5. Alternative options considered

5.1 Introduction

This chapter describes the alternatives considered throughout the evolution of the proposed Project and demonstrates how the preferred option was identified through the assessment of environmental harm and measures that minimise the impact and mitigate and compensate for any losses.

A description of the options considered at preliminary design along with a justification of the options against relevant polices and highway alignments has been considered. The detailed design option has then been presented.

5.2 Preliminary option appraisal

5.2.1 Option 1 - minor works

The first option considered was to replace the seized bearings on the existing structure. The works for this option would be as follows:

- Replace the bearings.
- Carry out work to the cantilevered footway.
- Adapt existing enclosure to ensure durability of the Corten beams.
- Re-paint the existing wrought iron edge girders.

A minor repairs option would address the key structural issues with the bridge and would allow the deck to behave in the manner for which it was designed. This option, however, fails to address non-compliant Vehicle Restraint System on the bridge and the poor road alignment on the western approach. The sub-standard carriageway width over the bridge and the severe congestion caused by the priority system would also remain.

Replacing the existing bearings would require two full road closures of up to 48 hours in each duration, whilst the deck is lifted, to facilitate their removal and installation.

The original edge girders would continue to be an ongoing maintenance liability. Additional land is not required, other than that required to provide a temporary construction site.

5.2.2 Option 2 - moderate repairs

A second option was to use the existing abutments and widen the structure to the maximum possible width. The edge girders would be replaced with a new reinforced concrete parapet edge.

The works for this option would be as follows:

- Carry out work to the cantilevered footway.
- Replacement of defective bearings and deck expansion joints with replacement likely to be required thereafter on a 15-year basis for deck joints and a 30-year basis for bearings.
- Grit-blasting and re-painting of existing severely corroded edge girders and footbridge structure in the immediate-term, with re-painting likely to be required thereafter on a 15-year basis.

- Remove wrought iron girders.
- Sub-structure masonry repairs in the immediate term, with routine repointing and eroded brick replacements as required thereafter.
- Modify existing abutments; add new corten beams, deck extensions and vehicle containment parapets.
- Replacement of timber deck to the footbridge in the immediate term, with replacement of the whole footbridge structure likely to be required thereafter on a 10 to 20-yearly basis. Replace enclosure.
- Re-waterproofing of the reinforced concrete deck in short-term, with replacement required on a 25-year basis thereafter.
- Closure of the bridge to vehicular traffic, cyclist and pedestrians during immediate maintenance works over an estimated eight-month period, followed by intermittent closures during subsequent maintenance works.
- Operation of a three-way traffic light system to manage traffic demand and entrance to the Cuckmere Inn and private properties.

With the provision of new vehicle restraint system, a compliant containment would be provided in addition to addressing structural issues. It also includes the removal of the original girders reducing future maintenance liabilities.

However, this option does not address the poor road alignment on the western approach, or the sub-standard carriageway width over the bridge which, coupled with the continued existence of the priority system, would not relieve the severe congestion that exists at peak times.

This option, however, would require two full road closures of up to 48 hours duration each, while the deck is lifted and the bearings of the existing beams are replaced.

Only a small amount of additional land is required to improve the road alignment at the eastern end of the deck, beyond that required to provide a temporary site compound.

5.2.3 Option 3 - deck widening

A third option would involve extending the abutments to the north of the existing structure and widening the deck to allow two-way traffic flow, as well as a mixed used pedestrian/cycleway route on the south side of the road.

A 3m wide footway would be provided to the south of the carriageway over the bridge and a 1.5m wide footway provided to the north with a viewing platform provided on both sides of the bridge.

Traffic calming measures and bus stops would be introduced.

The works for this option would be as follows:

- Provide a temporary footbridge using the 1975 ‘bailey bridge’ bank seats.
- Remove cantilevered footway.
- Extend abutments on the north side of the bridge.
- Replace bearings of retained corten beams.
- Add new corten beams and widen deck (to the north), with footway on south side of new deck.
- Add vehicle containment parapets (both sides).

Closure of the bridge to vehicular traffic, cyclists and pedestrians would be required over an estimated nine-month period, followed by minimal on-going maintenance

required over the design life of the new bridge (repainting of girder on a 20 to 25-yearly basis).

This option addresses all the structural issues present and most road alignment challenges with only the sharp bend on the western approach remaining.

It is envisaged that the new abutments, deck and a temporary running surface would be completed following which, traffic will be transferred to the new deck, albeit in a single lane. The original deck (with new bearings and a vehicle containment parapet) would then be reconstructed in phase two. Additional land is required to the north of the bridge, on which the widened abutments, deck and carriageway would be built.

The work would have a long construction phase, throughout which, traffic would be restricted to a single lane controlled by temporary signals. However, full road closures of more than a few (night-time) hours would only be required when traffic lanes are moved and surfacing works executed.

5.2.4 Option 4 - replacement bridge

This option would involve a new independent bridge to the north of the existing structure providing two lanes and a new footway/cycleway on the south side.

The works for this option would be as follows:

- Construct new bridge.
- Modify road approaches.
- Divert statutory utilities.
- Demolish existing structure.

The new bridge would allow construction work to continue unimpeded by traffic and only short (night-time) road closures would be required when the new road is “tied-in” to the existing surfacing. Land take is greater than that required by option 3. Queueing traffic would be eliminated.

5.2.5 Policy context and review

This section demonstrates that the proposed Project addresses the duties of the SDNPA, **Purpose 1** (conserving and enhancing natural beauty, wildlife and heritage), providing justifications for the following policies:

- **Policy SD42 (1)** which, in summary, states that proposals for new and improved infrastructure will only be permitted where (a) it is the least environmentally harmful option that is reasonably available and having regard to operational/technical factors, and (b) the design minimises impact on the natural beauty, wildlife and cultural heritage, and amenity of communities.
- **National Parks Vision and Circular 2010 Paragraph 85** ‘there is a strong presumption against any significant road widening or the building of new roads through a Park, unless it can be shown there are compelling reasons for the new or enhanced capacity and with any benefits outweighing the costs vary significantly’.
- **National Parks Vision and Circular 2010 Paragraph 86** ‘In exceptional cases where new road capacity were deemed necessary, a thorough assessment would be needed on the loss in environmental value resulting from any new infrastructure. This would need to be accompanied by measures to minimise any damage and where possible measures to enhance other aspects of the environment. This would include measures to compensate for the loss of environmental or landscape value to local communities and users of the Park’.

