2105 "Hold the line". More specifically "Allow flexible approach to landward/seaward adjustment in defensive strategy. Realignment of harbour structures could form part of a future flood risk management solution."
- The economic appraisal of preferred policy options proposed considering only avoided property damage (PV) of £1.166m and a cost (PV) of £5.422m giving a low B/C ratio of 0.22. The report commented that the high costs reflected maintenance costs for harbours and noted that many factors such as heritage, economic and wider impacts were not factored in the assessment.

The Hold the Line was necessary to ensure protection for residential and commercial properties at the Harbour.



From the report – this indicates the extent of the Future (2011) 0.5% flood risk area adjacent to the harbour plus sea level rise from a 1:200 yr water level.

July 2012 Royal Haskoning Report: *Mevagissey, Portreath and Newquay Harbours Study*, for Cornwall Council, Final project 9W3930, ref: 303478/Exeter [6]

This report contains the review of condition and structural integrity of breakwaters and an assessment of risks and the economic consequences of their failure. The evidence developed aimed to support an understanding of costs to maintain and upgrade assets as well as to inform subsequent funding bids for the works. Appendix A with walkover survey was not available.

Structural inspections and condition

- Quayside not included although includes 450m of other structures. The assessment looked at current condition and summarised in diagram opposite. Monitoring and repair was recommended with likely significant work to North Pier required (like South Pier). Inner harbour structure lack deep foundations and likely quickly lost should outer structures compromised.

Hydrodynamic modelling of flood risk

- Considers three scenarios i) structures in place and in fair condition; ii) structures degraded; and iii) structures absent and the extent that they afforded protection from waves, flooding and erosion;

- Wave climate (offshore to nearshore) uses MIKE21 model, wave climate impacts inform an overtopping assessment (AMAZON model) which calculates volume of water topping inner quay walls on a range of water level return periods and, in turn, provides input to an inundation model (using TUFLOW) to provide flood extents and mapping of damage.

Assessment of erosion potential

- Based on work in 2011 Shoreline Management Plan review with an upper and lower projected erosion rate of 0.0 to 3.0m over next 100 years; The report only considered tide and storm related flooding from the sea but clearly the town is vulnerable to fluvial flooding.

Economic Assessment

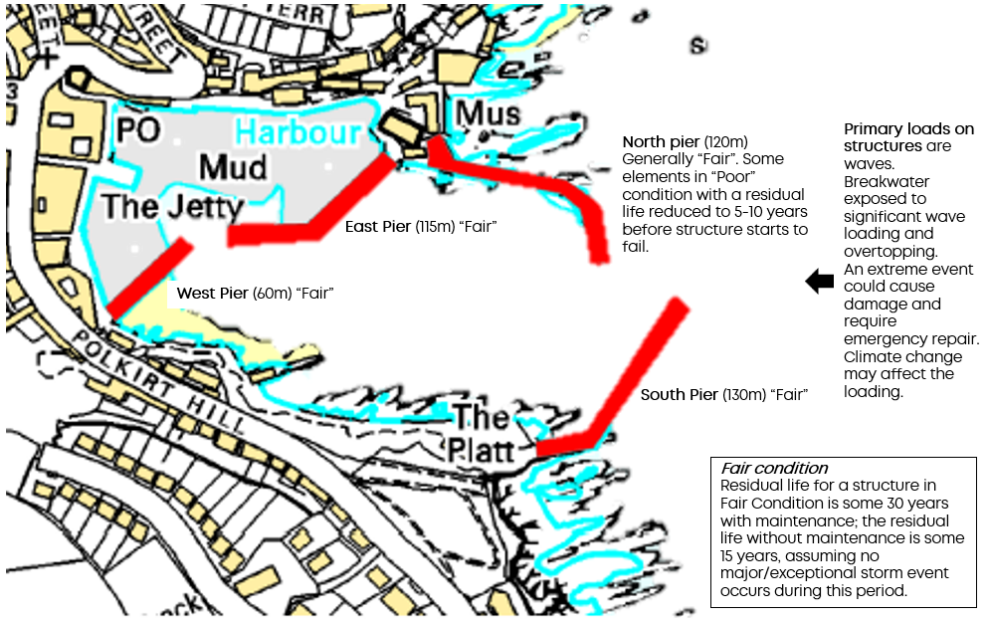
- Flood water depths are extrapolated to examine affected properties. This includes wider consequences beyond do nothing and property value approach. Review contains a good review of previous works and maintenance to arrive at option costs. Option benefits (£4.29m) are lower than expected due to the capping of damage costs in the areas that have been flooded in recent past. Wider benefits are not valued here but the assessment was in line with EA guidance for funding policy. Property valuations are likely to be significantly different at this time.

Wider consequences and conclusion

Its noted wider consequences would be felt by community including loss of commercial and recreational fisheries (charters) and a loss of tourism. Reportedly, wider consequences are only considered (in funding) if there is an impact at national level - this is not in line with more recent approaches to impact assessment which also value impact on communities or groups who may not be able to react in the way suggested (i.e. start fishing elsewhere!). There was little attempt to value wider effects (e.g. social, quality of life or environmental effects) although heritage value was noted.

The report clearly marks Mevagissey as being the harbour that is at most risk ("loss of the structures would have the most significant impact") and stands to benefit most from improvements (through avoided damage). However, wider benefits could have been valued. Critically, sections of the North Pier was observed in "poor" condition with a residual life of 5 to 10 years which is a concern as the report was produced >10 years ago.

Structural condition survey



Source: Kovia from Royal Haskoning 2012

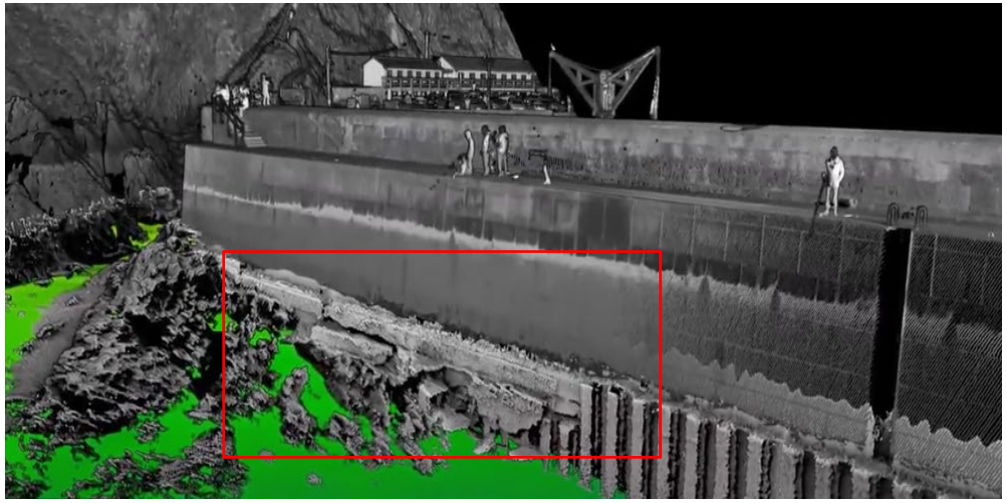
November 2017 CMS Geotech Report: *Sonar and laser breakwater inspection survey – preliminary analysis* (2017) for Mevagissey Harbour Trustees. Report number 2017-MEVA1. Date November 2017 [22]

The survey was commissioned to examine the integrity of the piers and to identify where more detailed survey would be required.

The survey found "the North Breakwater to be in generally good condition with one main area 6m in length on the offshore side requiring further investigation by a diver. The survey found the South Breakwater to be in generally good condition on the inshore side and on the end and offshore side where metal protection shuttering has been used. There is an area 30m in length on the offshore side, inshore end beyond the metal protection shuttering which requires further dive assessment. This area should be compared with as built surveys."

The survey inspections did not include input from a structural or civil engineer and recommendations treated in broad indicative terms.

Ultrabeam survey (2018) showing missing material and undercut on the South Pier, repaired in 2019.



