Addendum

Hunstanton Coastal Management Plan

60552153

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1. Introduction

1.1 Background to project

AECOM Infrastructure and Environment UK Limited has been appointed by the Borough Council of King's Lynn and West Norfolk (BCKLWN) to develop a Coastal Management Plan (CMP) to implement the 2010 Shoreline Management Plan's (SMP2) preferred management policy for the Hunstanton frontage.

1.2 Background to this document

This addendum to the CMP has been prepared in response to an instruction from KLWN BC, following a Council Management team meeting, where some additional analysis and indicative cost estimation was requested.

This document and its contents are designed to supplement the CMP with additional analysis not supersede the analysis already presented in the CMP.

1.3 Purpose and scope of this document

This document contains:

1. Cliff monitoring assessment (for Unit A)
2. Promenade re-surfacing cost analysis
3. Indicative slipway cost assessment

2. Cliff Monitoring (Unit A)

2.1 Introduction

The preferred management option identified in the CMP for Unit A is to construct an initial/pilot 250m stretch of rock armour protection (sill/revetment) in front of the cliff to protect the most vulnerable assets (i.e. the lighthouse area) in the short to medium term (5-15 years). Then in the longer term (50-60 years) construct the remaining 1075m of the rock armour protection to protect the rest of the frontage.

However, given the scale of the impacts and costs associated with this option, the Council have requested that AECOM develop some potential monitoring programmes to monitor the erosion of the cliff. In addition, they have requested that AECOM identify the potential consenting regime that will be required to undertake the proposed works (including environmental) and establish an indicative timeline for acquiring the required consents.

2.1.1 Purpose of the Monitoring

The purpose of the monitoring would be to:

1. Continue to proactively manage public safety along the frontage,
2. Establish a base-case position/status of the cliffs,
3. Monitor erosion to identify vulnerable sections and establish erosion rates
4. Use the collected data evaluate the risk to properties and determine the optimum time to undertake protection measures.

2.2 Existing Monitoring

KLWN BC undertake regular walk-over inspections of the frontage, both at the top and bottom of the cliff, the purpose of the inspection is primarily for managing public safety; i.e. maintaining the fence line along the cliff top or diverting the public away from unstable sections of the cliff. But it also serves to monitor evidence of erosion such as recent rock falls etc. or post storm damage.

The frontage is included in the Environment Agency's Anglian Coastal Monitoring programme, which has been undertaking strategic and risk-based monitoring of the Anglian coast since 1991. As such the frontage has regularly been subjected to the following monitoring and surveys:

1. Aerial photography surveys
2. Aerial LIDAR survey
3. Continuous hydrodynamic monitoring (of the Wash) since 2006
4. Hydrographic multibeam bathymetric surveys
5. Topographic survey of beaches

2.3 Potential Monitoring Techniques

Notwithstanding the monitoring of the frontage that already takes place, this section considers the potential monitoring techniques that can be utilised to specifically focus on the erosion of the cliffs:

1. **Walk-over survey / visual inspection**; regular recorded visual inspections of the frontage, monitoring evidence of erosion, such as recent rock falls etc or post storm events damage assessments. This is particularly useful for managing safety features, such as maintaining fence lines on the cliff top, or diverting the public away from unstable sections of the cliff.

2. **Aerial video survey**; Relatively quick method of taking a risk-free referenced recording of the entire cliff, that can be indicatively compared to earlier recording to identify any large collapses or areas of rapid erosion.

3. **Topographic survey of both beach and cliff top**; provides a geo-referenced survey of both the top and bottom of the cliffs that can be used for comparison purposes, identifying trends or vulnerable sections and determining the rate of erosion.

4. **Photographic cliff survey**; provides a referenced snap-shot in time of the cliff face that can be used for indicative comparisons or to assess the nature of the erosion and rock failure mechanisms.

5. **Aerial photography survey**; provides a risk-free referenced snap shot in time of the cliff line that can be used for indicative comparisons and to determine the rate of erosion.

6. **Terrestrial LIDAR scan of cliffs**; this provides a comprehensive geo-referenced survey of the cliff face, ideal for recording the position of the cliffs at a particular point in time and monitoring erosion. The images can be used to identify fissures, cracks, overhangs or other failure mechanisms within the face of the cliff.

7. **Aerial LIDAR scan of cliffs**; this will provide a risk free comprehensive geo-referenced survey of the cliff line and surrounding topography, recording the position of the cliffs at a particular point in time and monitoring erosion.

8. **Aerial photogrammetry survey**; provides a risk free comprehensive geo-referenced photographic survey of both the cliff line and face that can be used for recording the position of the cliffs at a particular point in time and accurately monitoring erosion. The images can be also used to identify trends, vulnerable sections and determining failure mechanisms.

