

Appendix 9: Black & Veatch's Technical, Environmental and Financial Assessment of BERA's Proposal

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TECHNICAL NOTE

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From	Black & Veatch	Ref	122165 - TN – 001
Subject	Shoebury Common FDS – BERA Alternative Option Review		

1 The BERA Proposal

The BERA proposal involves raising the existing seawall to allow for sea level rise resulting from climate change until the end of the seawall's residual life (approximately 30 years time). It also requires beach recharge to achieve an enhanced beach level, the installation of approximately 15 beach control structures (timber groynes) and the construction of a crescent shaped rock breakwater that will extend into the foreshore to protect the Shoebury Common frontage from the predominant wave action from the South East, and act as a terminal groyne.

2 Flood Risk

Southend-on-Sea Borough Council's (SBC) preferred option for flood risk management in Shoeburyness is to provide protection against a 1 in 200 year (0.5% AEP) coastal flood event. Table 1 below shows predicted still water levels (with sea level rise (SLR)) over the next 30 years for various flood events and the resulting freeboard based on the proposed level of 5.30m AOD.

Table 1 – Predicted water levels (including 30 years of SLR)

Return Period (Yrs)	2042 (mAOD)	Freeboard (m)
1	3.81	1.49
50	4.52	0.78
100	4.67	0.63
200	4.84	0.46

The 5.30m AOD seawall in the alternative proposal offers a freeboard of approximately 0.46m against the 1 in 200 year surge event still water level (0.5% Annual Exceedance Probability (AEP)). However, this does not account for wave action.

The proposal assumes that the construction of a terminal groyne/ breakwater will reduce the wave climate sufficiently as it approaches the shoreline and that the enhanced beach levels in front of the seawall will protect the seawall from wave overtopping.

3 Technical Review

Raising the seawall

An SBC investigation into the existing frontage has identified that the existing seawall does not have very substantial foundations, with only a limited amount of reinforcement in the face of the concrete (probably only designed to prevent surface cracking). Consequently, it is estimated that (particularly in the east) the existing seawall will not be able to withstand any significant additional loading.

However, it might be possible to raise the existing level the proposed 0.3m (to accommodate for SLR over the residual life of the existing seawall structure) without inducing failure, if the construction process were to be designed to avoid any significant loading from construction traffic, the existing condition of the seawall is improved through maintenance and the enhanced beach levels can be maintained to provide the seawall with additional lateral support.

However, in 30 years time when the seawall reaches the end of its predicted residual life it will have to be replaced and raised further to accommodate additional SLR, and therefore detrimentally impact upon both the landscape views and amenity value of the existing promenade. Whereas SBC's preferred scheme provides 50 years of protection, a future platform for a further 50 years of protection and does not impact on the views or amenity value of the promenade (except during construction).

It should also be noted that the existing level of the seawall along the neighbouring frontage to the east of Shoebury Common (Old Ranges), in front of the Coastguard station is approximately 6mAOD, which is 700mm higher than the BERA proposal.

Beach access

The proposals do not include any details of beach access over the raised seawall. However, it will be necessary to raise or replace the existing access points in line with the latest 'Access for All' guidance, which will include introducing disabled/wheelchair access along the frontage. Therefore for costing purposes B&V has included for 6 no. new beach access steps and disabled/wheelchair ramps.

Beach Recharge

The potential structural failure of the seawall (as detailed above) could be prevented if the beach is maintained at high enough levels to provide the seawall with the necessary lateral support. In order to achieve the levels required beach recharge will have to be undertaken, as well the proposed construction of additional beach control structures, such as timber groynes, to reduce the variation in levels that is currently experienced along the frontage.

For the costing purposes B&V has made a suitable allowance for beach recharge to achieve the enhanced beach levels, although no assessment of future beach management activities has been undertaken.

