Technical Note: Climping Costal Frontage

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Project: Climping Costal Defences overview

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1. Background Information

1.1. The Climping frontage is located on the south coast of England and extends between the River Arun in the east and the village of Elmer to the west. This technical note is focussed on the frontage located immediately adjacent to the Climping Street car park, as shown in Figure 1 below.

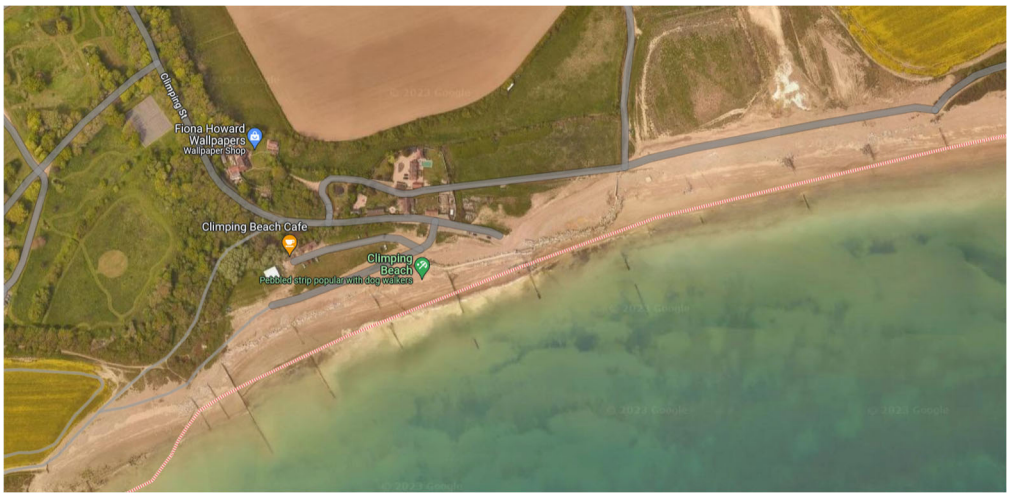

Figure 1 – Location of Climping Frontage (Google aerial imagery 2023)

1.2. During January and February 2020 the south coast of the UK was subjected to a number of notable storm events, the consequence of which was that the coastal defences were breached and the low-lying hinterland was flooded, as shown in Figure 2. These storms comprised the following; Storm Brendan (13th and 14th January 2020), Storm Ciara (8th and 9th February 2020) and Storm Dennis (15th and 16th February 2020).

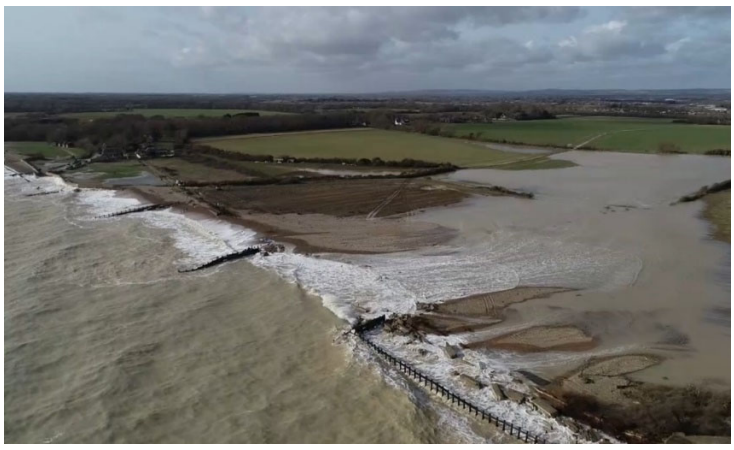

Figure 2 – Breach at Climping frontage in 2020.

1.3. Climping Parish Counsil (CPC) met with the local landowners on 28 September 2023 and have corresponded with the Environment Agency (EA) to discuss the potential options to defend this section of coastline. In advance of the next CPC meeting, which is to be held on Thursday 26th October 2023, CPC has commissioned Herrington Consulting Limited (HCL) to provide a view on the possible solutions outlined previously, from a technical perspective.

1.4. HCL has been involved with reviewing the coastal process along the Climping frontage for over a decade and this technical note draws on the experience and information obtained during this time.

2. Shoreline Management Plan

2.1. The Shoreline Management Plan (SMP), which covers the Climping frontage (policy unit 4d20) Beachy Head to Selsey Bill, is published online and sets out the preferred future policy along the coastline. Since the original SMPs were published, the development of second generation SMP (known as SMP2) has taken place, and the changes in policy options since the SMP2 was adopted by authorities in 2006 is set out below:

2.2. **Climping – policy unit 4d20**[1] – The SMP2 indicates a policy of 'Managed Realignment' and following the work done in the Arun to Pagham Flood and Erosion Risk Management Strategy, a policy of Do Nothing (Withdrawal of Maintenance) is currently being suggested.