- **Biodiversity designated sites: South Downs Local Plan policy SD9(1)(a) and (2)(b). SD9(1)(a**) requires that development proposals follow the mitigation hierarchy as set out in the National Planning Policy Framework (NPPF). This is echoed by SD9(2)(b) relating to national protected sites including SSSIs. Para 5.76 of the South Downs Local Plan states that avoidance of adverse impacts must be the first consideration and compensation is only considered after other options have been explored, and strictly as a last resort. Para 5.85 regarding national sites states 'for any development to be permitted that is likely to damage these sites. The developer must demonstrate to the satisfaction of the Authority and Natural England that: There are no alternative solutions; and the reasons for the development at that site clearly outweigh the nature conservation value of the site and the national policy to safeguard the national network of such sites'.
- **BNG: South Downs Local Plan Policy SD9(1)(b)** requires development proposals to 'identify and incorporate opportunities for net gains in biodiversity'.
- **Ecosystem Services: South Downs Local Plan Policy SD2 requires (1)** development proposals to have an overall positive impact on ecosystem services and (2) requires an Ecosystem Services Statement to be submitted.

Regarding **Purpose 2** (understanding and enjoyment of the National Park):

- **South Downs Local Plan Policy SD19(1)** requires development proposals to promote the use of sustainable modes of transport.
- **South Downs Local Plan Policy SD20** requires development proposals to (1) contribute to a network of attractive and functional non-motorised travel routes and (4) enhance existing NMU routes across watercourses.

For the purposes of demonstrating compliance for the optioneering review, the policy context has been summarised against the following elements as detailed in **Table 5.1**:

- Absence of an alternative.
- Provides the least environmentally harmful option.
- Avoidance of adverse impacts adopt the mitigation strategy.
- Any benefits outweighing the costs 'very significantly'.
- Minimises impact on the natural beauty, wildlife and cultural heritage, and amenity of communities.
- Provide measures to compensate for the loss of environmental or landscape value.
- Provide a positive impact on ecosystem services.
- Contribute to and enhance existing Non-Motorised Users (NMU) routes.

Table 5.1 demonstrates how each preliminary option was appraised against the relevant policy context in relation to SDNPA duties and purposes.

The task of examining the previous option appraisal exercise from an environmental perspective is qualitative. A summary of the key advantages and disadvantages is provided in **Table 5.1** which is based upon the elements underpinning **Purpose 1** and **Purpose 2** of SDNPA.

5.2.6 Option identification

Maintenance only (option 1 and 2) would retain the existing landscape and historical setting until major maintenance works became necessary which would necessitate lengthy closure. Apart from increasing nitrogen-deposition (N-deposition) from

queuing traffic, it would cause few environmental impacts. While no opportunities for improvements for pedestrians or cyclists would be available to meet anticipated growing demand, there would be few other environmental impacts.

In conclusion:

- For option 1 and 2 there would be no opportunity for naturalisation of the Cuckmere River or to address the effects of projected sea level rise or the effects of tidal prism in the medium and long-term, exposing the existing bridge to damage. Traffic congestion issues would remain.
- Online widening (option 3) would retain the existing landscape. However, there would be no opportunity for naturalisation of the Cuckmere River or to address the effects of projected sea level rise or the effects of tidal prism in the medium and long-term, exposing the existing bridge to damage. This option would require a lengthy closure and construction period.
- The preferred option (option 4) allows the existing movement of traffic to be maintained during construction, removes all liability and maintenance requirements for the existing structure and will provide the most complete and cost-effective solution for all highway users. It is the only option that provides an opportunity to address the problem of queuing traffic and improve air quality. Mostly importantly it is the preferred option as it offers the least impact on the surrounding landscape and has the most potential for environmental enhancements.