Timber Groynes

The proposed addition of beach control structures along the frontage will act to reduce the naturally occurring longshore drift of beach material (typically west to east) across the frontage. In that they will slow the movement of beach material, by enabling the beach to align with the prevailing waves. For purposes of pricing B&V has costed the proposed 15 no. timber groynes each 50m in length, and have not optimised the design or number of groynes required.

It should be noted that the installation of 50m groynes along the frontage will significantly increase the width of the beach and encroach upon the internationally designated foreshore (See Environmental Appraisal).

Beach Huts

The installation of timber groynes to the west of the Common will involve the removal, temporary storage, and reinstatement of approximately 10-20 no. beach huts that are located in front of the seawall. However, a previous inspection of the beach huts has identified that they are of variable construction type, age, and condition. It is therefore considered quite likely that a significant proportion of them will be damaged beyond repair during their removal.

Where huts are damaged beyond repair, under existing Defra guidelines on public funding it is very unlikely that replacement beach huts will be provided entirely out of public money, and replacements are only likely to be possible with substantial contributions from the existing owners. As a consequence of both the disruption and potential costs to owners an agreement from all of the 10-20 no. affected beach hut owners would be required before any works could commence. Therefore for costing purposes B&V has estimated the cost of removing, temporarily storing and reinstating the existing 10-20 no. beach huts and have not allowed for any replacements.

Terminal Groyne / Breakwater

Constructing the proposed crescent shaped breakwater at the eastern end of the Shoebury Common Frontage will potentially offer the existing frontage considerable protection from the offshore wave climate as it will act to reduce the size of the incoming waves (particularly from the south east). However, in order to protect the entire Shoebury Common frontage the breakwater would have to extend approximately 300m long and will have a significant footprint in the internationally designated foreshore (see Environmental Appraisal). The proposed curved alignment will also prevent east to west drift at the eastern end of the frontage, effectively increasing the need for recycling activities.

This structure will also act as a terminal groyne and completely interrupt the natural coastal process of longshore drift and capture all beach material that is moving along the shoreline (typically) from west to east (all-be-it reduced movement due to the presence of the groynes). However, over time this material will accumulate on the western side of the terminal groyne and effectively extend the beach offshore behind the breakwater, again encroaching upon the internationally designated foreshore (see Environmental Appraisal).

In addition, due to the construction of this structure and the resulting interruption of the longshore drift the neighbouring beach (Old Ranges) to the east in front of the coastguard station will be starved of new beach material from the west and would have to solely rely on material from the east to maintain its levels. Consequently the beach along the Old Ranges frontage is likely to be more vulnerable to erosional pressures and will slowly erode, eventually placing the seawall at risk of failure through both greater exposure to the wave climate and undermining through continued erosion.

For the purposes of costing B&V has estimated the approximate volume of rock for an indicative terminal groyne / breakwater structure, and has not optimised the design or position of the proposed structure.

Existing Outfalls

The proposal does not account for the existing surface water drainage network that outfalls along this section of the frontage including:

1. The location of the proposed terminal groyne/break water will have to consider the existing pumped surface water outfall that is adjacent to the existing slipway.
2. The design of the enhanced beach will have to consider the various gravity fed surface water drainage outfalls along the frontage.

Due to the lack of detailed information available at this stage, B&V have not estimated the cost of adapting the existing surface water drainage network to function with the BERA proposals.

4 Environmental Appraisal

Landscape

Raising the existing seawall by approximately 0.3m is unlikely to have a significant effect on views across the estuary from the promenade / cycle way, housing on other side of the road etc.

However, installing 15 new groynes and a rock terminal groyne/breakwater is very likely to have an adverse effect on the landscape character and visual amenity of this section of frontage, particularly at low tide, which would need to be assessed in more detail.