2.3.1 Monitoring - indicative costs

Table 2-1 below shows the indicative unit costs for each of the monitoring activities considered within this assessment:

Table 2-1: Indicative monitoring costs

Monitoring Event	Indicative Cost*	Duration*	Comment
Walk-over survey / visual inspection;	-	Half day walk-over	Nominal cost to the Council
Aerial video survey	£1-2k	1-day survey	Limited processing required
Topographic survey of both beach and cliff top	£3-5k	1 to 2-day survey 1-week data processing	The beach survey element could potentially be provided by the Environment Agency's Coastal Monitoring program. Beach survey subject to tidal constraints
Photographic cliff survey	£1-2k	1-day survey	Price varies subject to photograph resolution, but limited processing required. Survey subject to tidal constraints
Aerial photography survey	£1-2k	1-day survey	Price varies subject to photograph resolution, but limited processing required
Terrestrial LIDAR scan of cliffs	£7.5k	2-3 days of survey 1-week data processing	Survey subject to tidal constraints
Aerial LIDAR survey of cliffs	£3-5k	1-day survey 1-week data processing	This survey could potentially be provided by the Environment Agency's Coastal Monitoring program
Aerial photogrammetry survey	£10k	1-day survey 1-week data processing	-

*Please note that both the duration and cost of monitoring techniques detailed above have been estimated indicatively based on a 1.3km (approx.) linear cliff survey in a coastal zone.

2.4 Monitoring strategy options

For the purposes of this analysis three potential monitoring strategies have been developed and indicatively priced assuming an implementation date for the works associated with the preferred option of 15 years' time. The three approaches considered and detailed below are:

1. Comprehensive quantitative monitoring program
2. Indicative monitoring program
3. Post-storm monitoring

2.4.1 Comprehensive quantitative monitoring program

The purpose of the comprehensive strategy is to establish a precise baseline of the cliffs position and complete a quantitative record of all future erosion so that an accurate estimate of erosion rates can be determined to fully understand the risks on top of the cliff and inform decision makers with accurate information.

Table 2-2: Comprehensive monitoring program.

Monitoring Technique	Frequency	Unit Cost
Walk-over survey / visual inspection	Every 3 months	-
Topographic survey of both beach and cliff top*	Every 6 month *	£3-5k*
Aerial LIDAR survey of cliffs*	Annual *	£3-5k*
Aerial Photogrammetry Survey	Every 2 years	£10k
Terrestrial LIDAR scan of the cliffs	Every 2 years	£7.5k
Aerial video survey	Every alternate 2 years	£1-2k

*Data may be provided by the Environment Agency's Coastal Monitoring program for nominal costs

2.4.2 Indicative monitoring program

The purpose of the indicative monitoring strategy is to continuously monitor the cliffs, recording the results for comparison purposes to provide an indicative estimate of erosion rates and risks to assets to inform decision makers.

Table 2-3: Indicative monitoring program.

Monitoring Technique	Frequency	Unit Cost
Walk-over survey / visual inspection	Every 3 months	-
Topographic survey of both beach and cliff top*	Every 6 month*	£3-5k*
Aerial LIDAR survey of cliffs*	Annual*	£3-5k*
Aerial video survey	Annual	£1-2k
Photographic cliff survey	Annual	£1-2k

*Data may be provided by the Environment Agency's Coastal Monitoring program for nominal costs

2.4.3 Post-storm monitoring

The purpose of the 'supplementary' post-storm monitoring is to quantify any erosional damage that may have occurred to the cliff following a significant storm event, therefore enabling the monitoring strategy to be re-assessed by decision makers as required.

Table 2-4: Post-storm monitoring

Monitoring Technique	Frequency	Unit Cost
Walk-over survey / visual inspection following a storm event	As required	-
Photographic survey of the cliff face	As required	£1-2k
Aerial photography survey	As required	£1-2k

2.5 Consenting Regime

In order to implement the CMP's preferred management option to slow the rate of erosion by constructing a rock armour sill/revetment in front of the cliff various consents will have to be sought, this will include but not be limited to each of the following:

Table 2-5: Likely consenting regime

Consent /Permit	Statutory Body
Planning Consent	KLWN Borough Council
Marine License	Marine Management Organisation (MMO)
Flood Risk Activity: Environmental Permit	Environment Agency
Landowner Consent	Crown Estates / ANOther.
Wildlife Licencing and Enforcement	MMO / Natural England
SSSI Works Notification (if planning not required)	Natural England

2.6 Environmental

2.6.1 Environmental Designations

As identified in Section 3.1.4 of the main report, the Hunstanton Cliffs and its surrounding area are the subject of a number of international and national environmental designations, as detailed in Table 2-6 below.

Table 2-6: Environmental designations located along cliff frontage

Designation Type	Name
International Designations	
Ramsar Site	The Wash
Special Area of Conservation (SAC)	The Wash and North Norfolk Coast
Special Protection Area (SPA)	The Wash
National Designations	
Site of Special Scientific Interest (SSSI)	Hunstanton Cliffs (land)
	The Wash (marine)

2.6.2 Environmental Impact Assessment

Given the environmentally sensitive nature of the cliff frontage and the number of resulting designations it highly likely that it will be necessary to complete a comprehensive Environmental Impact Assessment (EIA), including a

Habitat Regulation Assessment (HRA), in advance of any coastal protection works being constructed along the frontage.

2.6.3 Indicative EIA Costs

The EIA process and indicative costs are described in Table 2-7 below.