Table 5.1: Policy review of bridge optioneering

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
Absence of alternatives	• Bridge considered to be unsafe in 2-3 years requiring weight limits. • Lengthy closures during major maintenance then regular closures on a 10 year basis.	• One-way working during works over long construction phase. • Low level disruption from future maintenance.	• Access open to all users during construction. • Low level disruption from future maintenance.	• Retention of existing bridge would cause a 15-minute detour for public transport as weight limits would be likely.
Least environmentally harmful option	• Temporary works site with 6 months construction disruption along with future maintenance disruption. • Retains the existing alignment. • Retains the existing bridge structure.	• Temporary works site with a nine-month construction disruption along with future maintenance disruption. • Some congestion likely to remain due to alignment. • Footprint of works area constrained to provision of temporary footbridge and land north of the bridge, on which the widened abutments, deck and carriageway would be built.	• Construction techniques adopted that avoid need for temporary piling within the river. • New bridge structure and alignment.	• The online renewal offers least environmentally harmful option. • Historic landscape setting would be altered by online widened and new bridge.
Impact avoidance	• Unable to address effects of climate change on flood levels.	• Unable to address effects of climate change on flood levels.	• Accommodates anticipated climate change.	• New bridge would avoid impacts from increased flood risk.
	• Continued N-deposition within SSSI.	• Minimal congestion thereby reduced N-deposition within SSSI.		• Online and new bridge delivers lowest levels of N-deposition within SSSI.
	• Avoids loss of agricultural land.	• Minimal land take.	• Greatest permanent and temporary land take.	• Maintenance of the existing bridge would have the least impact.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
	• No change to historic landscape and retains continuity with 18th century bridge alignment.	• Historic alignment retained but structural appearance of bridge would change to meet modern safety standards.	• Historic crossing point would be altered by the removal of existing bridge and introduction of a new bridge.	• Widening and new bridge options would cause some change to the historic landscape.
	• Avoids impact on known archaeological sites and unknown buried archaeological remains. • Avoids impact on designated features of built heritage. • Works compound sites have low risk of affecting unknown buried archaeology.			• Consideration of archaeology and built heritage has no bearing upon optioneering.
Impact minimisation - carbon	• Increased carbon emissions due to queuing traffic.	• Reduced operational carbon emissions by removal of queuing traffic. • Potential for increased carbon emissions should traffic avoid 10-week congestion by taking a detour of an additional 15 minutes per journey.	• Reduced carbon emissions 8,196 tonnes over the 60-year appraisal period by elimination of idling traffic despite 3% increase in traffic.	• Impact reduction of new bridge anticipated to be same as online widening.
Impact minimisation – Cuckmere River	• Risk to Cuckmere River during grit-blasting and painting operations	• Risk of debris over the Cuckmere River.	• Construction techniques adopted to lessen the risk of polluting the Cuckmere River.	• Impact of new bridge option has been reduced but would remain with a higher risk than the other options.
Impact minimisation – landscape	• Avoids impact on the hillside and Cuckmere Inn.	• Causes adverse impact on the landscape and views from the east due to cut into the hillside and construction of a retaining wall (approx. 2.5m high). • Bridge structure has least landscape impact and the least visual intrusion.	• Cause minimal impact on the hillside and avoid impacting the Cuckmere Inn pub frontage to the west of the bridge. • Minimises earthworks on western slopes but loss of screening vegetation from The Boathouse residential property.	• New bridge would cause temporary loss of vegetation and screening to one dwelling but avoid a large retaining wall.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
	• Retained as a gateway but with intrusion of traffic lights.	• Potentially discordant structure between former and new bridge elements.	• Design of bridge and street furniture reduces urbanising effect of former design.	• New bridge design delivers an appearance in greater harmony than the online solution.
Minimises impact on natural beauty	• Retention of existing alignment, earthworks and vegetation.	• Reduced level of adverse ecological impact due to embankments and loss of vegetation from cut in hillside. • Temporary loss of habitat due to fabrication area for replacement structure.	• Ecological impact due to temporary and permanent vegetation removal. • Temporary loss of habitat due to fabrication area for new structure.	• New bridge causes reduced loss of habitat from works on western embankment. • Habitat loss due to fabrication area anticipated to be greater due to large structural elements needed for the new bridge.
Minimises impact on wildlife	• Increased N-deposition from traffic congestion of 1km queues by 2028.	• Free flow of traffic prevents an increase in N-deposition.	• Free flow of traffic prevents increased N-deposition.	• Reduced N-deposition benefiting biodiversity with either online renewal or new bridge.
	• Temporary loss of land and negative impact on grazing marsh of the SSSI and other ecological resources during immediate maintenance, which may result in some permanent loss.	• Temporary change in land management within grazing marsh due to works area.	• Temporary change in land management within grazing marsh due to works area. • Permanent loss of approximately 400m^2 of habitat within the SSSI (a reduction of loss of 100m^2 from that stated within the 2021 application).	• New bridge would have largest temporary effect upon land management within the grazing marsh. • A compensation site has been agreed and could have been identified for the online option.
	• No change.	• Potential need for works to be undertaken within the river.	• Construction techniques avoid impact upon fisheries.	• Having the abutments set back on the new bridge allows construction techniques that minimise impact on wildlife.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
Minimises impact on cultural heritage	• No impact upon historic alignment.	• Negligible impact on historic alignment.	• Deviates slightly from existing 18th century crossing point across the river.	• Online widening would offer the do something option with least impact.
Minimises impact on amenities	• No ability to enhance gateway or public realm or address increased forecast 10% increase in pedestrian numbers.	• Retains a sharp bend at the western side of the bridge similar to existing, mirroring the sharp corners at the eastern end of The Causeway, retaining and allowing for further development of the gateway at the western side of the valley for all users (pedestrians, cyclists and drivers).	• Design of the bridge structure as a gateway creating a memorable experience for all users. • Improved quality of public realm to cater for all users.	• Current facilities would be enhanced with new bridge.
	• No change in traffic speeds during peak hours, at weekends and bank holidays, thereby assisting pedestrian crossing across the A259 during these busy periods in short-term.			• Traffic management
	• Lengthy and repetitive disruption to access across the river during maintenance works.	• Access across the bridge closed for duration of construction.	• Access maintained through construction period with some short-term disruption.	• New bridge represents the least disruption to access across the bridge.
	• Does not address issues relating to safety for vehicular traffic resulting from lack of vehicle containment, poor road alignment or width restriction.	• Two-way flow and low traffic speed and two footpaths would improve safety.		• Online and new bridge offer improved pedestrian safety.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
Public transport	• Unreliable bus services also affected by three-way traffic control.	• Enhanced bus service reliability benefiting over 2.4 million passengers over a year[131].		• Online and new bridge offers enhancement for public transport.
	• Limited improved access could be provided with this option	• Improved access to public transport by raised curbs.		• All options could provide improved access to public transport.
	• Eight months delay to public transport services due to closure with lengthy diversion.	• Nine-month delay to public transport services due to closure with lengthy diversion.	• Delay to public transport services during construction for about four months during tie-in works.	• Online and new bridge offers enhancement for public transport.
Impact compensation	• No opportunity for naturalisation of the river or improvement of air quality and could result in short-term impacts during maintenance works.	• No opportunity for naturalisation of the riverbanks.	• Naturalisation of riverbanks achieved with provision for otter and badger.	• Onsite and offsite compensation measures part of Proposed Project.
Positive impact on ecosystem services	• No reduction in flood risk.	• Enhanced flood protection.		• New bridge meets EA requirements on flood risk.
	• No change	• Creation of microhabitats through creation of gaps in flint faced walls and abutments.	• Creation of microhabitats through creation of gaps in flint faced walls and abutment and wildlife corridors for badger and otter.	• New bridge provides increased opportunity for habitat creation.
	• No change.	• Improved connectivity for visitors to the natural environment though a viewing platform and interpretation boards.		• New bridge increases attractiveness of area for tourists.
	• No change.	• Restricted opportunity for use of local materials.	• Street furniture to be made from local wooden materials where feasible.	• Greater local sourcing of materials with new bridge option.

[131] Brighton and Hove Buses comment made in support of DfT funding application.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
Contribute and enhance NMU routes	• Narrow footways do not accommodate passing wheelchairs etc.	• Adequate provision for two wheelchairs to pass.		• New bridge options offer enhancement for pedestrians/those in wheelchairs, mobility scooters and pushchairs to pass easily and safely.
	• Footway on north site causes users to cross carriageway twice.	• Footway on both sides removes need to cross the carriageway.		• New bridge options offer enhancement for NMU.
	• Absence of raised kerbs at bus stops impeding those with sight or mobility impairment.	• Raised kerbs incorporated.		• New bridge options provide enhancement for NMU.
	• Poor street lighting.	• Reduced opportunity to improve lighting.	• Enhanced street lighting with dimer controls to be provided. • Low level wayfinding lighting across bridge to be provided.	• New bridge offers enhancement for NMU.
	• Absence of formal crossing points with poor visibility at frequently used locations.	• Dropped kerbs and tactile paving incorporated.		• New bridge options offer enhancement of pedestrian access across both sides of the bridge to minimise the number of road crossings and improve safety.
Contribute and enhance NMU routes - Public viewing area	• Absence of safe congregation area.	• No provision due to highway alignment.	• Shared space provided outside Cuckmere Inn.	• New bridge offers enhancement for NMU through segregation of people from traffic across the bridge with sufficient width on the bridge.

Policy context	Maintenance only (option 1 and 2)	Online widening (option 3)	New bridge – replacement bridge (option 4)	Conclusion
	• No viewing areas.	• Viewing platform with views available to all.		• New bridge options offer enhancement for pedestrians to stop / pause to enjoy the landscape.
	• No benches.	• Anticipate provision would be constrained.	• Benches and wheelchair provision at three locations.	• New bridge offers enhancement for NMU.
Contribute and enhance NMU routes - Cycling	• No provision for National Coastal Path, South Downs Way and National Cycle Route 2.	• Provision for National Coastal Path, South Downs Way and National Cycle Route 2 possible.	• Safe capacity provided for National Coastal Path, South Downs Way and National Cycle Route 2.	• Online and new bridge enhancement for cyclists across the bridge to facilitate future improvements to the cycle network beyond the scope of the Project.