2.3. The recommended long-term plan for Littlehampton Harbour to Poole Place is to allow the coastline to realign to a more naturally functioning system, whilst continuing to provide flood defence to the large hinterland floodplain[2]. The SMP2 considers three epochs (Immediate, Medium-term and Longer-term) and for all three, the policy stated is to 'realign the coastline landwards in a proactive manner', with periodic recycling or renourishment of the beach possibly being required to assist in the natural roll back of the shingle beach.

3. Flood and Coastal Erosion Risk Management Strategy

3.1. A reduction in beach volumes along the study frontage overtime has translated to a lowering in beach levels and as a direct consequence, wave energy within the littoral zone has increased. Over the last 10 years, the combined increase in wave energy and the reduction in beach levels has significantly exacerbated the deterioration of the timber groynes, which were all reaching the end of their useful life by around 2010.

3.2. In 2010, the Arun to Pagham flood and coastal erosion risk management strategy was first being developed by Atkins, on behalf of the EA, and this strategy outlined recommendations for managing flood and erosion risk along the coastline between the River Arun and Pagham over

[1] Reference: https://se-coastalgroup.org.uk/shoreline-management-plans/beachy-head-to-selsey-bill/
[2] Beachy Head to Selsey Bill Shoreline Management Plan Final Document - 2006

the next 100 years. This strategy was updated in 2015[3] and in the body of the report the following is stated; *"For the section of Climping coastal frontage that is not covered by legal agreements, the cost of major repair or renewal of defences is more than the economic benefits of doing the work. We* [EA] *recommend that Do Minimum maintenance should be undertaken as long as the benefit of ongoing flood risk management work remains greater than the costs. Once it becomes uneconomic to continue investment, or there is a significant breach in the defences requiring costly repairs, the Environment Agency will no longer be justified in further expenditure and will be required to cease maintenance. As with all recommendations, implementation of Do Minimum works at Climping are subject to funding being available.[4]"*

3.3. The EA in separate correspondence, has previously acknowledged that works carried out on the neighbouring frontage to the west of the study frontage does, to some degree, benefit the study frontage as a result of shingle being fed to an updrift location. This increase in beach material allows a consistent flow of material past the study frontage.

3.4. It is understood that in November 2023 the EA are planning to import 1500 tonnes of shingle from Littlehampton harbour (if available) and are proposing to realign the car park bund further north, to reduce loss of shingle. An overlap is to be retained with the Mill Lane bund, to ensure that the lane is not blocked. CPC is in agreement that these works can progress and have actioned this in writing to the EA to formally confirm their position.

4. Community Discussed Options

4.1. The September 2023 CPC meeting with the landowners focussed on two possible options:

- Hard points clarified as rock islands making use of the available concrete blocks.
- More extensive use of shingle and repositioning of the bunds to improve stability.

4.2. The previous discussions with Dr Uwe Dornbusch (EA) and CPC outlined that he was of the opinion that the rock islands would need to be positioned 50m offshore for these structures to be effective. A proposal to place the available concrete blocks onshore, to fall eventually into sea, was not supported by the EA, as Dr. Dornbusch felt they would have limited benefit to the properties. This was on the basis that it would take too long for these to be of any use and their positioning would be uncontrolled.

4.3. Dr. Dornbusch concluded that any proposed islands would require proper design through a landowner appointed consultant and he felt approval could take 2 years based on EA experience.

[3] https://www.gov.uk/government/publications/arun-to-pagham-flood-risk-strategy/the-arun-to-pagham-flood-and-coastal-erosion-risk-management-strategy
[4] River Arun to Pagham Flood and Coastal Erosion Risk Management Strategy, para 1.4.3

4.4. HCL has since been in contact with the EA and Dr. Dornbusch to further discuss the details of the study frontage. The outcome of these discussions forms part of HCLs opinion, which is presented in the later sections of this note.

4.5. In relation to the second bullet point (4.1) above, the minutes from the CPC meeting state that shingle remains the most cost-effective approach as a means of coastal defence at Climping. Discussions were had with Dr. Dornbusch regarding the use of shingle to provide better/more extensive protection, if finances were not constrained. It was agreed that further retreat of the bund in the car park, and also to the north of Mill Lane, could be of value for bund stability. Discussions resulted in the landowners considering the possibility to fund some of the shingle movements in the future.

5. HCL opinion regarding current options

5.1. The following section of this note outlines HCL's thoughts on how best to progress, based on the information previously obtained through the various studies undertaken along this frontage over the past decade, the current national policies in place and the structure of the EA's capital funding programme, which is termed Flood Defence Grant in Aid (FDGIA).

5.2. **Hard Engineering Solutions -** Considering the first of the options discussed by the community, Hard Points (rock islands), HCL are of the opinion that this option would be difficult to deliver for a number of reasons, which are discussed in detail below.