Table 2-7: Indicative EIA costs

Phase	Description	Indicative cost (£k)
Screening	This screening process will both confirm the required consenting regime for the proposed works and confirm with Stakeholders the need to undertake an EIA.	5
Scoping	The scoping assessment will determine (and agree with Stakeholders) the full extent of the EIA and what potential monitoring activities will be required and how long the monitoring period will be.	5
Baseline Monitoring	During the monitoring/survey period all of the required monitoring identified in the scoping stage will be completed to establish a true base-line of the local environment to fully inform the EIA process. It is possible for this monitoring period to be extended across a number of seasons and therefore can be 1-2 years long. The cost is dependent on the nature and extent of the monitoring required.	50-100
EIA	The completion of the environmental impact assessment, where the baseline data will be considered and the scale of the impact of the proposed works will be evaluated and mitigations identified.	50-75
Planning / Consenting	Engagement with consenting bodies, preparation and submission of application and amending any plans to accommodate any planning or consenting constraints.	5-10
Undertake Works	Following receipt of all necessary consents and permissions; complete works in accordance with any constraints outlined by consents.	-
Post-work monitoring	Undertake any post-work monitoring that is specified in either the EIA or planning conditions. (Difficult to gauge at this stage, but some monitoring could be required over a number of years.)	~50+

2.6.4 Indicative EIA timeline

An indicative timeline of this process in relation to the proposed works is detailed below in Table 2-8.

Table 2-8: Indicative EIA timeline

Phase	Screening Assessment	Scoping Assessment	Baseline monitoring	EIA	Planning and Consenting	Undertake works	Post-works monitoring
Timeline (relative to works)	-3 years	-3 years	-3 to -1 years	-1 year	-0.5 years	-	+1 to 5 years

3. Promenade Cost Assessment

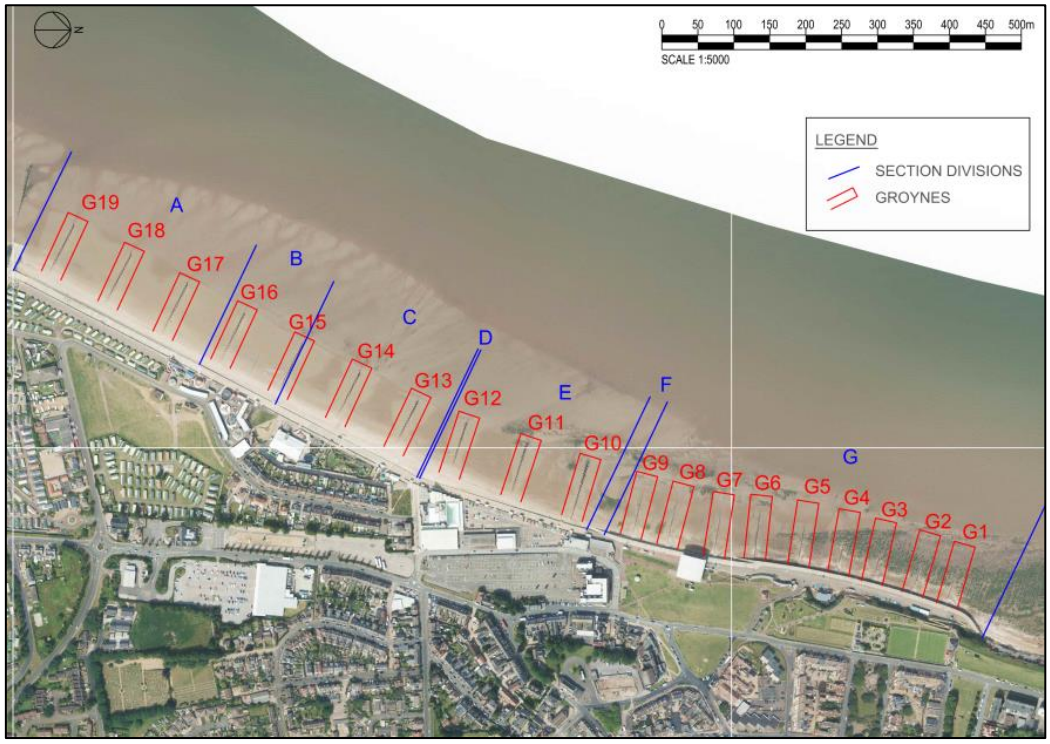
3.1 Introduction

Following a meeting with the BCKLWN Management Team in April 2019, AECOM were instructed to undertake further clarification and analysis of the costs of the promenade resurfacing in Unit B, this section of the addendum details that additional assessment.

Whilst the CMP considered two different types of finish for the promenade re-surfacing, following discussions with KLWN BC only concrete re-facing has been considered within this addendum.

For the purposes of this analysis the promenade has again been split into the sections identified in the main CMP report as identified in Figure 3-1 below:

Figure 3-1: Asset Identification System (Unit B)



3.1.1 Additional Assessment

The additional assessment detailed within this section of the addendum includes:

- Overview of promenade resurfacing costs detailed in the CMP
- Reduced Optimism Bias/ Risk allowance
- Potential efficiencies through combining works across sections
- Alternative timing of works (PV) comparison
- Aesthetic finishes

3.2 CMP Results

Table 3-1 below details the concrete re-surfacing costs of the promenade as identified in the CMP.