5.2.7 Highway alignment options

Highway alignment options were considered for option 4 (replacement bridge) during the detailed options appraisal process. These comprised of the following:

- Do something option 1 – replacement bridge along existing alignment
- Do something option 2 – replacement bridge parallel to existing
- Do something option 3 – replacement bridge near parallel to existing
- Do something option 4 – replacement bridge, skewed at an angle to existing

Option 1 would achieve most of the landscape and visitor movement objectives but would give rise to a significant adverse impact upon views from the east due to the cut into the hillside and construction of an approx. 2.5m high retaining wall with the loss of some localised loss of vegetation. The option would necessitate the prolonged closure of the A259 during the works.

A parallel new bridge (option 2) (refer to **Figure 5-1**) would closely resemble the current road alignment albeit still discordant with the historical alignment, but would have the following adverse consequences:

- A wide carriageway is needed for long vehicles to execute the turn manoeuvre safely, resulting in a large cutting into the western hill side with a retaining wall approx. 2.5m in height at the back of the southern verge compromising the surrounding landscape and highway environment.
- The overall length of both the bridge and the shared area outside the Cuckmere Inn is limited but would result in considerable change to the frontage of the Cuckmere Inn.
- Adverse impact on ecology owing to the land-take from within the designated SSSI.
- The alignment would not comply with either the DMRB or the Manual for Streets, necessitating traffic calming measures.
- Closure of the bridge to vehicular traffic, cyclist and pedestrians during tie-in works for an estimated period of up to one month, followed by minimal on-going maintenance required over the design life of the new bridge (repainting of girder on a 20 to 25-yearly basis)
- Option 2 was rejected due to its landscape impact.

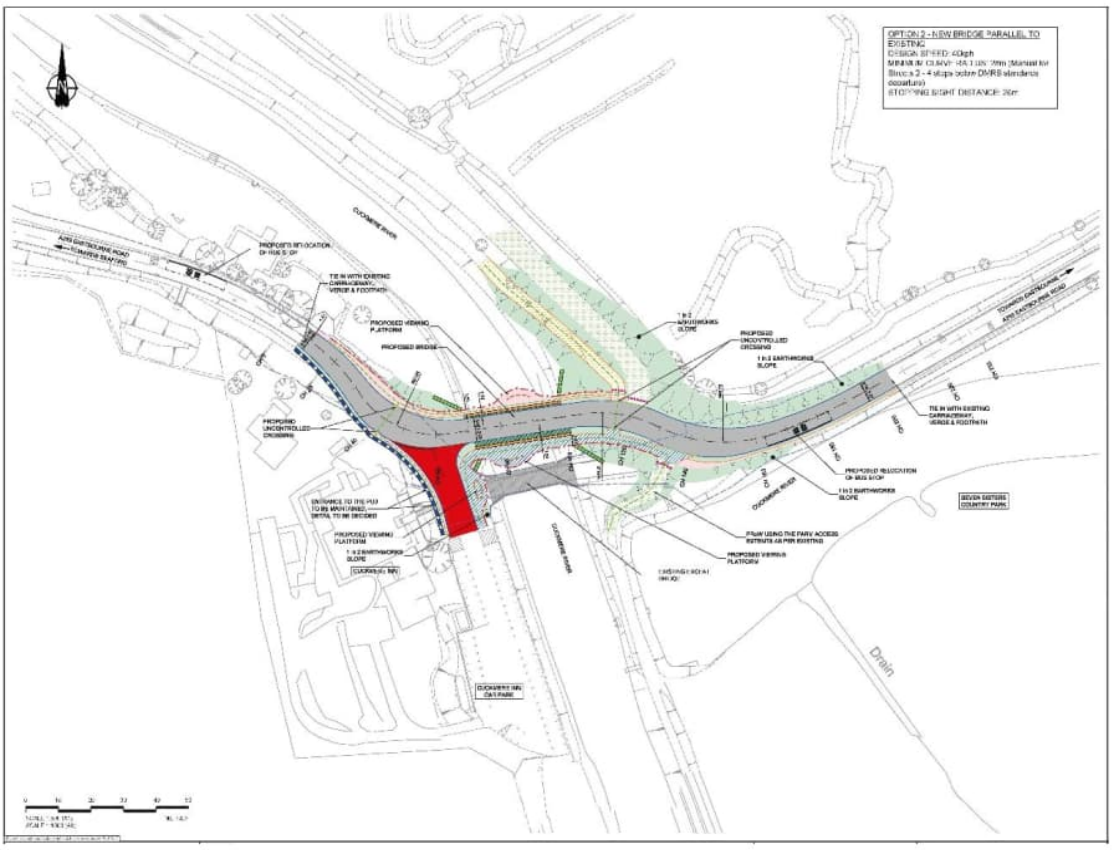

Figure 5-1: Option 2 - parallel alignment to existing bridge

Option 3 (refer to **Figure 5-2**) comprising a new bridge further to the north was examined. This option would be compliant with the DMRB and Manual for Streets. As with option 2, a retaining wall would be required on the hillside. In this instance, it would be a shorter, lower retaining wall along with some change to the frontage of the Cuckmere Inn. There would be some adverse impact upon the SSSI with little recognition of the presence of Cuckmere River. In summary, option 3 has the following implications.

- The most favourable option when considering landscape and road safety.
- The option closely resembles current road alignment.
- The bend on the western side of the Cuckmere River is slightly less tight allowing a narrower carriageway thereby, reducing the cutting on the western hill side, although a retaining wall is required for the southern verge.
- There would be a significant negative impact on the landscape along with views from the east due to its larger scale and alignment away from the existing bridge.
- The alignment could result in greater vehicle speed, negatively affecting pedestrian ability to cross the road.
- The increased overall length of both the bridge and the shared space outside the Cuckmere Inn, will provide more space for pedestrians, cyclists and vehicles.
- This option has the largest footprint within the designated SSSI.

This option is compliant with the DMRB and the Manual for Streets, encouraging slower traffic speeds without needing significant and imposing traffic calming measures.

Figure 5-2: Option 3 – near parallel alignment

Option 4 (refer to **Figure 5-3**) is aligned on a greater skew to the existing structure or that of the preferred option with two less tight bends either side of the bridge to tie in with the existing highway. This option offered the following advantages:

- Carriageway width was the least which along with its position resulted in less cutting into the western hill side with no retaining wall at the back of the southern verge.
- The overall length of both the bridge and the shared space provided outside the Cuckmere Inn pub are the greatest with this option.
- Complies with both the DMRB and the Manual for Streets.

The reasons for rejecting this option were as follows:

- It does not closely align with the existing road alignment and does little to recognise the Cuckmere River crossing.
- Offers the least resemblance to the current layout.