Source: Ultrabeam hydrographic, 2018 [9]

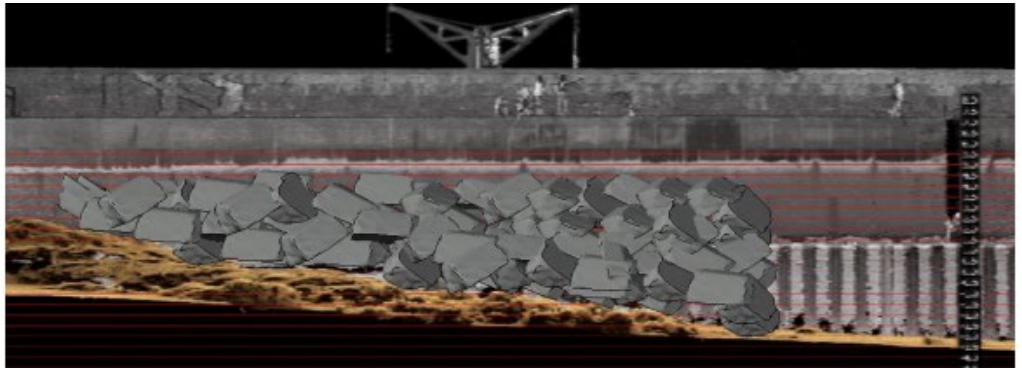
January 2018 Keynvor Morlift Ltd with Sea Wide Services Ltd Quotation: *Mevagissey Harbour North and South Pier Repair and Rock Armour Works (2018) for Mevagissey Harbour / EA* 09/01/2018 Includes a review of necessary marine civil engineering works for void repair and repair to rock armour (Ref: KML-10-229-MH) [56]

A quote for works identified in CMS survey and further investigated by diver. The report confirmed the general state of repair including:

- Harbour walls originally extended variously in 19th C to form current harbour. Late 20th C significant repairs carried out to the outer North and South Pier arms to reinforce the granite ashlar (fine worked / cut stone) sea walls. A combination of sheet piling and concrete encasement provided to seaward faces
- Evidence of significant undercutting / voids of lower in situ concrete on South Pier and some cracking and spalling on lower in situ concrete on North Pier
- Repairs are required urgently before 2018 and wave attack and scour mitigated with rock armour (at toe) to mitigate potential future larger scale failure

This confirmed the following scope of works:

- Void repair and remediation £73,470 ex VAT
- Rock armour £114,000 for South Pier and £313,533 for North Pier



Proposed rock armour to South Pier (source as above [56]).

South Pier (2018)

North Pier (2018)

Source: **2018 Keynvor Morlift Ltd with Sea Wide Services Ltd Quotation**

March 2018 Repairs to piers. Internal File Note of meeting with EA

This note was from a meeting attended by MHT and the Environment Agency (officers NE and PR) and regarded emergency repairs to the piers that were required. Notes included:

- Funding for emergency works could be available but would require and outline business case which included a description of maintenance spend to date. Potentially £400k might be available;
- Competition for the funding was likely to be difficult in the future considering total amount available;
- Mevagissey needed a long-term strategy and plans to help with onward funding bids and help illustrate it is ranked highly in terms of need (The note suggested it needed to be “top 10” harbour;
- Work should be supported and include engagement with all stakeholders;
- Other sources of funding might need to be considered such as loans.

July 2018 Marine-i Report: *Electrical consumption and renewable energy options* (2021) ORE Catapult/ Marine-i project (Neil Farrington) 12/08/2021 (V2) for Mevagissey Harbour

The report, commissioned by Mevagissey Harbour, considered feasibility of meeting current electrical demand by the Harbour with on-site renewable electricity generation. A total estimate annual consumption was 115,770KWh and based on current conversion figures related to annual emissions of 24.58 tonnes / yr CO_2e.

The study focussed on solar PV system and with advice from ZLC Energy illustrated options for on-in roof solar PV on viable built structures. This identified a potential total of 32.68kw and an estimated 31,578kWh of on-site green energy, therefore meeting 27% of demand and saving 6.7 tonnes / yr CO_2e displacing grid tied supply. Illustrative financial costs were provided over the life of the PV system at one of the locations. It was suggested this was compared with guaranteed green tariff to examine overall viability.

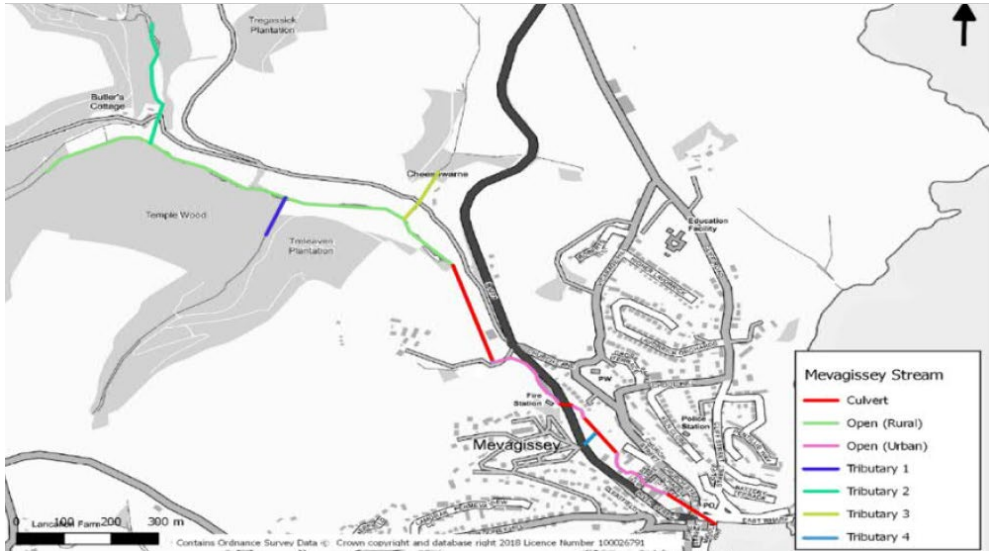
It is noted that the Harbour have changed their supplier to green (75%) or low carbon (25%) sourced.

April 2018 to August 2021 Studies of fluvial flood risk, Mevagissey

Three pieces of work have been undertaken examining fluvial flooding at Mevagissey [58, 59, 60]. These were prepared by Mott McDonald for the Environment Agency:

- The April 2018 report described how a model of flood risk would be developed for Mevagissey Stream and was developed to inform an appraisal (of flood risk), flood mapping and an economic assessment of flood risk management options in the Mevagissey catchment. The initial report noted that that since 1954 there had been 38 recorded flood events, of which 11 have been fluvial sourced.
- The May 2019 damages and benefits report provided a comprehensive assessment in line with accepted guidance (such as Flood and Coastal Erosion Risk Management Appraisal Guidance A Manual for Economic Appraisal, Flood Hazard Research Centre, 2013) of flood benefits and damages from coastal and fluvial flooding. This also included an assessment of residual damages from tidal flooding. Both the management options considered (1. do minimum and 2. Fluvial 1 in 100 standard of protection including fluvial and tidal damage) were likely to help with an estimated avoided damage of between £6.0m to £13.6m. However, there were a variety of damages and benefits that were not included in the assessment (including wave damage) and likely to provide an underestimate of the potential damage.
- The full flood modelling report was produced in August 2021 and examined fluvial modelling only. This predicted peak flood water levels and was calibrated with information from previous events. This highlighted the need for regular maintenance of drainage infrastructure to minimise flood events and limit risk to potential additional properties. The model included a variety of limitations and did not examine the impact of any potential mitigation measures.
- Further work to strategically address Mevagissey's climate change adaptation and flood risk will need to consider all elements of flood risk (coastal, tidal, fluvial, surface) and the above will be important to inform any business case for funding.

Watercourses within modelled study area (Mevagissey Stream)



Source: Mott McDonald [58, 59,60]

Key considerations for Mevagissey

- The shoreline management plan review for PDZ4/ MA08 states that flooding will become increasingly severe with time as sea levels rise, affecting numerous listed buildings (over 45). It recommended, ultimately, a hold the line approach with an option to realign the defences- landward or seaward, or a combination of both.

- A report by Royal Haskoning on Mevagissey harbour in 2012 found the condition of the breakwaters to be 'fair' giving a residual life of 30 years with maintenance. However, some of the North pier was in 'poor' condition with a residual life of 5-10 years- a timeline that has since expired. The economic appraisal undertaken at the time was limited and a more comprehensive assessment may indicate a higher cost benefit ratio and case for change.

- A technical harbour overview used multibeam sonar to survey the North and South piers at Mevagissey. They indicated repairs were required on the outer pier and a 6m break in the concrete skirting to the offshore side of the north pier.

- The full extent of repair undertaken in 2021 by MHT is not recorded.

- The scope of work to upgrade the structures in the harbour to address future wave and storm loading is also unclear and would need to be defined in light of current models of sea level and climate change effects. Note that such a study has been proposed and is underway – see next steps section.

Case studies

Overview of section

This section provides a review of a number of case studies chosen to illustrate similar projects as well as some that have wider objectives that might be relevant here:

1. Looe – a very similar situation but a little further ahead in progress
2. St Mary's, Isles of Scilly – recent project to protect low lying land
3. Dawlish – high risk to national infrastructure on same coast
4. Plymouth Breakwater – effectiveness of breakwaters reducing wave energy
5. Pentewan - local scheme close to Mevagissey seeking to protect homes, coast and heritage buildings and structures
6. Coverack – introduction of a coastal sea wall to protect the Coverack shoreline
7. Newlyn – ecoblocks - an addition to enhance biodiversity of rock armour
8. Nature based solutions and enhancements – seagrass and kelp beds

Key considerations for Mevagissey and an outline business case complete the section.