Table 3-1: Original CMP promenade re-surfacing costs

Section	Promenade Length (m)	Approx. Area (m^2)	Raw Cost	Preliminaries (35%)	Optimism Bias / Risks (60%)	Total (Cash)
A	292	2978.4	£227,459	£79,611	£184,242	£491,312

B	117	1146.6	£87,662	£30,682	£71,006	£189,350
C	204	2040	£156,536	£54,788	£126,794	£338,118
D	6	60	£5,742	£2,010	£4,651	£12,403
E	260	2600	£199,380	£69,783	£161,498	£430,661
F	33	330	£25,777	£9,022	£20,879	£55,679
G	561	5610	£429,184	£150,214	£347,639	£927,038

Table 3-2 below shows the present value costs associated with undertaking the promenade re-surfacing works in different years in the future, this is calculated utilising DEFRAs recommended discounting factors.

Table 3-2: Original CMP PV Costs

Unit	Year 0	Year 1	Year 5	Year 10	Year 15	Year 35	Year 50
A	£491,312	£474,697	£413,671	£348,300	£293,259	£150,994	£96,917
B	£189,350	£182,947	£159,428	£134,234	£113,022	£58,193	£37,352
C	£338,118	£326,684	£284,686	£239,698	£201,819	£103,913	£66,698
D	£12,403	£11,983	£10,443	£8,792	£7,403	£3,812	£2,447
E	£430,661	£416,098	£362,605	£305,304	£257,058	£132,355	£84,953
F	£55,679	£53,796	£46,880	£39,472	£33,234	£17,112	£10,983
G	£927,038	£895,689	£780,541	£657,195	£553,340	£284,905	£182,870

The CMP assumed that the proposed promenade works would be undertaken at the same time as the encasement of the existing seawall, i.e. when the seawall approaches the end of its serviceable life, and wherever possible when the floodwall was scheduled to be raised and/or when the floodgates are expected to be replaced. Therefore, ensuring that the re-surfacing works would avoid having to include costs for raising and re-sealing the existing floodgates to accommodate the new raised promenade surface.

3.3 Reduced Optimism Bias / Risk (CMP)

Throughout the development of the CMP (a strategic planning document) a 60% optimism bias / risk allowance was applied to all estimated costs in line with DEFRA's guidance for strategic documents. However, this level of contingency could be considered conservative especially where an outline design has been considered, a pricing estimate completed, and the risks can be quantified. In this situation, the DEFRA guidance states that the contingency can be reduced to a low as 30%. Table 3-3 below shows the variance in the cost estimates for each frontage (from the CMP) for different allowances for optimism bias and risk.

Table 3-3: CMP cost variance due to optimism bias/risk allowance

Frontage	Optimism Bias / Risk Allowance			
	60%	50%	40%	30%
A	£491,312	£460,605	£429,898	£399,191
B	£189,350	£177,516	£165,682	£153,847
C	£338,118	£316,985	£295,853	£274,721
D	£12,403	£11,627	£10,852	£10,077
E	£430,661	£403,745	£376,828	£349,912
F	£55,679	£52,199	£48,719	£45,239
G	£927,038	£869,098	£811,158	£753,218

3.4 Combining sections

Following discussions with KLWN BC, it was clear that they would like to improve the public amenity value of the promenade, which could include the re-surfacing of some sections of the promenade in advance of the timings proposed in the CMP. In doing so, it is possible to combine the promenade re-surfacing works of several adjacent sections and benefit from some efficiency savings. However, by adjusting the timings proposed by the CMP it is also possible to incur some additional costs by negating some efficiencies already identified within the CMP. Both the potential efficiencies and additional costs have been summarised below.

Please note that the timings proposed in the CMP were determined for coastal protection purposes, and by adjusting these timing it will potentially jeopardise any funding for the promenade that could be associated with coastal protection.

3.4.1 Efficiencies

Preliminary costs which are nominally assumed to be 35% of the estimated construction costs typically include (but not limited to) the following activities or cost items:

- Consents and Planning
- Design Consultants' fees
- Contractors' fees
- Cost consultants' fees
- Site investigation and survey
- Mobilisation/ Demobilisation
- Environmental mitigation
- Environmental monitoring
- Site supervision
- Early Contractor Involved (ECI)

By undertaking works on the promenade across several adjacent sections simultaneously it is assumed that a number of the above preliminary activities or cost items could be completed more efficiently. As such, it has been assumed that where promenade works take place on adjacent sections simultaneously a 50% saving can be applied to the preliminary costs.

3.4.2 Additional costs

As detailed in Section 3.2, the CMP assumed that the promenade works in each section would be undertaken in conjunction with either the floodwall raising and/or floodgate replacement, therefore avoiding the need to raise and re-seal the existing floodgates to accommodate the new promenade surface.

However, by adjusting the proposed timings of the promenade works in each section it will mean that the works are likely to be out of step with either the floodwall raising and/or floodgate replacement and will therefore result in additional works to raise and re-seal the gates in each section to accommodate the new promenade surface.

This additional cost has been estimated to be 10% of the installed costs of a new floodgate as quoted in the CMP (adjusted to 2019 prices); this equates to £2,375 per floodgate.

Table 3-4: Cost of raising and re-sealing floodgates

Section	Number of floodgates	Rate	Total Cost
A	0	£2,375	£0
B	6	£2,375	£14,250
C	5	£2,375	£11,875
D	1	£2,375	£2,375
E	5	£2,375	£11,875
F	1	£2,375	£2,375
G	0	£2,375	£0

3.5 Combining sections cost results

This section of the addendum details the results of the alternative approach to re-surfacing the promenade, that incorporates both the anticipated efficiencies and estimated additional costs of combining sections.