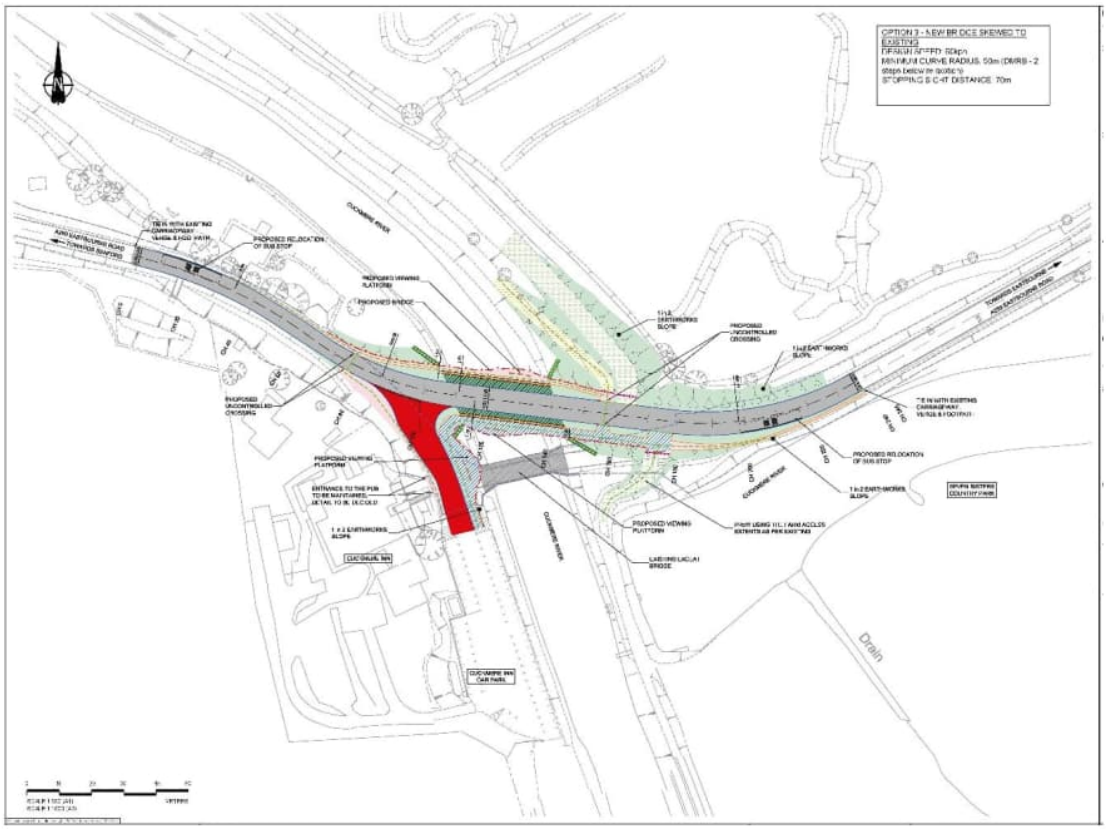

Figure 5-3: Option 4 – skewed alignment

An evaluation of the alignment options rests upon the following factors:

- The historic alignment.
- Medium-term impacts upon the SSSI.
- Landscape and visual amenity impacts.
- Future proofing against climate change.
- Disruption to accessibility during construction works.
- Traffic congestion.
- Public transport and access/safety for walkers and cyclists.
- Creating a modern user-friendly gateway.

While Table 5.2 provides an evaluation of the proposed Project in terms of the SDNPA Purpose 1 and 2 objectives, it is nevertheless recognised that the following short-term adverse effects would result from the selection of option 2.

- Temporary constrained access to the residents of the Boathouse and Blackberry Cottage
- The loss of tall screening hedge at the Boathouse
- Removal of the historic bridge and effects upon the medieval historic crossing
- Short to medium-term loss of CFGM habitat
- Disruption to traffic due to movement of construction plant, equipment and workforce between construction compound and the works site
- Disruption to residents in the vicinity of construction compound
- Disruption to the Cuckmere Inn business

Table 5.2: Evaluation of proposed project against SDNPA Purpose 1 and 2 objectives

Environmental aspect	Identified alignment option
Purpose 1: conserve and enhance natural beauty and wildlife	
Least Harmful Option	• Removes negative effects on visual amenity and N-deposition within SSSI from queuing traffic. • Avoidance of impact upon fisheries. • Naturalisation of riverbank habitat. • Least repetitive disruption to visitors and users of the bridge. • Least loss of habitat and landscape impact from works on western embankment.
No Increase in Capacity	• No meaningful increase in highway capacity (3% increase in traffic is forecast).
Compensation for Loss	• 1ha compensation for loss of 0.79ha SSSI of which 0.05ha is coastal saltmarsh and neutral grassland associated with coastal floodplain grazing marsh habitat.
Mitigation Hierarchy	• Adopted bridge design and construction techniques that avoids, mitigates and compensates for the adverse effects upon landscape, visual amenity and ecology.
Biodiversity Net Gain	• Provision of BNG at a ratio of 1:13 (approximately 11:95%) exceeding the 10% threshold.
Ecosystem Services	• Accommodates climate change and flood risk reduction. • Local employment and sourcing of materials.
Purpose 2: Promote understanding and enjoyment	
Promote Sustainable Transport	• Addresses delay and reliability issues for public transport. • Improves pedestrian safety.
Contribute to Enhancements for NMU	• Enhanced gateway opportunities for visitors at Cuckmere Inn. • Improved connectivity for visitors to the natural environment though a viewing platform and interpretation boards.

5.2.8 Detailed design optioneering

This section demonstrates the manner that the proposed Project design has evolved through the iteration of alternative design and construction solutions.

5.2.9 Landscape-led design

Construction of a new bridge is fundamentally an engineering rather than landscape-led task since the bridge design must achieve critical safety standards in terms of its structural integrity and its buildability. It must also not cause the principal designer to be in contravention of the most recent Construction and Demolition Regulations.

The landscape-led design decisions as part of the design optioneering have been:

- The choice of a bridge structure which reduces the overall height of the bridge and so impact on the landscape.
- The use of the same structure means that the road and the walkways are separated, and bridge has pedestrian parapets rather the vehicle parapets hence they can be lighter in construction and more in keeping with the surrounding landscape as well as being made from timber.

- The selection of the location option that has a bend at both ends of the bridge to reduce traffic speeds, while keeping as close as possible to the existing alignment of The Causeway.
- Increased bridge span, moving the abutments away from the Cuckmere River creating a wildlife corridor along the Cuckmere River.
- Cladding all retaining walls and abutments with flint as the locally used construction material.
- Selection of a grey colour for the bridge to reduce visual impact at all times of year.
- The incorporation of two walkways and viewing platform into the bridge design, making the bridge a place for people to stop and view the landscape.
- A shared space outside the Cuckmere Inn, with a change in paving material, making a place for people, rather than vehicles.
- The creation of two viewpoints and seating areas away from the bridge enabling people to understand and appreciate the landscape.
- The use of native species of plants so that the bridge blends into the landscape.