Case study 1: Looe

There are many similarities between the situation at Looe and Mevagissey:

- Flooding reportedly cost the economy £39 million between 2012 and 2017 and is important in a context where tourism economy is worth £47.8 million and supports 1,100 jobs [34]. As part of this flooding 65% of businesses experienced flooding struggle to get insurance [36].
- Sea level rise is predicted to increase the flooding area from 2.5 hectares to 16 hectares, including fire station, railway station and main road A387, sewers, healthcare facilities, fish market and main food stores [34, 36]. As a result funding has been secured from the Environmental agency [34] with the aim to protect the town including 331 homes, 208 businesses, the harbour and fishing fleet [36].
- Various proposals are put forward o adapt to the effects, a tidal barrier, a southern breakwater, an extension of the Banjo Pier, a cut of wall below East Looe beach, and a new walkway between built up areas (from Pennyland to Hannafore) [35].

Costs

- Current estimated costs for delivering this project are between £60m and £75m and the project has been in receipt of a number of sources of funding including £2.3 million Flood defence grant for flood barrier starting in 2025 [34], £0.05m from Cornwall and the Isles of Scilly Local Enterprise Partnership to help assess the economic benefits [36], £0.02m from Looe Harbour Commissioners for initial options and appraisals and £0.02m from Looe Town Council for Neighbourhood plan. There is scope to obtain up to £25 million from potential Environment Agency Flood Defence Grant in Aid [36].

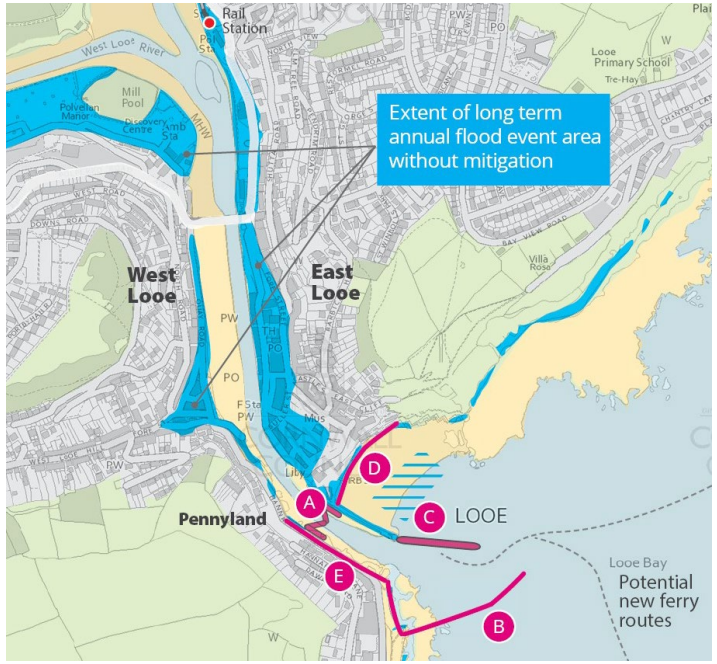
Timeframe

- November 2020: strategic outline case and preliminary design.
- 2021-2022: Final outline business case to be submitted to Government for funding as well as work to seek a Harbour Revision Order / marine licences.
- If funding secured: 2022-2024 work commence on detailed design and planning permission
- If planning permission secured: 2024 begin delivery of scheme with completion in 2027/28.

Relevance to Mevagissey

- The type of flood risk and issues are similar to Looe.
- Like Mevagissey, Looe is a thriving fishing port and a key tourist destination with flooding having a huge impact on businesses and tourism in the area.
- Looe is a little ahead of Mevagissey in having undertaken strategic feasibility and now seeking funding from same “pots” including the Flood Risk Defence Grant in Aid managed by the EA. This indicates there may be scope to secure funding to examine economic benefits to the village from Cornwall and the Isles of Scilly Local Enterprise Partnership.

Proposed flood defense scheme at Looe



A) Tidal barrier which will close when flooding is likely
B) Southern breakwater to prevent overtopping of the flood gates during tidal surges, provide a shelter for vessels when the flood gates are closed and protect Hannafore Road.
C) Extension to the Banjo pier, creating a low water landing stage providing boat access at all states of the tide.
D) Cut-off wall below East Looe beach to prevent tidal flooding bypassing the tidal barrier
E) Separate low-level walkway from Pennyland in the town to Hannafore

Source: https://letstalk.cornwall.gov.uk/looe-proposed-flood-defence-scheme

Case study 2: Isles of Scilly

- The Isles of Scilly are low lying islands with approximately 30% of their land area at or below 5m elevation from sea level. The main threat to the Isles of Scilly is coastal flooding caused by storms occurring at hightide [42]. These projects are on St Marys the largest Island.
- Along with a local population that relies on tourist trade the Isles of Scilly are also classed an AONB, a conservation area and a heritage coast with numerous further designations such as RAMSAR sites of global importance, Special SAC, SPA, a Marine Conservation Zone, 26 SSSI and 129 Listed Buildings [42].
- The Isles of Scilly secured £3.6 million towards their innovative 'Adaptive Scilly' climate change project. This comprised £2.2 million from the European Regional Development Fund and £1.4 million from the Environment agency [41].
- *Porthmellon* – overtopping of the sand dunes and seawall are creating a risk to the road, industry and businesses. The proposed solution is rock armour along the top of the beach. The rock armour will dissipate the waves, causing the wave to break up rather than scour back. The strength of waves, surges and overtopping will be reduced and there will be less impact on road and the properties behind it. This will not change the look of the area as it will be replacing the sand dune, it is a more natural option than a seawall [41].
- *Porthloo* – Boating storage and repairs business and local footpath are vulnerable to erosion and flooding over the sand dunes [41]. Proposed changes to add more rocks to the existing rock armour to protect the sand dunes and not change the existing profile or look of the beach. Also, a new retaining wall to keep the rocks in place and prevent erosion. This work will use local granite and rock. It will take approximately 2 months to carry out and cause limited disruption to the area.

Relevance to Mevagissey

- Parts of Mevagissey is also a low lying and at risk from coastal flooding, especially from overtopping during storms. These areas also include conservation and heritage areas, AONB with a high density of listed buildings and dependence on tourist income.
- Rock armour may be a feasible option to protect the outer piers, as proposed to protect the sand dunes here from high energy waves and overtopping. The retaining wall in Porthloo acts to keep the rock armour in place and may be a similar principal with the piers at Mevagissey.

Porthmellon sea defence proposals

Porthloo sea defence proposals

Source: https://scilly.gov.uk/environment-transport/climate-emergency/climate-adaptation-scilly/porthmellon-sea-defence-proposals

Case study 3: Dawlish

- The wave damage at Dawlish is well documented and often discussed in national media mainly as a result of the impact on UK rail network at this location.
- Extreme winter storms with high energetic waves and high tide have had significant impacts and it was estimated the economic impact of the 2013/14 winter railway line damage cost the economy £60 million to £1.2 billion. At the time emergency repairs cost £20 million and took 2 months to put in place.
- In 2020 a new £80 million sea wall funded by the Department for Transport was approved for the Dawlish coastline to protect the railway and the town for the next 100 years [43].

Relevance to Mevagissey

- An extreme storm coinciding with an extreme high tide can cause millions of pounds worth of damage to coastal infrastructure. Coastline are exposed to similar easterly storms and while the rail link is infrastructure critical to the SW this illustrates scale and nature of works occurring on the coast to the east.

An artist impression of the new sea wall along with a cross section

Source: https://www.networkrail.co.uk/running-the-railway/our-routes/western/south-west-rail-resilience-programme/dawlish-sea-wall-section-two/