In addition, this section also shows the resulting PV costs for four different combinations of timing the works (as detailed in Table 3-5), it also details the difference in the results due to the reducing of the optimism bias/ risk allowance from 60% to 30%.

Table 3-5: Alternative works timing combinations

Unit	Combination 1 (year)	Combination 2 (year)	Combination 3 (year)	Combination 4 (year)
A	35	35	35	35
B	35	35	35	35
C	1	5	10	15
D	1	5	10	15
E	1	5	10	15
F	1	5	10	15
G	15	15	15	15

Table 3-6 below shows the estimated cash re-surfacing costs associated with the alternative combined approach.

Table 3-6: Alternative combined re-surfacing costs

Section	Promenade Length (m)	Approx. Area (m^2)	Raw Cost	Floodgate Adjustment Cost	Reduced Preliminaries	Optimism Bias / Risks (60%)	Total (Cash)
A	292	2978.4	£227,459	£0	£39,805	£160,359	£427,623
B	117	1146.6	£87,662	£14,250	£17,835	£71,848	£191,595
C	204	2040	£156,536	£11,875	£29,472	£118,730	£316,613
D	6	60	£5,742	£2,375	£1,420	£5,722	£15,260
E	260	2600	£199,380	£11,875	£36,970	£148,935	£397,160
F	33	330	£25,777	£2,375	£4,927	£19,847	£52,926
G	561	5610	£429,184	£0	£75,107	£302,575	£806,866

Table 3-7 below shows the PV costs associated with undertaking the revised combined promenade re-surfacing works in different generic years in the future. All PV costs have been calculated utilising DEFRAs recommended discounting factors.

Table 3-7: PV Costs of alternative timing combinations (with 60% OB/Risk)

Unit	Year 0	Year 1	Year 5	Year 10	Year 15	Year 35	Year 50
A	£427,623	£413,163	£360,047	£303,150	£255,244	£131,421	£84,354
B	£191,595	£185,116	£161,318	£135,825	£114,361	£58,883	£37,795
C	£316,613	£305,906	£266,579	£224,453	£188,983	£97,304	£62,456
D	£15,260	£14,744	£12,848	£10,818	£9,108	£4,690	£3,010
E	£397,160	£383,729	£334,398	£281,554	£237,061	£122,059	£78,345
F	£52,926	£51,136	£44,562	£37,520	£31,591	£16,266	£10,440
G	£806,866	£779,581	£679,360	£572,003	£481,611	£247,973	£159,165

Table 3-9 3-8 shows the PV costs for associated with each of the four proposed timing combinations with a 60% optimism bias/risk allowance.

Table 3-8: PV Costs of alternative timing combinations (with 60% OB/Risk)

Unit	Combination 1		Combination 2		Combination 3		Combination 4	
	Year	PV Cost	Year	PV Cost	Year	PV Cost	Year	PV Cost
A	35	£131,421	35	£131,421	35	£131,421	35	£131,421
B	35	£58,883	35	£58,883	35	£58,883	35	£58,883

C	1	£305,906	5	£266,579	10	£224,453	15	£188,983
D	1	£14,744	5	£12,848	10	£10,818	15	£9,108
E	1	£383,729	5	£334,398	10	£281,554	15	£237,061
F	1	£51,136	5	£44,562	10	£37,520	15	£31,591
G	15	£481,611	15	£481,611	15	£481,611	15	£471,802

Table 3-9 shows the PV costs for associated with each of the four proposed timing combinations with a 30% optimism bias/risk allowance.

Table 3-9: PV Costs of alternative timing combinations (with 30% OB/Risk)

Unit	Combination 1		Combination 2		Combination 3		Combination 4	
	Year	PV Cost	Year	PV Cost	Year	PV Cost	Year	PV Cost
A	35	£106,780	35	£106,780	35	£106,780	35	£106,780
B	35	£47,842	35	£47,842	35	£47,842	35	£47,842
C	1	£248,548	5	£216,596	10	£182,368	15	£153,549
D	1	£11,979	5	£10,439	10	£8,790	15	£7,401
E	1	£311,780	5	£271,698	10	£228,763	15	£192,612
F	1	£41,548	5	£36,207	10	£30,485	15	£25,668
G	15	£449,589	15	£449,589	15	£449,589	15	£383,339

3.6 Aesthetic Finishes

3.6.1 Potential Types of Concrete Finish

Following discussions with KLWN BC, it was clear that they are looking for ways to improve the aesthetic appeal of the promenade as an amenity space. Consequently, AECOM have been instructed to summarise some of the potential ways to improve the appearance of the existing concrete promenade (through re-surfacing) and estimate the indicative cost implications of adopting them.

3.6.1.1 Brushed Finishes

Brushed finishes are the traditional way to finish a concrete hardstanding, various patterns (see Figure 3-2) can be brushed into the surface as the concrete begins to cure. This type of finish serves to not only improve the finish but also to provide a ‘non-slip’ surface for public use.