As part of the detailed evaluation of alternative design solutions for the parapet railings along the bridge were assessed (refer to **Figure 5-4**).

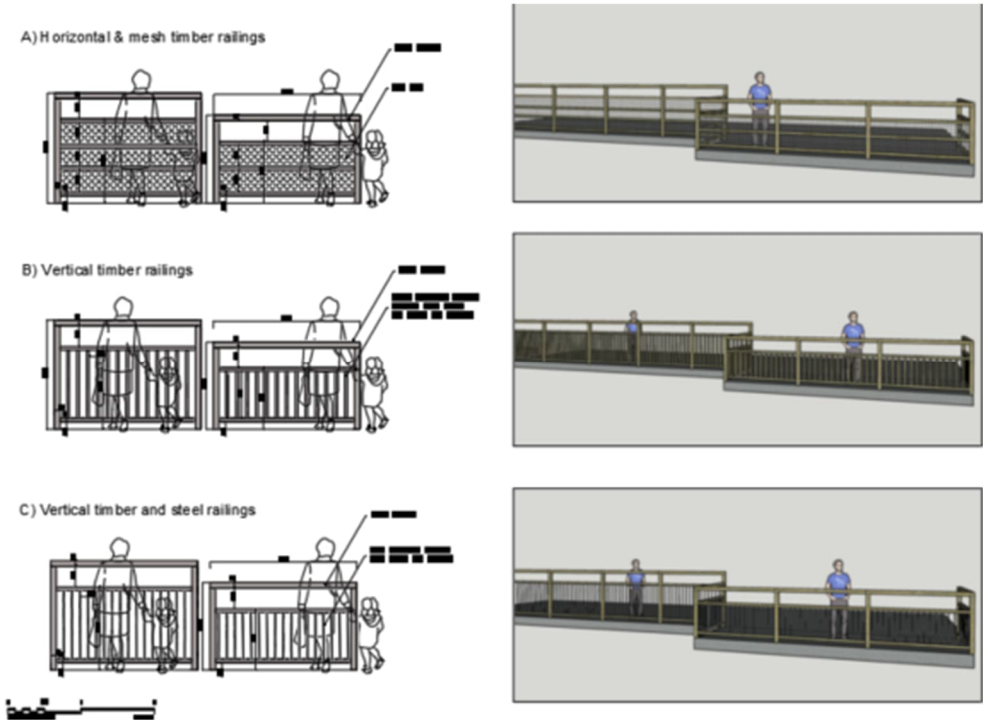

Figure 5-4: Alternative parapet railing designs

5.2.10 Bridge design

By the adoption of square cross beams, there would be no requirement for special fabrication and the bridge would be easier to install. In turn this would have the benefit of reducing the embodied carbon associated with the bespoke specification of the cross beams for the original design. As a result of making installation easier, the risk of debris falling into the Cuckmere River would be reduced.

The 2021 outline design for the bridge required excavation below the water table and in-channel to place the foundations. This would require dewatering. A revised design involves the raising of ground level thereby removing the need to de-water. Instead, a single sheet pile would be required to protect the maintenance and

mammal corridor from scour. The sheet piles would be cut to ground level to remove them from view (refer to **Figure 5-5**).

A conventional reinforced concrete bridge abutment has been replaced with a contiguous pile wall with a cill beam and wing walls. This option offers the following advantages:

Piling can be undertaken from the top in dry environment.
Reduces the need for working below water.
Eliminates the requirement of invading the river with the cofferdam and associated works to remove the cofferdam sheet piles.

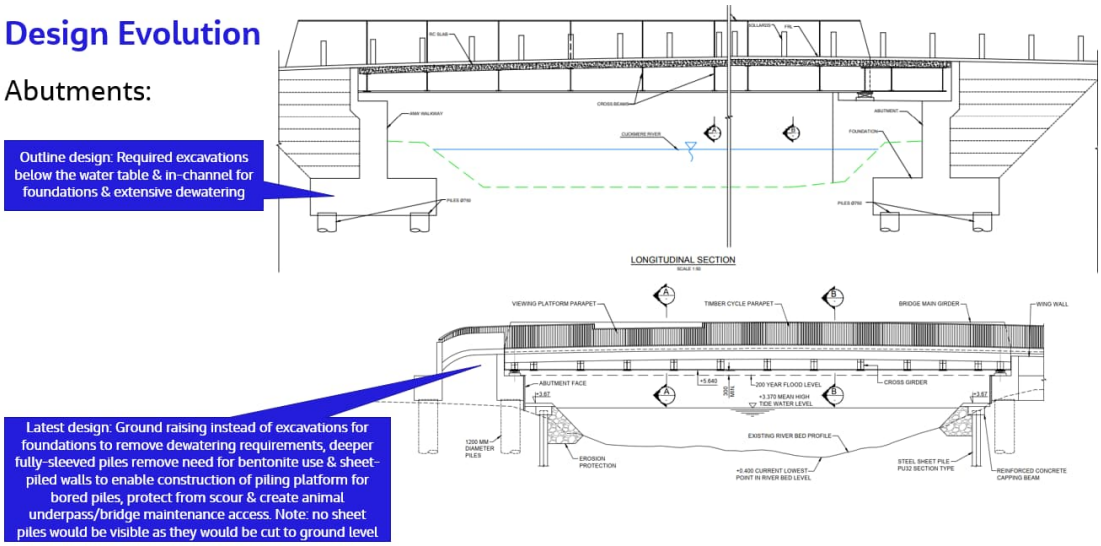

Figure 5-5: Revised abutment design

5.2.11 Piling for bridge foundations

The following piling options to create bridge foundations have been examined:

- Bored piles would negate the need to constrain operations to address the concerns of the Environment Agency. However, there is a potential risk of allowing infiltration into the ground.
- Sleeved piles have been examined to avoid the requirement for the use of bentonite with the associated risks of contamination to the surface and groundwater. Sleeved piles would have the disadvantage of lengthening the duration of piling. The sleeved piles approach avoids the need to provide for two bentonite pumping sites with the associated disturbance to residents.

The sleeved pile solution has been adopted, however while this technique offers some benefits, the Environment Agency has reported that solid cylindrical piles are able to form a seal when driven through a clay layer with a thickness of at least two pile diameters. However, given that piling would be into a chalk aquifer, there is a risk of localised contamination of the groundwater.

To negate a risk to the groundwater, a piling risk assessment would be prepared by the delivery partner for the consideration by the Environment Agency to confirm that an appropriate methodology is put in place to minimise groundwater contamination.