Designated nature conservation sites

The foreshore and intertidal areas along this frontage are both internationally designated as Benfleet and Southend Marshes Special Protection Area (SPA); and nationally designated as Benfleet and Southend Marshes Site of Special Scientific Interest (SSSI). Benfleet and Southend Marshes is also a Ramsar wetland (designated under the Ramsar Convention). This area contains an extensive series of saltmarshes, cockle shell banks and mudflats which provide a wide range of feeding and roosting opportunities for internationally important numbers of wintering wildfowl and waders.

The proposed option would therefore need to be subjected to a detailed Habitats Regulations Assessment, undertaken in consultation with Natural England, in order to assess the potential for a likely significant effect on these internationally and nationally designated habitats and species, and to obtain consent for the scheme from Natural England.

The following issues associated with the proposed option are likely to be of particular concern to Natural England:

- Footprint loss of internationally designated intertidal mudflats as a result of installing 15 new groynes plus a rock terminal groyne within the designated site; this loss of footprint would require the provision of replacement habitat within the designated site, or fully functioning compensatory habitat elsewhere;
- Continuing to Hold The Line (HTL) across this frontage will result in coastal squeeze and the loss of internationally designated habitat, this loss would require the provision of replacement habitat within the designated site, or fully functioning compensatory habitat elsewhere. However, this impact will result from any options that HTL along this frontage;
- Potential for the new groynes to reduce the natural supply of sediment to the above internationally and nationally designated sites resulting in erosion of saltmarsh and mudflats, and resulting loss of habitat for wintering wildfowl and waders. This also has the potential to adversely affect the internationally and nationally designated sites to the east of the frontage (Essex Estuaries Special Area of Conservation and Ramsar wetland, Foulness SPA and SSSI) due to the prevailing west to east direction of longshore drift;
- Potential impact of beach recharge and changes in sediment deposition on benthic invertebrates, although this impact is likely to be localised and temporary during recharge activities;
- Consent from Natural England under Section 28 of the Countryside and Rights of Way (CROW) Act 2000, would be required in order to undertake works within the SSSI.

Natural England may object to the scheme on the grounds that an alternative solution that has a lesser effect on the internationally and nationally designated sites (i.e. no footprint loss of designated habitats) could be designed. This would also mean that pursuing consent for the proposed option through the route of demonstrating Imperative Reasons of Overriding Public Interest (IROPI) could be difficult, as there are other feasible alternative solutions that would have a lesser effect on the designated sites.

At this stage it has not been possible to identify either a suitable replacement habitat site or estimate the cost of providing it, therefore no costs have been included.

Water Framework Directive (WFD)

The scheme would need to be assessed for compliance with the Water Framework Directive, which states that the Thames Lower water body should aim to meet 'good status' by 2027.

Potential issues with the proposed scheme that would need to be assessed for compliance with the WFD, in order to satisfy the Environment Agency include:

- Beach recharge and placement of new groynes directly within the estuary may affect the Quality Elements (hydromorphology, physico-chemical) of the Thames Lower water body through changes in turbidity and thereby oxygenation, and by altering erosion and sedimentation processes;
- Designated bathing waters (Thorpe Bay; Shoeburyness and Shoebury East) have the potential to be affected by the beach recharge and construction works along the frontage through a potential increase in turbidity and suspended sediments;

- This frontage lies within the EC Southend Shellfish Waters and the Foulness Shellfish Waters. Beach recharge has the potential to affect benthic invertebrates through changes in sediment deposition. More information on the quantities, depth and location of recharge would be required to assess this affect, and a baseline survey of the specific areas of recharge and monitoring of benthic invertebrate fauna may be required;
- Under Article 4 (1c) of the WFD the designated nature conservation areas (see above 'Designated nature conservation sites') are considered to be 'Protected Areas' which must meet and maintain favourable condition status. By HTL coastal squeeze may result in the loss of intertidal habitat which would need to be compensated for, as well as the loss associated with installing 16 new groynes on the foreshore.

In relation to the final bullet, to comply with the WFD, Natural England would need to provide their support for the scheme, which as noted above could be problematic where a solution that is less damaging to the internationally designated sites could feasibly be found.