Figure 3-2: Example brushed finishes

3.6.1.2 Stamped Finishes

Stamped finishes are achieved by pressing a template into the surface of the concrete as it begins to cure, which then leaves a permanent imprint in the surface of the concrete that can form patterns. The complexity and coverage of these patterns will determine the price.

Figure 3-3: Example stamped finishes

3.6.1.3 Coloured Finishes

Coloured concrete finishes can be achieved by adding a coloured pigment to the concrete mix without significantly effecting the surfaces performance. The number of colours and the complexity of the design will ultimately determine the price.

Painted or sprayed concrete could provide a similar finish initially, however, due to the promenade's exposure to wind and wave activity, abrasion from beach material and the expected level of foot traffic, painting or spraying options are unable to provide the required durability for the promenade and have therefore been discounted.

Figure 3-4: Example coloured finishes

3.6.1.4 Concrete slab/paving combination designs

It is possible to incorporate paving designs into a concrete hardstanding (see Figure 3-5), however, this will potentially introduce a durability issue as the paving and the concrete hardstanding will not have the same design life and the join between the two will be a potential weak spot. The nature of the paving slab and the complexity of the design will ultimately determine the price.

Figure 3-5: Example combinational finishes

3.6.1.5 Alternative or patterned jointing

The jointing details of the concrete hardstanding can be designed to create an alternative or patterned finish, however, increasing the number of joints and utilising non-standard shapes for the promenade will potentially

jeopardise both the strength and durability of the finished surface. Again, the complexity of the design will ultimately determine the price.

Figure 3-6: Example of alternative or patterned jointing

3.6.2 Finish Cost Implications

Table 3-10 below shows the approximate cost implications of applying each of the finish types detailed above:

Table 3-10: Finish type cost implications

Finish	Cost Implication	Comment
Brushed	Negligible	Standard finish
Stamped	Approx. 5-10%	Depending on the complexity of the stamp
Coloured Concrete	Approx. 25%	Depends on the number of colours and complexity of design
Concrete slab/ paving combination designs	Approx. 25-50%	Price really depends on complexity of design. Variable durability
Alternative or Patterned Jointing	50%+	Depending on the complexity of the design Potential durability and strength issues

4. Sailing Access – Slipway

4.1 Introduction

The diminished beach levels and exposed rocks on Frontage G adjacent to the existing beach access ramp have been impeding members of the Hunstanton Sailing Club from readily accessing the sea with their boats, dinghies and surf equipment (wind and kite). Following a meeting with the Council's Management Team in April 2019, AECOM were instructed to identify some potential slipway options to improve the sailing access to the sea and provide some indicative pricing to aid the Council's future decision making.

4.1.1 Purpose of this section

This section of the addendum identifies a number of size and layout options for a potential slipway as well as three of the most feasible slipway types for this location. It also provides indicative price estimates for each of the type and size permutations (12 in total).

4.2 Slipway Geometry

The objective is to improve access to the sea from the existing beach access ramp at the top of the beach, Figure 4-1 shows the current situation:

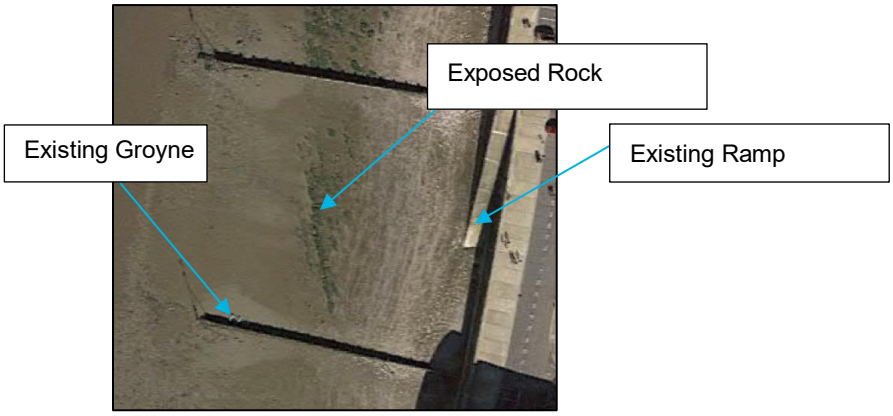


Figure 4-1: Hunstanton's Sailing Club existing beach access

Although no consultation with statutory stakeholders has been undertaken at this stage, it is clear that to benefit any potential consenting applications it will be necessary to demonstrate that the slipway has a negligible impact on the surrounding environment, including coastal processes such as longshore drift. Therefore, to minimise the impact on coastal processes all the options assume that the slipway will be directly adjacent to and will not extend beyond the existing concrete groyne.

4.2.1 Slipway Layout Options

Figure 4-2 below shows the four (A-D) potential slipway layouts that have been considered within this assessment.