No percussive piling would be used for the bridge foundations to reduce disturbance caused to residents and visitors to the National Park. However, percussive piling would be used to establish the sheet piles.

Piling of the bridge foundations is expected to take place between November 2023 and February 2024 with a duration of about 12 weeks. Given the desire to reduce the impact upon Cuckmere Inn and the neighbouring property (Blackberry Cottage), piling on the western embankment would preferably be undertaken outside the peak tourist periods, usually summer-time.

Should the delivery partner elect to use a bentonite system then there would be risks to the groundwater and river water from leakages. The delivery partner would then be required to provide a risk assessment demonstrating the absence of an environmental effect to the satisfaction of the Environment Agency[132].

The risk assessment would need to set out a monitoring programme (i.e. volumes used) to demonstrate that the bentonite has not found other pathways. Should losses arise then a procedure would need to be agreed to mitigate against such effects. The monitoring boreholes proposed as part of the additional GI works in summer 2022 would provide a detailed characterisation of the groundwater environment and be used to monitor potential bentonite losses during piling trial(s).

Daily visual checks of surface waters would be required during piling to check for losses and any other impacts[133].

While wintering birds are present over winter/spring, short term disturbance is assumed not to cause an impact since the birds would migrate to other locations found to be acceptable to them.

5.2.12 Bridge construction techniques

Consideration was given to employing small cranes or a large crane during construction. While the small cranes would be able to lift individual steelwork items, a large crane would be capable of lifting onsite pre-assembled steelwork and permanent formwork.

In terms of the footprints for each crane option, use of small cranes would need a 33m x 18m platform at the northeast corner of the bridge and a 35m x 7.5m assembly area northwest of the platform. In contrast, the large crane solution would require a 45m x 45m crane platform at the northeast corner of the bridge and a 35m x 20m assembly area northwest of the platform.

While the use of a large crane would reduce the amount of working over the Cuckmere River, a much larger assembly area and crane platform would be required. There would also be possible programme delay due to crane non-availability as there are only a few of these cranes available and which have to be booked over 12 months in advance.

It was concluded that, smaller cranes are preferable given the land constraints and the potential for lifting over properties raised safety implications.

Another option considered was to launch the assembled deck from east to west, however this was considered not to be feasible as the A259 needs to be kept open during construction to avoid a negative impact on the public.

The northwest corner beyond the bridge comprises a coastal saltmarsh. This is a priority habitat and a qualifying feature of the SSSI with low potential for reinstatement. Deploying the cranes and assembly areas to the northeast corner of the bridge would disturb neutral grassland and mixed scrub which provides for easier reinstatement. The northeast bank is also at a raised level.

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[132] See CEMP clause Wat083

[133] See CEMP clause Wat084

It has been concluded that the northeast corner of the bridge is only suitable location for the lay down area, crane platform, etc[134].

5.2.13 Cofferdam

Should a decision be taken by the delivery partner to construct the bridge by creating a dry working area on the western side of the river from within the Cuckmere River, then the usual manner is to create a cofferdam by placing contiguous piles into the watercourse.

The preliminary design of a sheet pile cofferdam on the western bank was found to have the potential to give rise to a small amount of flooding to the north. To avoid this challenge, a mobile water retention technique is proposed, the dimensions of which are to be defined by the delivery partner in discussions with the Environment Agency.

Percussive piles could generate considerable disturbance to migratory fish within the Cuckmere River as well as acoustic impact to residents and visitors to the National Park. Further the Environment Agency would constrain operations to between 1st March and 30th November inclusive.

It is not acceptable to pile into the Cuckmere River for the following reasons:

Impact on sea trout and migratory eel populations.
Increased turbidity and smothering of benthic organisms.

For the above reasons, percussive sheet piling to construct cofferdams is excluded via the CEMP.

An alternative as use by the Environment Agency as part of flood defence works is a mobile solution using impervious fabric sheets on a steel support framework (refer to **Figure 5-6**). Should this approach be taken then the weight of the water at low tide would provide a watertight seal to prevent water egress into the works area.

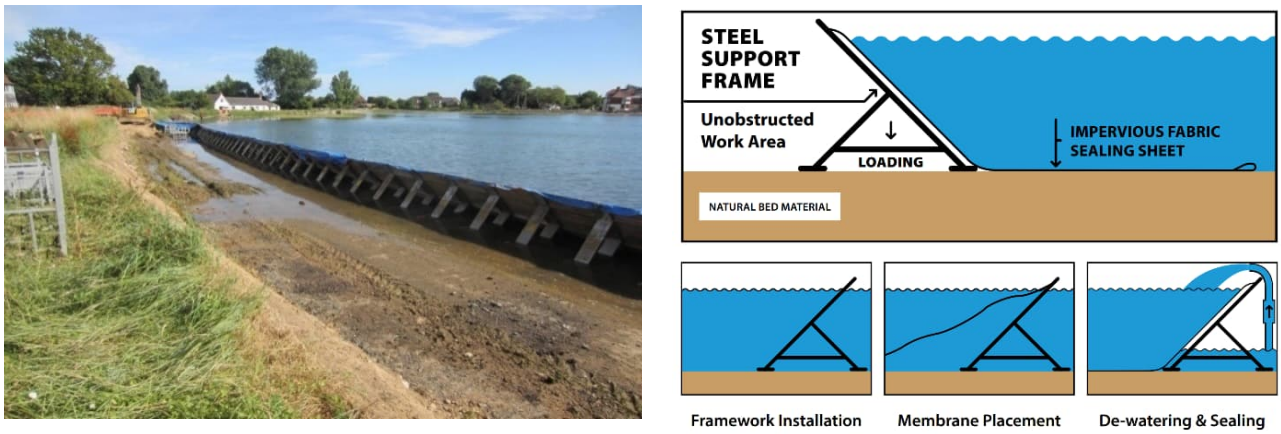

Figure 5-6: Mobile water retention technique

The sea trout peak migration period is assumed to be May-July and into August upon which they then pass through to the works area for spawning. Consequently, it is assumed that a mobile water retention technique can be put in place and removed anytime outside this period as the river at this location is channelised and thus is an area where the sea trout would tend to pass through quickly rather than one where

[134] Please see drawing number 3520000-0260-020-00-001-4 Rev P1.

they would reside. This assumption would need to be checked with the Environment Agency by the delivery partner[135].

As the sea trout tend to move after dusk, installation and removal works and other construction works in the within 10m of the river, would need to cease one hour before dusk.

The next operation would be to de-water the area between the riverbank and the impoundment. Trapped fish would be returned to the river.

The water cannot be pumped directly into the river since this would increase turbidity and smother benthic organisms. Instead, it would be necessary to pump the water through tanks to ensure the removal of sediment before discharge. This would be a 24-hour 7 day a week operation that would be expected to last for 5 days.