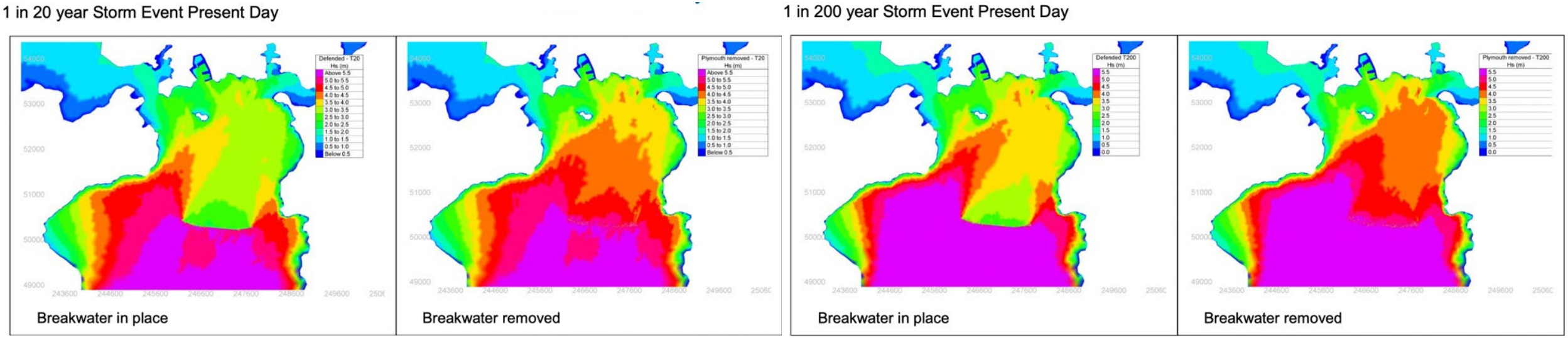
Case study 4: Plymouth Breakwater

- Plymouth Breakwater was constructed starting in 1812 and, after some alterations, completed in 1847. Four million tonnes of stone were reportedly used to make the mile long structure which is 13 m wide at the top and 65 m at the base. In total it cost £1.5 million to build which is roughly equivalent of over £87 million today.
- It was needed for protection of the harbour and lower lying areas of Plymouth Sound from Southernly gales [40].
- A study into the potential volume of water that might be carried by a wave onto the land during a storm has been assessed to illustrate the effectiveness of Plymouth Breakwater compared with it removed. The Breakwater reduces the wave height and therefore reduced the overtopping along the Plymouth coast by 15-30% during a 1 in 20-year event and a 10-50% during a 1 in 200-year event (figure 23). It is likely that the benefit is provides more than compensates for the maintenance and upkeep costs.

Relevance to Mevagissey

- Study of Plymouth breakwater shows the effectiveness of the breakwater and the potential it has to reduce wave and the likelihood of overtopping. This illustrates the potential reduction in coastal flood risk an outer breakwater might afford Mevagissey and the force reduction on the pier walls. By reducing the overall energy level leading to smaller waves reaching the pier walls, the outer piers might receive less damage and need less repair over time.
- While a smaller shorter break water being appropriate at Mevagissey the one-off cost of Plymouth breakwater was expensive and may be considered prohibitive. However, an effective economic model over a significant period of time would capture the potential benefits.

Modelled wave height (m) for a given storm return period with and without Plymouth Breakwater



Source: Understanding Coastal Floods in Plymouth. Environment Agency, 2018 [39]

Case study 5: Pentewan

- In 2017 Pentewan Valley Parish Council and local MP approached Cornwall Council and the Environment Agency for advice on concerns they have over the deteriorating old harbour wall arm and longer-term flood and coastal erosion risk to the village and the Holiday Park. An assessment was funded and concluded that the most economically favourable option is to construct set back dunes in front of the existing lock gates using existing and imported sand.

- A setback dune with a rock core will reduce the overtopping volume entering the basin which is the objective of this scheme. It also makes use of the offered contribution of granite blocks. The proposed structure has a design working life of 50 years and provide at least a 1 in 40 year standard of protection in the present day.

- Dune with a rock core is not considered prohibitively expensive, unlike other options ruled out at the long list stage. The solution was flexible / adaptable and did not restrict the future aspirations of some of the local community to reopen the harbour in the future. It is also aesthetically more in keeping with the local environment.

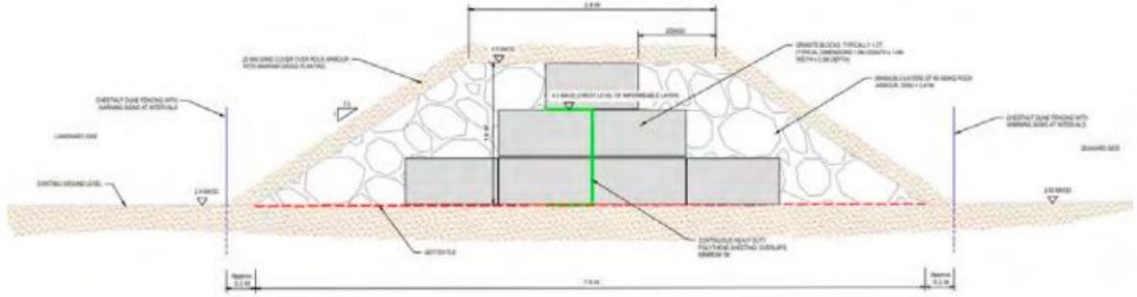
Costs

- The cost of the scheme is dependent upon whether an existing stockpile of granite blocks owned by Pentewan Sands Ltd could be made available as a contribution toward the scheme. Without the rock contribution the cost of the scheme is around £300k. With the contribution this is reduced to around £150k, making it more likely that the scheme can be fully funded through Defra flood defence grant or, at least, the need for additional funding would be minimised.

Relevance to Mevagissey

- A recent local scheme close to Mevagissey seeking to protect homes, coast and heritage buildings and structures

Design drawings of the scheme



Source: https://www.pentewanvillage.co.uk/wp-content/uploads/2020/11/pentewan-flood-defence-update-nov-2020.pdf

Case study 6: Coverack

- In 2021 a consultant was appointed by Cornwall Council to review the Coverack shoreline that in recent years had been subject to a number of flash floods including a significant one in 2017 following a period of intense rainfall which caused major damage in the village including the road and Coverack's existing sea defences.
- The review determined the Coverack shoreline was "at risk of substantial erosion" from the sea and flash floods, with the main access road into the village, the B3294, among the assets that could be affected.
- Consequently, Cornwall Council proposed the development of a new 87m long coastal sea defence wall, comprising a 56m sea wall on top of a rock revetment – a sloping structure built on shorelines, along the base of cliffs or in front of sea walls to absorb and dissipate the energy of waves – in the south, and a 31m rock armour revetment slope in the north.

Costs

- Construction costs for this project were not available however it was reported that the project would deliver around £8million in benefits through reducing the risk of coastal erosion to three residential properties and avoiding the cost of disruption associated with the main highway and utilities.

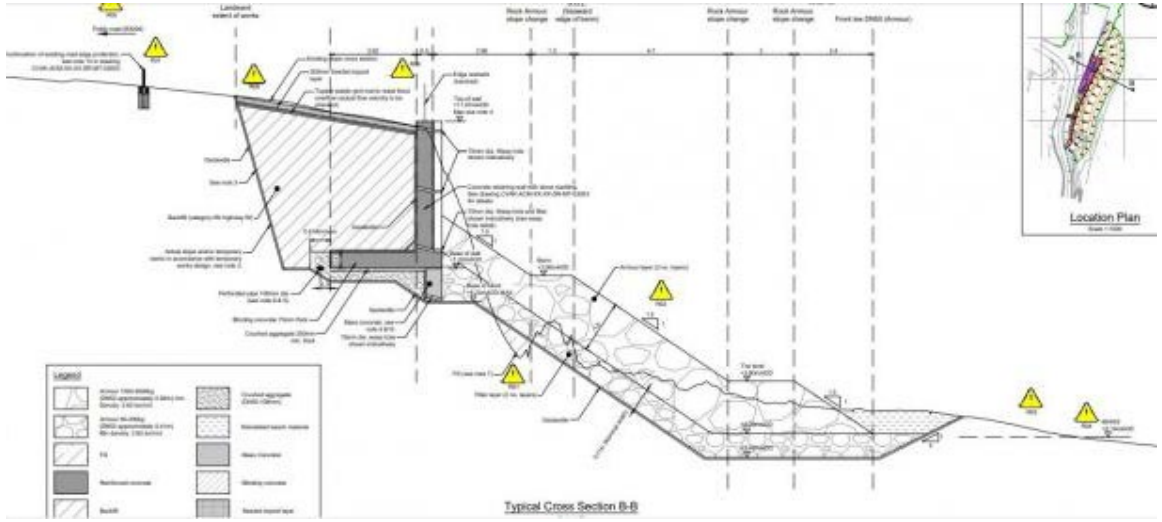
Timeframe

- The construction timeframe for this project was six to nine months and undertaken in two stages:
- Stage 1 – construction of the south frontage to protect the B3294; and
- Stage 2 – construction of the northern frontage.

Relevance to Mevagissey

- Both sites are vulnerable to flooding and are currently protected by sea walls that in recent years have not been enough to prevent damage to the village and businesses they set out to protect.
- Similar geography and similar layout to Mevagissey.
- Similar in project structure – response to concern over flooding.

Design drawing of the scheme



Source: https://www.pentewanvillage.co.uk/wp-content/uploads/2020/11/pentewan-flood-defence-update-nov-2020.pdf

Case study 7: Newlyn eco block reef pilot

- After modelling carried out in 2019 it was decided that upgrading the existing breakwater would be the most cost-effective option to alleviate this risk of coastal flooding and erosion.
- The project is based on funding from Flood Defence Grant in Aid (FDGiA) and is also part-funded by EU Interreg under the SARCC (Sustainable and Resilient Coastal Cities) project to look at nature-based solutions for environmental improvement and flood and erosion risk management. Also funded through Environment Agency's national strategy for Flood and Coastal Erosion Risk Management (FCERM)

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- Scheme includes low-carbon concrete units/blocks designed as a habitat for marine life and coastal armour. The focus is on the biodiversity impact and not just on their ability to act as a coastal defence. These have been placed along the existing breakwater. Over 18 months these have proven successful in improving biodiversity including seagrass.