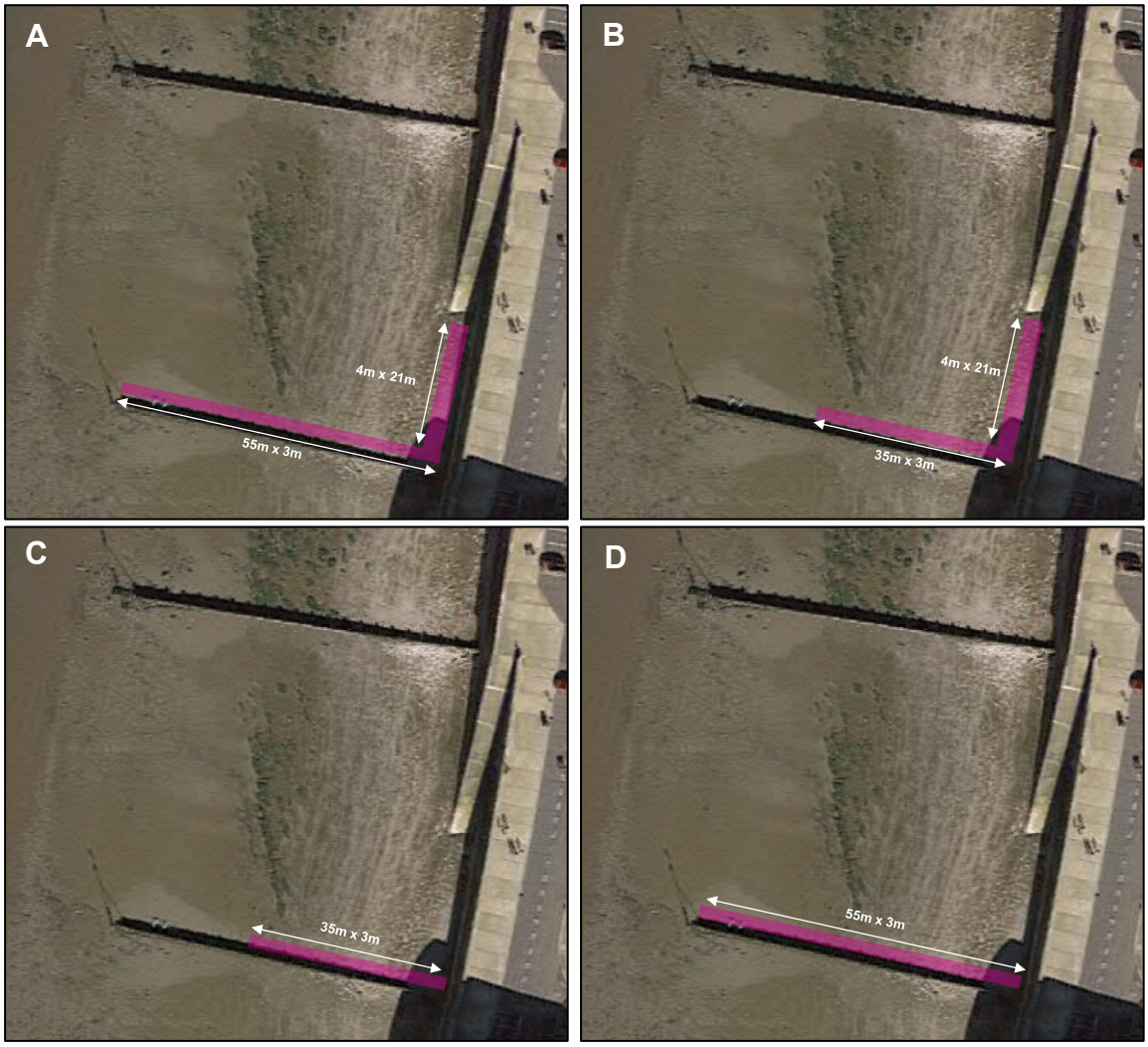


Figure 4-2: Potential slipway layouts (not to scale)

Options A and B both have top sections that extend along the beach to adjoin with the existing ramp. Whereas options C and D only extend across the beach adjacent to the existing groyne.

Options A and D have a slipway length equal to that of the adjacent groyne (55m), whereas options B and C only extent across the beach to just beyond the exposed rock (approximately 35m).

4.2.2 Indicative Dimensions

Table 4-1 below show the indicative dimensions adopted for pricing purposes for each of the layouts identified in section 4.2.1 above.

Table 4-1: Indicative dimensions

Dimension	Layout Option			
	A	B	C	D
Top of beach section				
Width	21m	21m	-	-
Length	4m	4m	-	-
Area	84m^2	84m^2	-	-
Slipway section				
Width	3m	3m	3m	3m
Length	55m	35m	35m	55m
Area	165m^2	105m^2	105m^2	165m^2

4.2.3 Vessel type and Loading constraints of slipway

Neither typical vessel details nor loading constraints have been provided for this assessment, however, it has been assumed that the vessels will be limited in size to small dinghies that can be launched by a hand driven trailer, as no vehicle access has been anticipated on the slipway. However, it should be noted that this assumption may be subject to change in any future design, which will inevitably impact upon the estimated costs.

4.2.4 Consenting regime

To establish a slipway at this location to improve sea access for sailing club members various consents will have to be sought, this will include but not limited to each of the following:

Table 4-2: Potential consenting regime

Consent /Permit	Statutory Body
Planning Consent	KLWN Borough Council
Marine License	Marine Management Organisation (MMO)
Flood Risk Activity: Environmental Permit	Environment Agency
Landowner Consent	Crown Estates / ANOther
Wildlife Licencing and Enforcement	MMO / Natural England
SSSI Works Notification (if planning not required)	Natural England

4.3 Slipway Options

4.3.1 Option 1: In-situ reinforced concrete slipway

Option 1 is to install a traditional in-situ poured reinforced concrete slipway as shown in Figure 4-3.