5.2.1. *National Objectives* - Whilst further feasibility work can be commissioned to take a detailed look at the design of any potential rock structures, consideration should be given to the overall national objectives along this frontage. These objectives are defined by both the SMP2 and the Flood and Coastal Erosion Risk Management Strategy, outlined in Sections 2 and 3 above. A deviation away from the preferred policy to realign this frontage in the future is likely to be met with resistance from the EA and Natural England (NE) in the longer term. Even in the event that a suitable 'hold the line' scheme could be designed, it may not obtain the necessary planning permission and consents required to be approved by the EA and NE.

5.2.2. *Capital Funding* –The National Flood and Coastal Erosion Risk Management Strategy for England sets a framework for Flood and Coastal Erosion Risk Management (FCERM), which aims to reflect both national and local priorities. Continued investment in projects is crucial to achieving this and projects are identified for all Authorities through the capital investment programme. An annual refresh of the capital investment programme is undertaken, which invites Authorities to confirm present projects they wish to be considered for capital grant allocation. Following the review, the list of projects that are eligible for a capital grant are determined. The relevant forms (Coast Protection Act – form CPA1 or CPA2 for coastal protection projects) to obtain capital funding are submitted to the Flood

and Coastal Risk Manager in the local area, by the Local Authority (LA), with all relevant supporting information (such as the Business Case or Short Form Business Case).

Capital grant is available to fund a study to investigate a FCERM problem and appraise potential solutions. A typical study will define the problem, identify a range of potential solutions and undertake a technical, environmental and economic appraisal to determine the outline design of an optimum solution that can be developed into a capital scheme. However, the initial assessment must include evidence to show how the Study links to the shoreline management plans (SMPs) and local flood risk management strategy and is consistent with the National Flood and Coastal Erosion Risk Management Strategy for England.

As a hard defence goes against the proposal to manage the retreat of the shoreline (stated in the SMP2), funding is unlikely to be granted. Notwithstanding this, the benefits of the assets being protected must also be shown to outweigh the costs of any proposed works and, on this basis alone, it is also unlikely that the threshold criteria will be met to release any funding. The total cost to construct a rock headland (or similar) of a size required to stabilise the study frontage will be significant (a rough cost estimate £2-10M) and this is likely to outweigh the benefits that such a scheme could protect.

5.2.3. *Private Funding* – Whilst another option could be to privately fund the defence works, the mechanism to deliver these works would need to follow the same process outlined above, engaging with the Local Authority, Environment Agency and Natural England. Planning permission would still be required to permit any construction and, unless there is support from all of these organisations collectively, planning permission could be refused on the basis that the proposed works do not align with the national longer term strategy to manage the retreat of the coastline.

5.2.4. *Technical Considerations* – Assuming that the Local Authority can submit an application on behalf of the landowners and/or match funding is also presented to address the cost/benefit ratio of any proposed scheme, there lies the technicality of placing a structure(s) along this frontage. Based on the local Elmer scheme, which is subject to similar coastal processes and almost identical wave climate, it is likely that a substantial structure comprising either one or two rock structures will be required, along with beach renourishment to hold the shoreline in place.

Based on the information currently available, we would agree with the EA, that such structures would need to be located at least 50m from the shore to provide any significant benefit and as such, would be located in relatively deep water. This depth of water is predicted to increase with climate change, as the sea level rises, and therefore the structure will need to protrude above the current surface of the water by some way.

An initial review of the number of concrete blocks currently available would suggest that there is an insufficient number of blocks to construct such a structure and the crest is likely to be located below the maximum sea level. If the structure is not of the appropriate size, its influence on breaking the wave energy will be minimal and it will not have the desired effect of protecting or stabilising the coastline. In summary, the use of the concrete blocks to form an adequate coastal defence island(s) is currently discounted for these reasons. There is the option to import rock, as was the case at Elmer, however, this may not be economically viable if this is not supported by FDGIA funding.

5.3. **Soft Engineering Solutions –** With respect to the second option discussed by the community, shingle movement, HCL are of the opinion that this option would be the most cost-effective solution for the reasons discussed below;

5.3.1. A constant feed of shingle along the frontage would enable the beach to act more naturally, responding to storm events by rolling or retreating backwards. This is clearly the rationale of the EA in constructing the current protective bunds. Whilst the accumulation of shingle in the short term will offer some additional protection from the sea, it should be recognised that any protection offered by a soft engineered solution such as this, may be limited when the impacts of climate change and sea level rise are taken into consideration. Nevertheless, an increase in the volume of beach material would provide the current landowners some opportunity to protect their assets in the short to medium term. Furthermore, the option to manage the beach material at this location would align with the overall national policy to manage the retreat of the coastline.