Costs and timeframe

- The work is part-funded by EU Interreg under the SARCC (Sustainable and Resilient Coastal Cities) project.
- Winter 2022: installation of eco-blocks around the existing rock armour breakwater at the mouth of Newlyn Coombe River, expected to take 10 weeks.
- Post-construction: ongoing monitoring of project.

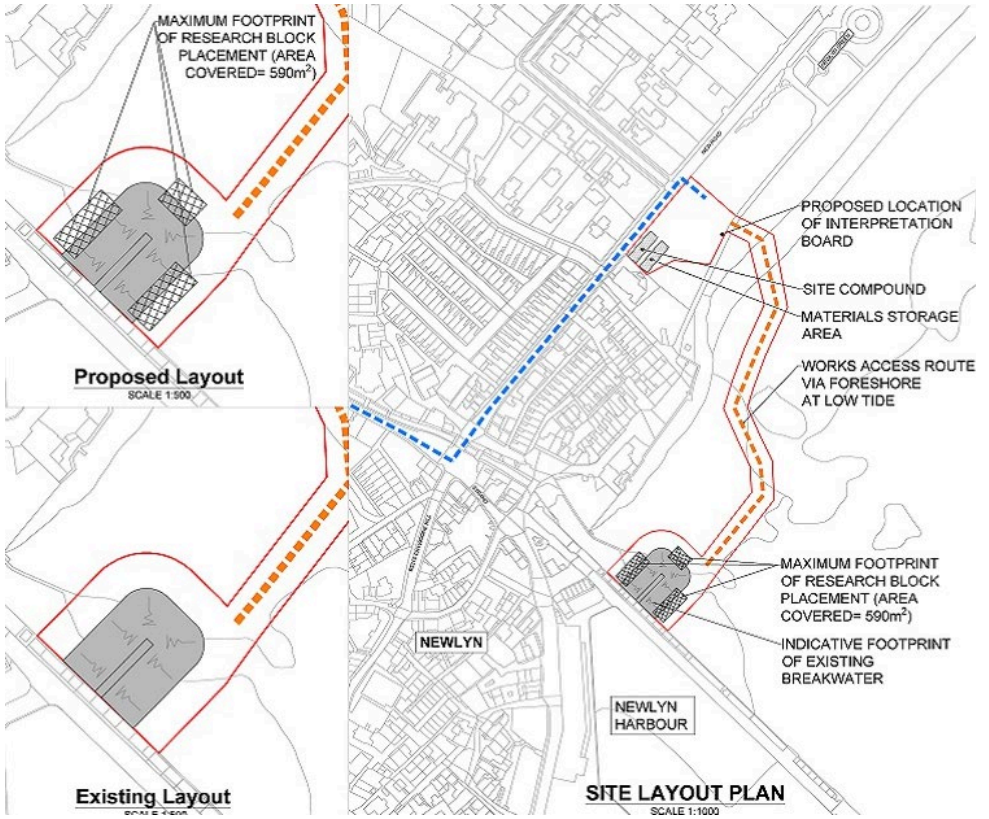
A small, trial eco-block, 9 months after being deployed

Source of both images: https://www.gov.uk/government/publications/newlyn-coastal-research-and-development-project/newlyn-coastal-research-and-development-project

Relevance to Mevagissey

- Newlyn and Mevagissey have a similar profile as both areas have a very restricted land-based area meaning that any defences need to be deployed at sea. There is an option to use and/or include an eco-reef at Mevagissey which has the potential to increase biodiversity and disperse the energy of the waves before they hit the piers.
- May be possible to apply for similar funding from Flood Risk Defence Grant in Aid managed by the EA although the EU Interreg project – the SARCC project looking into nature-based solutions to coastal defence will not be available.

Zones for proposed eco-block installation around Newlyn breakwater



Case study 8: Nature based solutions - Seagrass and kelp beds

The use of nature-based solutions for coastal defence is becoming an increasingly popular way of flood and erosion damage prevention.

Seagrass and kelp

- The use of seagrass and kelp is one prominent example of a nature-based solution that helps slow wave energy and wave height above them to reduce risk of coastal flooding and erosion.
- Increasing research into seagrass and kelp has found
- Work by Narayan *et al* (2016) sought a meta-analysis to determine the effectiveness, costs and coastal protection benefits of different natural and nature-based defences including seagrass and kelp beds.
- The analysis took account of 96 studies on natural habitats that resulted in a significant reduction in wave height as water passes through dense vegetation.
- The meta-analysis showed that there was a 36% (25-45%) reduction in wave height in coastal areas with seagrass and kelp habitats.
- In addition, the study suggests seagrass and kelp beds include multiple other benefits such as being relatively low cost, low maintenance, help increase in biodiversity, blue carbon/carbon sequestering, nutrients cycling/water purification, tourism, education and research [52].
- Morris et al *(2018)* investigated the efficacy of eco-engineering solutions for nature-based coastal defences including the efficacy of seagrass and kelp beds, highlighting specifically some of the disadvantages the use of seagrass and kelp beds have as an optional coastal defence.
- One disadvantage is that as of 2018 there were no examples in the UK where the effectiveness of seagrass or kelp beds had been used as part of a coastal defence.
- Effects potentially negligible in storm events with elevated water levels due to high tides and storm surges [53].

Relevance to Mevagissey

- Literature sources suggest seagrass and kelp beds help slow and diminish waves, offering some protection to coastal areas from flooding. - However – the extent to which this method is effective is limited during storm surges which is also when Mevagissey is most at risk.
- Offers potential to improve marine biodiversity in the area as well as a additional protection measure against flooding.
- Potentially low cost.

Key considerations for Mevagissey

- Looe Harbour project provides a clear indication that the wider value of coastal communities is now important to coastal and flood resilience policy. The case study also sets out a pathway for many of the same actions that will need to be followed by Mevagissey.

- There are many projects underway along the south coast and follow as a result of clear evidenced technical studies and business cases made for funding.

- The findings from the case studies also show there are different types of coastal defence and may represent options to be considered or included at Mevagissey harbour including a breakwater, a tidal barrier, rock armour and Eco reef.

- Of these options, rock armour in front of the existing North and South outer piers may help in the short term and reduce the damage and cost of maintenance required to maintain the pier. This might be able to also address the likelihood of overtopping of the piers. A study is required to examine the technical feasibility of options has been proposed and is underway – see next steps section. It is recommended that wider benefits such as including areas of eco-reef are considered in any design.

Funding

Overview of section

This section provides an overview of some of the main relevant sources of funding that have been available and relevant to any project coming forward.

Flood and Coastal Erosion Risk Management Grant in Aid (Environment Agency)

- The Flood and Coastal Erosion Risk Management Grant in Aid, or "FCERM GiA", is the funding from central government for managing flood risk in England. The grant scheme is managed by the Environment Agency on behalf of DEFRA. The amount of FCERM GiA available for a particular scheme is based on a formula that factors in the number of properties protected, the estimated value of damages being prevented and the other benefits a particular project would deliver including environmental improvements.
- Each year, all the flood risk management authorities across England are required to draw up plans for the flood alleviation works that they believe are needed. These applications, known as "Medium Term Plans", cover a six-year period. These are submitted to the Environment Agency, which uses the information to draw up a prioritised list of projects to support.
- The current FCERM GiA for England is worth £5.2 billion and aims to better protect circa 336,000 properties. It is likely most of the money has already been indicatively allocated based on the proposals submitted by the flood risk management authorities for the next 6 years, but changes are possible.

Measures

Projects have to report anticipated benefits against the following outcome measures (OM):

- OM1 a, b, and c: damage to infrastructure and psychological impact of flooding (the latter is hard to assess, and it is usually acceptable to add a 20% uplift per property)
- OM2 a and b: properties that are benefitting from flood defence measures now and properties that will benefit in the next 30 years (usually acceptable to add a 20% uplift to OM2a to calculate OM2b). To claim a benefit for a property, projects need to move a property from a higher-level to a lower-level risk category (there are 4 categories in total). As a rough indication, the EA uses a benchmark of approximately £15,000 of funding per property benefitting from the scheme. It is not allowed to count flats above shops, properties have to flood on the ground floor! There used to be a different weighting depending on the type of property benefitting (much higher weighting for residential than for commercial properties) but this is less clear in the new funding guidelines. To be clarified over time.
- OM3: properties protected from coastal erosion. It is worth noting it is not possible to double count properties which are benefitting from a reduction in risk of both flooding and coastal erosion. The EA values much more projects which tackle risks of flooding than risks of coastal erosion (50p to the pound vs. 5p to the pound). For these reasons, an ideal project is one that predominantly supports properties at risk of flooding, as well as others at risk of coastal erosion a bit further way from the core project area.
- OM4: additional environmental benefits

An FCERM project may be:

- a scheme to reduce flood or coastal erosion risk
- a study to investigate options for a scheme
- a study leading to a strategy or management plan
- a study to investigate the environmental impacts of works
- work to prepare a strategy

Cornwall Council is the Lead Local Flood Authority for Cornwall and as such, is responsible for developing a Local Flood Risk Management Strategy, reviewed every 6 years (last time was in 2020), and for submitting a Medium-Term Plan. The last was submitted in 2020 and covers the 2021-2027 period. The Mid-Term plan is reviewed every year and during the review process, projects can be put on hold e.g. if they fall short of match-funding, and others can be added.