Figure 4-3: Example in-situ poured RC slipway

Table 4-3: In-situ RC slipway advantages/disadvantages

Advantages	Disadvantages
Very durable, with a long design life	Requires pouring concrete in a tidal zone
Well established/ straight forward construction methodology	Relatively long construction process (by comparison)
Low maintenance	Environmental risks associated with pouring concrete in the tidal zone

4.3.2 Option 2: Pre-cast Concrete Mattress slipway

Option 2 is to install a pre-fabricated concrete mattress slipway as shown in Figure 4-4.

Figure 4-4: Example pre-cast concrete mattress slipway

Table 4-4: Pre-cast concrete mattress slipway advantages/disadvantages

Advantages	Disadvantages
Quick and relatively easy to install	Requires large plant for installation
Relatively durable	Shorter design life compared to solid alternatives
Individual blocks can be easily maintained or replaced	Flexible mattress may move over time
Avoids pouring concrete in the intertidal zone	Potential for mattress to be undermined

4.3.3 Option 3: Pre-cast Concrete slipway

Option 3 is to install a pre-cast concrete slipway as shown in

Figure 4-5.

Figure 4-5: Example pre-cast concrete slipway

Table 4-5: Pre-cast concrete slipway advantages/disadvantages

Advantages	Disadvantages
Quick and relatively easy to install	Requires large plant for installation
Very durable with low maintenance	Potential for precast units to be undermined
Avoids pouring concrete in the intertidal zone	
Factory prepared concrete with a quality guarantee	

4.3.4 Other alternative options

In addition to the three options that have been considered, several other options were considered but for the reasons listed below were not considered further at this stage.

- Fibrous mass concrete slipway; cracking and durability concerns
- Timber decked slipway; durability and maintenance concerns
- Plastic/resin decked slipway; durability and maintenance concerns

4.4 Indicative Cost Assessment

This section details the indicative cost assessment that has been undertaken for each of the potential slipway options identified above.

4.4.1 Pricing Methodology

The cost estimations for capital works were undertaken using the best available information from a variety of sources. In the first instance where costing information was available from previous projects, published data or supplier quotations, these costs were used as a basis to cost the options. In the absence of this information, values have been estimated from rates provided in civil engineering price books (e.g. Spon's Civil Engineering and Highway Works Price Book 2019) and Environmental Agency guidance.

Other assumptions:

- All prices have been uplifted to 2019 prices, using published pricing indices.
- A 35% of constructions costs allowance has been applied cover the costs of preliminaries.
- A 30 % combined optimism Bias and risk allowance has been applied to all estimated costs.

For further details on the adopted costing methodology please refer to the main CMP report.

4.5 Indicative Cost Results

The tables below show the results of the indicative pricing assessment. However, it is worth noting that these are indicative estimates based on general engineering principles using the methodology detailed in Section 4.4.1 and will be subject to change when the slipway is designed.

4.5.1 Indicative Cost Results

Table 4-6: Indicative cost results

Layout	Slipway Options					
	In-situ Reinforced Concrete		Concrete mattress		Precast Concrete	
A	**Raw**	£42,399	**Raw**	£27,756	**Raw**	£37,187
	Prelims	£14,840	**Prelims**	£9,715	**Prelims**	£13,015
	Risk/OB	£17,172	**Risk/OB**	£11,241	**Risk/OB**	£15,061
	Total	£74,410	**Total**	£48,712	**Total**	£65,263
B	**Raw**	£31,433	**Raw**	£21,068	**Raw**	£28,226
	Prelims	£11,001	**Prelims**	£7,374	**Prelims**	£9,879
	Risk/OB	£12,730	**Risk/OB**	£8,533	**Risk/OB**	£11,432
	Total	£55,165	**Total**	£36,974	**Total**	£49,537
C	**Raw**	£19,867	**Raw**	£11,704	**Raw**	£15,681
	Prelims	£6,953	**Prelims**	£4,097	**Prelims**	£5,488
	Risk/OB	£8,046	**Risk/OB**	£4,740	**Risk/OB**	£6,351
	Total	£34,867	**Total**	£20,541	**Total**	£27,521
D	**Raw**	£30,833	**Raw**	£18,393	**Raw**	£24,642
	Prelims	£10,792	**Prelims**	£6,437	**Prelims**	£8,625
	Risk/OB	£12,488	**Risk/OB**	£7,449	**Risk/OB**	£9,980
	Total	£54,113	**Total**	£32,279	**Total**	£43,247

4.5.2 Rationalised Indicative costs

Table 4-7: Rationalised indicative costs

Layout	Slipway Options					
	In-situ Reinforced Concrete		Concrete mattress		Precast Concrete	
A	**Total**	**£74.4k**	**Total**	**£48.7k**	**Total**	**£65.3k**
B	**Total**	**£55.6k**	**Total**	**£37.0k**	**Total**	**£49.5k**
C	**Total**	**£34.9k**	**Total**	**£20.5k**	**Total**	**£27.5k**
D	**Total**	**£54.1k**	**Total**	**£32.3k**	**Total**	**£43.2k**

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