5 Construction Issues

Raising the Wall

Two key points to be considered when raising the existing seawall are:

1. The condition of the existing seawall.
2. The loading applied throughout the construction phase.

It may well be necessary to repair/maintain the existing seawall and raise the level of the beach through beach recharge in advance of raising the seawall.

Beach recharge

The long and broad foreshore at Shoeburyness presents a number of issues when undertaking traditional beach recharge. In that due to the lack of depth the dredging vessel will have to remain approximately 2km from the shoreline and the imported shingle material will have to be pumped to shore. This practice will inevitable incur very large mobilisation costs, and it may be desirable to undertake the beach recharge in conjunction with some other frontages. For costing purposes B&V has assumed that the recharge mobilisation costs are split with recycling activities at 2 no. other sites in close proximity to Southend-on-Sea.

To avoid these high mobilisation costs, one alternative would be to import the new beach material in to Shoeburyness via road deliveries. However, this would require a large number of truck movements that would cause significant disruption to both local residents and local traffic.

Timber Groynes

Installation of timber groynes along the frontage particularly to the west of the Common, will also potentially be problematic, due to the presence of the beach huts (of variable condition) in front of the seawall, some of which (as discussed) will have to be temporarily removed and stored throughout the construction phase then reinstated. However, those that remain are also likely to be exposed to damage from the considerable vibrations resulting from the piling that is required to install the timber groynes.

Rock terminal groyne / breakwater

Similar to that of the beach recharge, the construction of the terminal groyne/breakwater is also complicated by the nature of the very broad flat foreshore at Shoeburyness. As the significant quantities of rock required to construct would ideally be delivered by sea, therefore avoiding significant disruption to both local residents and traffic. However, the lack of available draught will potentially make deliveries by the sea impossible.

Construction of the terminal groyne/breakwater will have to be programmed around both the tide and other environmental constraints, such as feeding/breeding birds etc.

Environmental Impacts of Construction

At this stage no environmental opinion/assessment has been made of the construction activities required to implement this scheme.

6 Costs

A high-level costing exercise has been undertaken by B&V using both their experience on similar projects and by using the Environment Agency's Price Guide. Table 2 below summarise the results of the costing exercise.

Table 2 – Summary of Construction Price Information

Construction Activity	Price Estimate
Temporary works	£64,000
Repairs to existing seawall	£486,000
Raise seawall – Eastern end	£238,000
New beach access x 6	£180,000
Road ramp in Ness Road/ Slipway	£45,000
Surface water drainage alterations	Not Included
Timber Groynes	£998,000
Removal, storage and reinstatement of 20 no. beach huts	£105,000
Rock Armour Terminal Groyne / Breakwater	£1,463,000
Beach Recharge	£938,000
Mobilisation (assuming recharge takes place in conjunction with 2 other frontages and the £1,014,000 cost is split accordingly)	£338,000
Net Construction Costs	£4,855,000

Additional Costs

Contractor Preliminaries	£913,000
Contractor Fee (6.5%)	£370,000
Engineering & Site Supervision (12.5% capped at £450k)	£450,000
Compensation (7.5%)	£460,000
Replacement Habitat Costs	Not Included
Project Risk Allowance (50%ile)	£2,235,000

Total Scheme Value	£9,283,000
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7 Conclusion

The BERA proposal is for a small increase in seawall height (300mm) but for this to be effective in flood protection terms requires the additional construction of a new groyne field, beach recharge and a breakwater on the foreshore. The breakwater is the principal weakness of the proposal in that it would be unacceptable to Natural England as there are alternatives that do not require encroachment on to the protected foreshore. It would also complicate the beach management as it would starve beaches to the east of shingle and trap shingle on the Shoebury Common frontage that by-passes the groynes that would then require additional recycling.

The estimated cost of implementing this scheme would be approximately £9.3m, excluding the cost of compensatory habitat or potential drainage alterations.