The business case must be developed in three stages:

- Stage 1: strategic outcome case: this authorises an investigation to work out the best option and commercial strategy
- Stage 2: outline business case : this shows results of the investigation and seeks authorization to complete the detailed design and tender prices. The partnership funding calculator should be updated at this stage.
- Stage 3: the full business case: this asks for authorization for the full scheme value based on the detailed design and tendered prices.

Relevance to Mevagissey

- This is the main fund available at this time for the scale and nature of works required and while there is no immediate call there is time for Mevagissey to prepare to bid in the next review.
- There is no money available through this to help develop businesses cases (although might be undertaken at risk and reimbursed when successful).
- Applications would be made by Cornwall Council to the EA.
- A key principle and consideration relates to partnership funding: projects which secure contributions from other sources are likely to be favourable and might be more likely to be successful in a GiA bid.

Flood and coastal resilience innovation fund

- Between 2021 and 2027, the environment agency allocate the flood and coastal resilience innovation fund to:
  - 25 local areas to demonstrate how innovation can improve resilience to flooding and coastal erosion;
  - £36 million to the coastal transition accelerator programme in East Riding of Yorkshire and it might expand to other locations in the future;
  - The adaption pathways programme for climate adaptation in the Thames and Humber estuaries, the Severn Valley and Yorkshire.

Flood and coastal resilience innovation programme

- A local area might be a county, city, town or village. On average each area will receive £6 million
- Programmes need to demonstrate practical innovative actions to improve resilience. These might be nature-based solutions, sustainable drainage systems, approaches for increasing the resilience of existing properties and local businesses, building upon community and voluntary sector capacity to respond and recover.
- The programme aims to improve evidence on the costs and benefits of the innovative resilience actions and demonstrate how different actions work together across geographical areas.
- The 25 areas have been allocated however there may be a new call in the future. As an example, Cornwall Council have secured £6M through the FCRI programme for a project called 'Making Space for Sand' looking at 40 different coastal communities around Cornwall.

Five principles of the programme:

- Principle 1: achieve practical changes which increase resilience within the project area by reducing the likelihood or consequences of flooding or coastal erosion
- Principle 2: provide public benefits
  - Principle 3: be consistent with existing flood and coastal erosion plans, for example: Local flood risk management strategies
  - Flood risk management plans
  - Catchment flood management plans
  - Shoreline management plans
- Principle 4: demonstrate added value- for example they must:
  - Go beyond other local resilience work programmes and other funding mechanisms
  - Work with actions funded by other routes
- Principle 5: demonstrate innovation

Relevance to Mevagissey

- While it appears as if this fund may have been allocated any successor would be a useful source of funding for development of wholistic climate change and flood resilience plan for Mevagissey and business case for capital funding (FCERM GiA). Consultations with the EA (see next section) suggest similar funding may be available.

Maritime and Fisheries Fund (Marine Management Organisation)

- Launched in anticipation of Brexit, the Maritime and Fisheries Fund (MMF) is administered by the MMO and is intended to "provide support for sustainable development within the fishing and aquaculture sectors and conservation of the marine environment, alongside growth and jobs in coastal and marine related sectors".

- Projects to be considered under the MFF should have project costs comprised between €100,000 and €2 million (see applicable exchange rates), and applicants cannot be awarded more than €1 million in any calendar year during the scheme.

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- SMEs are eligible to apply and one of the funding priorities include "support for improvements to shore-based facilities".

- Under the "support for improvements to shore-based facilities" strand, eligible projects might include "investments that contribute to environmental protection". Funding rates vary from 50% to 100% depending on the type of applicant and type of project.

Application process:

- The first stage is to submit an expression of interest. A template is available on the MMO website . If feedback is positive, a full application can be submitted, however an expression of interest response is only an indication of potential eligibility and not a guarantee of funding.

- The funding application needs to be accompanied by:
  A business case if the project costs more than £24,999.99. A template is available on the MMO website.
  Financial information: 3 years of either audited or unaudited accounts.
  Quotes for costs to be incurred
  Company and VAT registration numbers
  Organisation's headcount numbers

Relevance to Mevagissey

- May be relevant for elements of any project coming forward – especially that may look to include benefits beyond flood and climate change adaptation.

Consultations

Overview of section

This section provides a summary of consultations undertaken with:

- Cornwall Council
- University of Plymouth and Exeter
- Environment Agency

Key considerations for Mevagissey and an outline business case complete the section.

Paul Minshull, Senior Policy Officer, Cornwall Council (June 2022)

Responsibilities

- Cornwall Council is the Lead Local Flood Authority for Cornwall and as such, is responsible for developing a Local Flood Risk Management Strategy, reviewed every 6 years (last time was in 2020).
- The responsibility of managing flood risks is shared between different organisations depending on the source of the flooding (See https://www.cornwall.gov.uk/media/peifd5yq/fcerm-annual-report-2020.pdf):
  - From main rivers: the Environment Agency
  - From the sea: the Environment Agency
  - From statutory reservoirs: the Environment Agency
  - From surface water runoff and groundwater flooding: Cornwall Council
  - From highway drainage (except for the A30 and A38 trunk roads): Cornwall Council as Highway Authority
  - From highway drainage for the A30 and A38 trunk roads: Highways England
  - From public sewers: South West Water
- Cornwall Council has also statutory responsibilities for flood recovery and for the management of coastal erosion.
- Mevagissey Harbour is at a triple risk of fluvial, tidal and surface water flooding and is experiencing issues similar to Looe.

Funding landscape

- Cornwall Council is responsible for bidding for flood defence scheme funding through DEFRA's Capital investment programme (the Medium-Term Plan or MTP). Funding provided by Central Government through the MTP process is known as Flood Risk Defence Grant in Aid.
- In 2020, Cornwall Council submitted its proposal for the 2021-2022 to 2026-2027 6-year MTP plan. This provides an indication of the projects to be funded and it helps the Environment Agency (managing the scheme on behalf of DEFRA) to allocate an envelope. Nothing is set in stone, the plan is reviewed every year, projects can be put on hold and others can be added. Project holders can't apply to the EA directly. They need to apply via Cornwall Council, acting as grant facilitator.
- Cornwall Council had offered to apply for a Flood Risk Defence Grant in Aid on behalf of Mevagissey Harbour to refurbish the North Pier (6 years ago). The application was not progressed and thought to be as a result of MHTs difficulty raising funds for the outline business case.

PM provided a variety of information about funding (reproduced elsewhere) and also noted:

- The EA would anticipate to see private contribution from the harbour. A levy exists and is managed by Cornwall Council, but it is used towards projects in harbours that are publicly owned, to either match-fund them or support them when they can't go ahead through the grant in aid scheme (because cost/benefit ratio isn't favourable under current guidelines for example).
- While it may be more difficult for the Council to grant facilitate a project any applicant need illustrate financial shortfall which would need to be covered.
- PM noted discussions regarding a large scale project in Mevagissey (looking at beavers introduction in upper catchment area, improvement to Chapel Square culvert, and other wider schemes looking holistically to address issues of coastal, surface water and fluvial flooding). PN noted smaller targeted projects might equally be more successful given a lower level of risk. PN suggested that an application for repair / maintenance might be more realistically considered in short term for similar reasons compared with an application for large scale works.
- PM noted various nature-based solutions that were being explored (seagrass, eco-blocks) and was not aware of any projects including renewables with sea defences. MMO funding for support to fishing communities might be helpful for a sea defence project.
- An update to the SMP was expected in Autumn 2022 which might provide guidance / policy on Hold the line in different areas.
- Mevagissey and Looe share similar issues and the Looe project has been successful securing funding for business cases and estimates a significant total project cost. Paul indicated that an outline business case for coastal defence project would be in the region of £25k.