5.2.14 Approach embankments

The preferred construction strategy would involve the use of GEOfoam blocks on the eastern approach to the bridge as a means of minimising disturbance caused by piling and reducing carbon emissions. Should the delivery partner elect to deploy 55 piles then it is anticipated that these works would have a duration of approximately 11 weeks whereas the GEOfoam solution would take approximately five weeks.

The ability to provide a steeper slope to the northern side of the east approach embankment has been adopted reducing the earthworks footprint and the loss of habitat on-site (0.5ha in the 2021 ES to 0.4ha).

On the western slope it is necessary to avoid the constraint of National Trust land while also providing an appropriate highway alignment to the new bridge.

The 6m tall hedge adjacent to The Boathouse would be removed. As fast-growing screening plants would not fit with the character of the National Park, so only native species shall be used and thus a visual screen fence would be used to reduce such intrusion at The Boathouse for the benefit of the residents of that property.

5.2.15 Lighting strategy

The lighting strategy was submitted alongside the 2021 planning application. The lighting strategy recorded that the proposed lighting sought to achieve the best possible solution whilst trying to maintain the natural beauty of the area, ensuring compliance with the Dark Night Skies policy and having minimal impact to the local flora and fauna. It sought to provide some levels of lighting in the areas where the departures are taking place to lessen the extent of the lack of standard levels of illumination.

Despite the full extent of the proposed lighting extents not being lit to highway lighting standards, the design is considered to be safe, in particular at the pedestrian crossings as per the Road Safety Audit.

To address appropriately any environmental constraints, the following was considered in the lighting design:

- Timing (e.g. hours of operation).
- Strict optic control.
- Light source colour temperature.
- Column mounting heights.

[135] See CEMP clause Nat124

The lighting across the proposed bridge girder which would provide illumination along the footpath for pedestrians crossing the bridge would be similar to that illustrated in **Figure 5-7**.

Figure 5-7: Lighting on the bridge girder

The proposed lanterns across the bridge would control the spread of light and would focus on the footpath and not produce any light spill into the Cuckmere River.

Three 8m tall East Sussex standard steel street lighting columns are proposed along with ten way-finding luminaries on the bridge girder. The columns are of a simple design, in keeping with the design philosophy to minimise street 'clutter'. The columns would be placed at back of the verge to ensure maintenance and easy excess.

At night-time, it is important to curtail the perception of light intrusion and glare to road users as well as those within the public house and surrounding dwellings. The locations of the lighting columns were chosen to aid this objective, endeavouring to keep the columns out of sight as much as possible whilst maintaining the integrity of the design and the allowance of safe maintenance.

5.2.16 Drainage strategy

Consideration has been given to the preferred location of the highway runoff outfall and its design with the objectives being to:

- Maximise dispersion of the runoff.
- Minimise visual intrusion.
- Minimise damage to ecological habitats.
- Capture opportunities for ecological enhancements.

Due to the constraint of gravity, three different outfall locations were explored for the east bank drainage:

- Existing ditch to the north and into the Cuckmere River.
- Existing ditch to the south and into the Cuckmere River.
- Outfalling to the Cuckmere River was discounted due to achievable levels.

Reflecting the views of the lead local flood authority, the outfall will be located to the north.

5.2.17 Candidate construction compounds

Two candidate construction compound sites have emerged following discussions with the landowner. The 2021 candidate site (also known as option A) is located on

the edge of Seaford (refer to **Figure 5-8**). Subsequently the landowner has indicated a desire for the compound to be located closer to the Boathouse and the construction site (refer to **Figure 5-9**).

While the 2021 site is broadly level and would require the stripping of the topsoil, the 2022 site (also known as option B) would necessitate larger scale earthworks to create a level platform for the compound.

Figure 5-8: 2021 candidate construction compound location

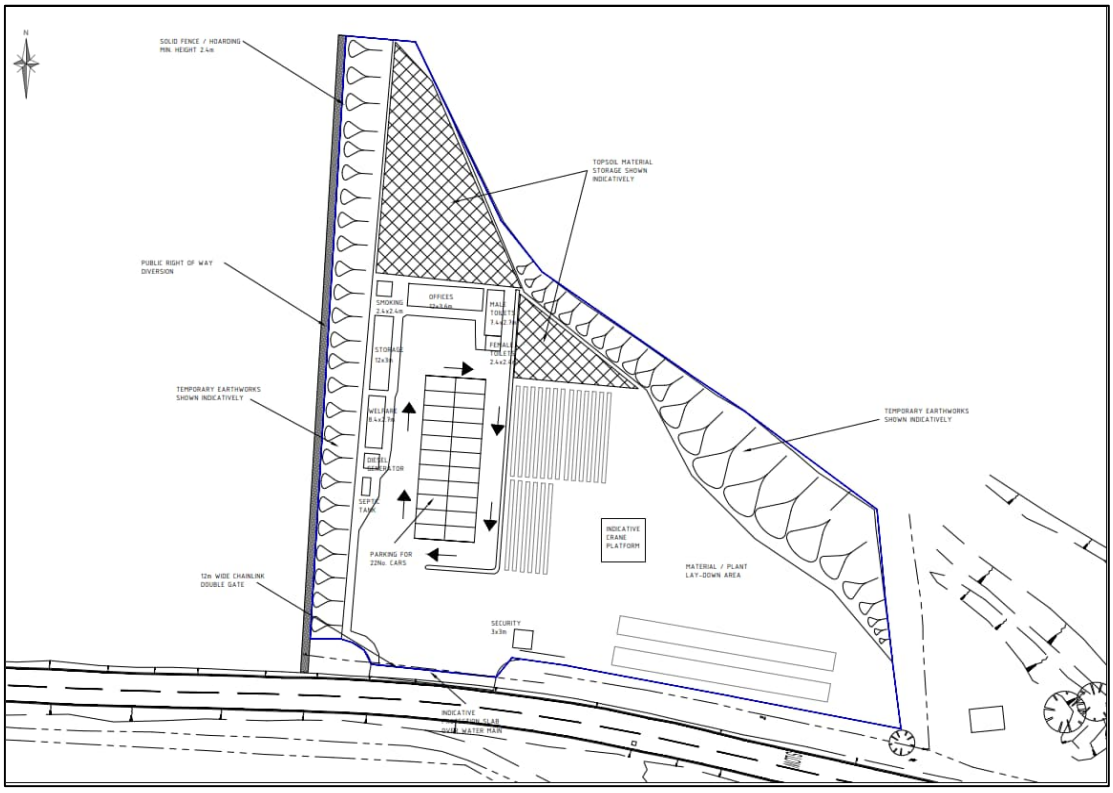

Figure 5-9: 2022 candidate construction compound location