5.3.2. *Funding* – Whilst additional capital funding may be something that could be explored with the EA and LA, this would again be subject to a business case which would need to demonstrate that the benefits outweigh the proposed costs. The EA has currently agreed to fund some shingle movements from the Littlehampton harbour area (borrow pit) and with additional funding provided by the landowners, the volume of shingle moved could be increased.

5.3.3. *Technical Considerations* – Increasing the volume of shingle on the frontage could help to dissipate wave energy during a storm event, however, without any control structures in place (e.g. groynes) this material will be readily transported along the coastline over time. The overall net transport of beach material is likely to be dependant on the dominant wave climate and the direction of travel and therefore, regular movements of shingle will be required if material is placed in the active part of the beach. An alternative option, as has been suggested, is to build up a series of bunds to the rear of the active part of the beach. This material will offer some degree of protection to the hinterland during more severe storm events, i.e., when the water level is at its highest and the waves are large. This bunded material is likely to be redistributed during such an event and it is likely that the bund(s)

would need to be reconstructed after each successive storm event. The exact location of the bunded material can be considered in more detail and further analysis and investigative work would be required to be commissioned to determine the likely standard of protection that this type of soft engineering defence could offer.

5.3.4. *Property Level Flood Protection (PTP)* – The presence of the shingle bund will not remove the risk of the bund being eroded, or indeed breached during an extreme storm event,. Therefore, it is recommended that properties are protected via an alternative, independent, means. PTP can be considered as a secondary barrier, either preventing water from reaching properties, or minimising the impact on the buildings, i.e., if water was to reach the properties. Further work can be undertaken to determine the suitability of PTP for each of the properties that could be affected.

6. Concluding Summary

6.1. HCL has been commissioned by CPC to provide some initial advice and thoughts on the options presented at the last CPC meeting with the landowners (held on the 28th September 2023) and in advance of the forthcoming meeting to be held on 26th October 2023.

6.2. HCL has been involved in various projects along this stretch of coastline for over a decade and as such, has gained a sound understanding of the coastal process along the frontage. This previous work comprised detailed analytical reviews, numerical modelling and extensive correspondence with both the EA and local landowners. Using this knowledge, HCL are able to provide CPC with an overview of the likelihood of success for delivering the options discussed during the last CPC meeting, which are summarised in this note.

6.3. Following an initial look, HCL has held two meetings with the EA to gain a better understanding of the EA's position and to consider the technical constraints in delivering both hard and soft engineered solutions.

6.4. Dr. Uwe Dornbusch (EA) is currently in the process of investigating the use of hard structures to form an equilibrium bay, however, the conclusions of this work highlight the constraints and limitations of this approach. Firstly, repurposing the existing available concrete blocks is unlikely to be suitable to create a structure of sufficient size, which is required to reduce the effects of erosion along the study frontage. An alternative would be to use imported rock, which could prove to be prohibitively expensive.

6.5. In any case, the use of hard point structures is unlikely to be considered acceptable to the EA and LA, as the current national policy and objectives are to 'manage the retreat of the frontage', as outlined in both the Beachy Head to Selsey Bill SMP and Arun to Pagham Draft Flood and Erosion Risk Management Strategy. As any proposed structure intended to 'hold the line' would

require planning permission, it is considered unlikely that this would be granted based on the current policy requirements.

6.6. There are also concerns regarding the funding of a hard engineered solution, which could run in to several millions of pounds, and is unlikely to attract capital grant in aid funding due to the limited benefits that a coastal scheme at this location would provide.

6.7. A soft engineered approach is considered to be more suitable, economically viable and acceptable to the EA. Notwithstanding this, this type of protection does come with some limitations and is unlikely to offer long term protection, as the impacts of climate change are realised (e.g., rising sea levels).

6.8. The EA currently moves shingle from the Littlehampton harbour area and has more recently constructed two large shingle bunds. There is a proposal by the EA to move ~1500 tonnes of beach material in November 2023 and this was supported by CPC and the landowners at the last parish meeting. Additional funding provided by the landowners would help to increase the volume of beach material moved, and/or could increase the frequency of these movements. Both of which could help to provide greater protection in the short to medium term and offer a more cost-effective approach, one that is likely to be agreeable to all parties.

6.9. Further analytical work could be undertaken to better understand the level of protection that could be offered by the current bunds and to determine the impact of any proposed realignment or improvement to the bunds. We would therefore recommend that this option is further explored in consultation with the EA and, where necessary, the LA and NE.

6.10. Assuming that the preferred approach is to provide a soft engineered approach, it is also recommended that property level flood protection is considered on an individual property basis. As the requirements for each of the potentially effected properties will differ, the use of PTP should be considered on an individual basis to determine the most suitable options.

6.11. HCL are happy to provide ongoing technical support to CPC and the Landowners and can take the role of technical liaison with the EA and LA as required.