Justin Ridgewell Coastal Advisor for Cornwall & the Isles of Scilly. SMP17 Lead & CISCAG Chair. Partnership and Strategic Overview Team (West) Devon, Cornwall and the Isles of Scilly. Environment Agency (26th July 2022)

- Flood and Coastal Erosion Risk Management Grant in Aid: To apply for the flood and coastal erosion risk management grant (main capital grant available) there needs to be a strategic outline case prepared (follow five case methodology) with a case for change that identifies four or five feasible options, along with a preferred option (see Funding section). SOBC to include likely cost averages and robust idea of the benefits together with an idea of any partnership funding available – it helps if local businesses can contribute to funding.

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- The overall timescale would envisage a strategic outline business case (SOBC) being completed first. The Council would be working at risk if it were to fund/ develop business cases and costs might have to be recovered when funding successful. The capital programme is refreshed on a 6-year basis from 2021 to 2027. It has been through its first refresh and there are no opportunities this year. Subject to bid being available, the earliest bidding to draw down funds would be '24-'25. The timeline to submit a proposal to the Environment Agency is likely to be based around a refresh in early spring 2024 with a deadline c.June 2024, so there is a reasonable window for this project to meet this deadline.

- Funding is not necessarily available for the development of the outline business case and the funding available for Looe from Cornwall Council. A full business case is needed afterwards in order to get to the project review stage.

- The grant calculator requires information to be split out and meet various gateways. The formula typically values impacts on residential properties more. It uses a different outcome measure than commercial properties. It is up to 40p for every residential dwelling protected vs. 6p in £1 for commercial. There is a difficulty here that critical infrastructure, such as sewerage, roads also they sit within commercial property. It is noted that Looe included valuation of a wider range of benefits / avoided costs.

- Previous work to examine a case for action (see work in ref. 6) included modelling of extreme water flood levels and was based on a complex horizontal model to estimate damage and there are potential limitations to that approach that could be refined in any business case. JR provided a list of strategic policies that should be considered in any business (see next section on issues and opportunities).

- A project proposal and business case would need to be submitted via Cornwall Council. For example, at Pentewan Sands, It was agreed that Cornwall Council, through the Environment Agency, would commission an appraisal of options by civil engineering consultants. The scheme had estimated costs of up to £300K, and the required steps have been approved. The project was interesting (see case studies section) as included some value engineered solutions with use of available local materials and a focus on protection of the harbour / low lying buildings. Works based around improving the "core stability" of a dune with rock. Another example is the project at Coverack where emergency works have been undertaken due to damage from fluvial flooding. The project is drawing down grant aid with a Cornwall Council submitted business case.

- There may be an opportunity to look at the outer piers and how we can develop a plan to make them more resilient and generally maintaining the harbour structures as route to accessing funding. This would include looking at significant fluvial flood risk to create a comprehensive argument / case considering wider arguments such as the mental health and heritage value. There are also pots available for innovative approaches, such as the eco blocks at Newlyn. There are no indications in terms of budget size, but it needs to show value for money.

- Community adaptation funding may be available which may help develop a business case and wider strategic plan for Mevagissey. This would provide an opportunity for a comprehensive strategy considering significant fluvial flood risk. Tom Fletcher, strategic projects at EA involved with Looe is talking with community and leading from a comms and engagement. The idea would be to create a resilience plan for Mevagissey setting out all repair and renewal and a potential delivery framework. This would building a more comprehensive argument and would include aspects such as supporting mental health and heritage and funding options. This can also make point for moving critical infrastructure (such as electrical points) as well as how the community might adapt.

- JR would organise a meeting to review scope for funding for a resilience plan and funding for an SOBC.

Universities of Plymouth and Exeter - John Miles and Alex Whately (July 2022)

- The meeting initial reviewed the scope of a project that had received funding relating to Mevagissey. Plymouth Uni Student to undertake work to look at civil and coastal engineering study – look at wave load, and scope feasible improvements to piers and potential benefit of breakwater.
- Start work on this project in September (2022) and present a final report in May next year (2023).
- Will look at habitat / biodiversity potential although typically not useful
- solutions for immediate priority (mitigating high wave / storm related flooding)

Some notes in relation to potential to develop renewables as part of any development was discussed:

- Wave energy: the wave climate at Mevagissey probably gives you low waves for most of the year, with sporadic large, steep seas in easterlies. Expected to be of limited usefulness in terms of consistent supply and will give a very high cost of energy. A caisson based Oscillating Water Column with a Wells turbine on top is an options but potentially noisy.
- Lagoon power – interesting idea however the concern is that area of water behind a breakwater is relatively small and might affect port access.
- Wind reasonable but the area close to the harbour is relatively sheltered from Westerlies and South Westerlies and may affect landscape.
- Solar PV – roof top solar on harbour buildings has been further investigated as possibly the most reliable and accessible and reported in other section.

Key considerations for Mevagissey

- Cornwall Council and the Environment Agency support this study and want to help MHT develop means to apply for funding and to address short term maintenance and longer-term adaptation required.
- Funding for larger capital work is available and would require working with Cornwall Council to make an application to the EA in early 2024. In all cases some contribution from private sector will help with funding bids.
- There will be other funds available for innovative solutions and warrant further consideration in preliminary design of options and business cases.
- The harbour is similar to Looe and faces a triple risk fluvial, surface water and sea flooding which lends itself to a coordinated approach to flood management and resilience planning which may access more immediately available funding and may help cover part of the costs of outline business case.
- The regulators are meeting to discuss potential ways forward for the Harbour (September 2022).

Issues and opportunities

Overview of section

This section considers the evidence provided in the previous slides (especially the key considerations) to establish what the potential key issues and opportunities are for Mevagissey harbour. These will need to be tested and developed in any subsequent outline business case.

This contains the following sub-sections:

- Key issues; and
- Opportunities.

These are used to develop and test options for the harbour and exclude the critical immediate key issue for the harbour which is the availability of funding.

A section describing key strategic policies that are likely to be important to any future strategic case made as part of an outline business case and will be important for project options to align with.

Key issues

Key issue 1: Immediate need to refurbish and maintain harbour walls

- The outer piers (north and south) will benefit from repair to maintain their function as a breakwater and also as they are listed heritage structures. MHT are maintaining the harbour to the best of their capability although funding and costs are a constant issue.
- If the outer walls go into disrepair this will compromise available protection to vessels, harbour and village as well as a liability for upkeep of heritage structures.

Key issue 2: Flooding

- Sea flood defences are currently underperforming and require an upgrade to better perform considering current anticipated flood conditions.

Key issue 3: Climate change effects

- Given a significant proportion of Mevagissey is low lying (c. 3.5m above sea level) it will become even more vulnerable to the effects of Climate Change including a rise in sea levels (The current most likely prediction for future sea level increases at Mevagissey are for a 70mm increase by 2035, 170mm by 2050 and 470mm by 2100. Predictions for 2100 range between optimistic and pessimistic levels of 370mm- 700mm).
- The bay at Mevagissey is exposed to storms and waves that approach from the Southeast resulting in wave heights of 4-5m. If Climate Change also results in an increase in frequency and magnitude of storm events the combined effect (combined with sea level rise) will result in an increased amount of overtopping and flood damage.
- The harbour defences need to be reviewed and adapted to consider future effects of Climate Change.

Key issue 4: Safeguarding businesses vulnerable to the effects of flooding

- There are a large number of businesses and livelihoods including businesses within low lying buildings, those dependent on tourism and harbour that are vulnerable to future flooding. The harbour is the second busiest in Cornwall and lands an excess of £2.5 million gross value of fish per annum (2019).
- For a range of reasons, it is not reasonable to expect the working community will be able to recover from future events or move elsewhere.

Key issue 5: Designated features and landscape

- There are several designated features that will need to be considered in any future options including two priority habitats (maritime cliffs and slopes, and intertidal mudflats) Cornwall AONB. Mevagissey harbour is within 2km of a SSSI, a SAC and a SPA. Much of the village is within a conservation area and of landscape value.

Opportunities

Opportunity 1: Biodiversity

- There is an opportunity to enhance the local marine biodiversity in any future work (perhaps through the use of eco block reefs or seagrass and kelp habitats).
- Funding is also available to support investment that contributes to environmental protection.
- Biodiversity and nature-based solutions may have knock on benefits in terms of fish stocks and or recreational opportunities.

Opportunity 2: Social and economic activity

- Projects could include features that support additional fishing and associated activities perhaps within other marine leisure and tourism.
- Projects may introduce employment and other business opportunities.
- Significant proposals such as a harbour gate which might change the way the harbour can be used might help encourage wider community activities or otherwise improve wellbeing.

Opportunity 3: Wider environmental opportunities

- Projects may support decarbonisation of fishing fleet or other marine activities or potentially support renewable energy.
- Projects may include improvements that address pollution (e.g. by upgrade of sewage treatment) or other environmental issues.

Opportunity 4: Village flood resilience

- A wider flood resilience programme that looks to protect the town from fluvial as well as tidal flooding, through innovative methods.
- This might open the programme up to different funding streams, such as the Flood and coastal resilience innovation fund by the Environment Agency.

Strategic policies

This sub-section provides details of the likely strategic policies that the Mevagissey projects will need to consider and align with. The list is not exhaustive and based on the list provided by the Environment Agency:

- National Flood and Coastal Erosion Risk Management Strategy for England (2022)
- Maritime 2050: navigating the future (2019)
- South West Inshore and South West Offshore Marine Plan (June 2021)
- *Gyllyn Warbarth, Together We Can*: The Cornwall Plan (2020 to 2050)
- Cornwall Economic Growth Service Plan (2018-2022)
- Cornwall and Isles of Scilly Environmental Growth Strategy (2020-2065 | Natural foundations for a green recovery)
- Shoreline Management Plan Review for area PDZ4 / MA08
- SMP1 - Local Policy statements including Planning for Coastal Change (Cornwall Council - various)
- Mevagissey Parish Neighbourhood Development Plan (2018)

Options

Overview of section

This section summarises *some* different flood resilience options* for Mevagissey harbour and illustrates broadly where there is a high-level alignment with key issues, opportunities identified. Developing a Mevagissey-wide flood resilience plan is the critical next step.

* This is an initial long list of projects and additional elements to be considered further in any subsequent strategic outline business case. An initial technical review of project options considering future requirements is to be developed by Plymouth University and available next year.

Indicative alignment of potential options with issues and opportunities

Examples of options (long list to be developed and in reality some may be used in combination with others)	Description	Likely costs (H / M /L)	Key issues				Opportunities					Comment
			1. Immediate maintenance & protect heritage	2. Current flood risk	3. Climate change	4. Safeguard vulnerable jobs	5. Safeguard ecology and landscape	1. Biodiversity enhancement	2. Socio-economic benefit	3. Environmental benefits	4. Wider flood risk	
Rock armour	The addition of large interlocked boulders to front of piers could control erosion to Mevagissey harbour by dissipating wave energy. May be limited in terms of over topping.	M	✓	✓	✓	✓		✓				To be informed by coastal civil and marine study by PU. Wave topping and heritage
Breakwater	Offshore breakwater of rock or precast concrete units and work to primarily reduce wave energy and wave heights and encourage beach formation [50]. Scope to include other elements and wider benefits.	H	✓	✓	✓	✓						Outer piers constructed +130yr ago. Consider similar period of benefit.
Eco reef	Newlyn case study used blocks made with granite by-products from a local quarry, on and around the existing breakwater. Designed to allow marine organisms to colonise and develop living structures. May be limited in terms of protection [51]	L-H					✓	✓	✓	✓		Work in combination with others.
Increasing height of harbour walls [51]	Height of harbour to exceed the height of the maximum tidal range and allow for extreme wave heights. Harbour walls need to be effective against predicted levels of sea rise.	L-M	✓	✓	✓	✓						May need strengthening. Heritage / landscape issue?
North pier repair [51]	In cost effective material / method.	L-M	✓			✓						Short term.
North pier concrete apron [51]	In cost effective material / method.	L-M	✓			✓						Short term.
Develop Mevagissey-wide flood resilience plan	Plan to set out how all flooding (fluvial, surface water and sea) and climate change resilience can be tackled going forward. Funding to include OBC of future actions.	L	✓	✓	✓	✓	✓	✓	✓	✓	✓	Short actions and long-term plan.
Seagrass/kelp bed	Meta-analysis of studies shown that seagrass beds can help with reduction in wave height in coastal areas with seagrass and kelp habitats [52].	L-M		✓			✓	✓	✓	✓		Reduces wave height? Energy yes.
Renewable energy generation	Devices either housed on or enabled by flood protection measures (e.g. new breakwater). Consider tidal stream / lagoon, wave energy, hub for floating offshore wind or other.	M-H			✓					✓		Climate change mitigation

Next steps

Overview of section

This section provides a suggested action plan including known actions underway and describes short, medium to long term actions.

Immediate and ongoing

	Action	Objective / outcome(s)	Date	Responsible	Resources	Comment / status
1	*Preliminary studies and way-finding*					
1 A	Complete high level feasibility study	Set out long list of options and potential way forward to address needs. Sets up OBC	Q3 2022	KCL	£1,750 ex VAT	To be completed w/c 22/08/22
1 B	Meeting to discuss potential funding for OBC via a Resilience Plan for Mevagissey	Discuss and confirm funding for OBC available via innovative approach: preparing resilience plan for Mevagissey. Confirm way forward / action plan.	Q3 2022	JR (EA), TF (EA), PM (CC)	Meeting time only	Date awaited
1 C	Exeter / Plymouth University Study	Ongoing work to examine civil and marine engineering options to upgrade. To be brought into OBC in next phase.	Q3/Q4 2022	Exeter & Plymouth Uni	Plymouth Uni Student and Mentoring	To look at technical issues and options.

Short term

The meeting (1B) will hopefully outline a potential means to secure funding for the next stage of more 'detailed' appraisal (see 2 below). Note that OBC aims to confirm high level case to secure funding (3 below) for design, planning, details design and delivery (see 4, overleaf). Resilience Plan may also indicate other actions and funding required.

	Action	Objective / outcome(s)	Date	Responsible	Resources	Comment / status
2	*Resilience Plan and OBC*					
2A	Secure funding for Resilience Plan and OBC	Following outcome of meeting with EA and CC submit details / application for this stage as directed. Develop brief	Q4 2022	MHT / TBC	Use high level study	
2B	Stakeholders and steering group	Confirm, with CC / EA advice and appoint steering group for study.	Q4 2022	MHT / TBC	MHT time + partner	
2C	Brief and procurement for support	Finalise brief with CC and EA and if required procure consultant to support.	Q4 2022	MHT / TBC	MHT time + partner	EA/CC have clear brief for OBC – focus on securing funding.
2D	Develop Resilience Plan and OBC	Steering group + consultant to develop plan with stakeholders. Programme to be developed by consultant and agreed and informed specific studies as required. Output: Plan and studies with OBC as appendix (? TBC) Suggest pre-application if appropriate.	Q4 2022 to Q4 2023	TBC	Suggested c.£25k for OBC with potential additional preliminary studies – e.g structural survey and cost planning. Scope for efficiencies.	Work may involve more engagement to help develop Resilience Plan. Pre-app consider c£8-15k for plans / planner.
3	*FCERM GiA Funding*					
3A	Refresh of FCERM GiA (EA) fund and call for proposals	Suggested timeframe (JR – EA)	Q1 2024	EA		
3B	Submitting proposal for FCERM GiA EA funding	In addition to OBC relevant application submission. Note that OBC developed may indicate wider benefits and will need to be made clear when using funding	Q1 / Q2 2024	CC / MHT + partners	CC responsible for submission of OBC to EA	Key fund of scale to contribute to detailed case, design, delivery, etc. Will need other sources.
3C	Likely deadline for receipt of proposals	Suggested timeframe (JR – EA)	June 2024	CC to submit to EA		Include CC / EA comment as possible to ensure robust case

Medium to long term

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The following provides an illustrative timescale of flood enhancement project (not wider flood resilience works as may be defined by Reliance Plan) following submission of funding bid / OBC. Planning and consents may include determining if Environmental Impact Assessment (EIA) is required for planning submission. EIA can include screening to determine if required and a statutory period for regulators to consider statement produced.

Action	Objective / outcome(s)	Date	Responsible	Resources	Comment
Project management	Confirm steering group, stakeholders, brief and procure team as required for planning and detailed design.	Q3/Q4 2024	Steering group	MHT + Partner time	Advise use of experienced project manager. Commencing work without main funding might be at risk (and can be reimbursed when funding obtained) and/or require additional funding to commence at this time.
Survey and design	Design team develop more detailed design and develop assessments and relevant documents for consent and planning approval. May include trials and preparing Environmental Statement as part of EIA or Habitat Assessment	2024-2025	Various – planning & design team, stakeholders, steering group	Estimate £50k to £500k	Depends on scale, sophistication and nature of proposals. Grant for Looe understood to include these stages.
Consents and planning approval	As appropriate, harbour revision order (to HA), submissions for Marine Licence (construction/removal /deposits and/or dredging and possible Wildlife Licence) and planning application (above MLWM for new or replacement infrastructure), environmental permitting (flood risk activities), SSSI notification, etc.	2024-2025	As above	Application fees.	To MHT / MMO / EA / CC / NE / HE, etc.
Funding decision		TBC	EA / Defra		
Construction design and contractor procurement	Develop construction designs and select and construction contractor. Enabling / conditions and	2025-2026	Design team / contractor	Estimate £50k to £500k	Depending on delivery model may have detailed design before procurement or Design and Build
Construction	Deliver scheme	2026-2030 2 to 4 years*	Contractor	TBC	Depends on option and enabling required.

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