

**ASEA Ecology Mitigation and Flood Defence Project**

**APPENDIX D**

**RISK REGISTER / OUTPUTS**

Details of the risk register and risk outputs are provided in this appendix as supporting information to the OBC.

The project has been subject to the risk management processes and techniques described in Environment Agency Operational Instruction 152\_10 'Manual of Technical Guidance for Risk Management in ncpms Projects'. Risks were identified by the project team at progress meetings and at a dedicated risk workshop on 15<sup>th</sup> May 2017 attended by the Environment Agency, Bristol City Council and South Gloucestershire Council project leads.

Mitigation measures have been identified and as far as possible incorporated into the scheme proposals. Residual risks after mitigation have been quantified through team discussion and analysis using rates provided by the ESE Contractor. Enclosed within this appendix are the following files developed for use with the Palisade Decision Tools @Risk Software. The software has allowed multiple project outcome scenarios to be simulated and output from this has been used to determine risk budgets for incorporation into the economic assessment.

**Table 1 List of Risk Management Files**

Title/File name	Details
'IMSW002194-CH2-000-000-RA-GEN-0002'	Main risk register. Identifies key project risks, together with their probability of occurrence and consequences of them coming to fruition. Mitigation measures are shown. The residual risks are re-evaluated post-mitigation and quantified in terms of 'Least Cost', 'Most Likely', and 'Maximum Cost'.
'IMSW002194-CH2-000-000-RA-GEN-0004'	The Monte-Carlo risk simulation output file based on analysis of the risk register

At this stage of project development, all of the quantified risks are allocated to the client, and the results are presented in terms of 'All Risks Excluding Big 7', as required by the Operational Instruction. There are a number of Contractor Risks relating to Weather and Flooding, but allowance for these has been made within the ESE Contractor's costed working methodology, so are not quantified in the risk register.

A selection of the risk output is shown on the following pages. Key data taken through to the economic assessment are:

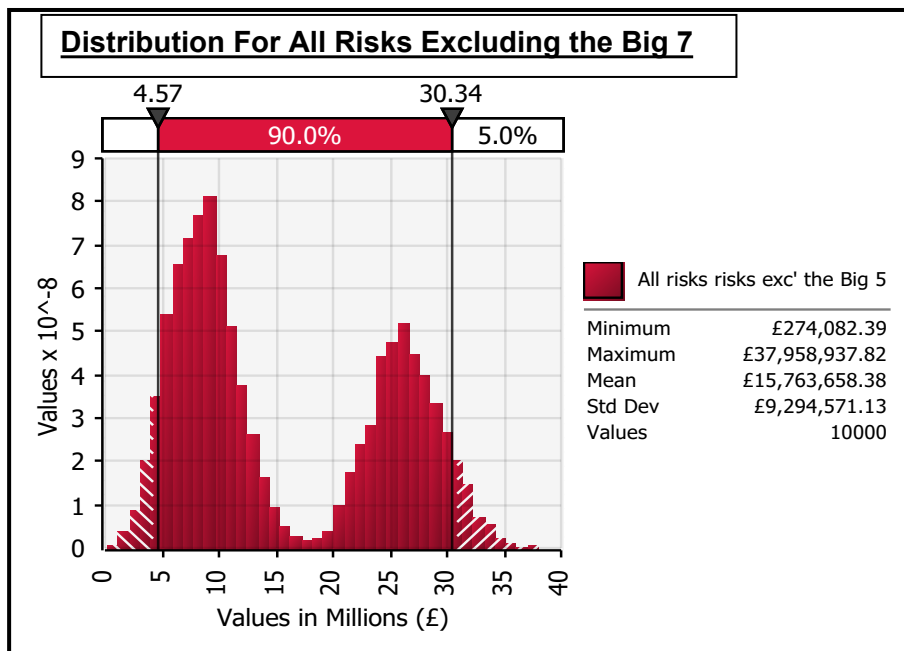
- All Risks Excluding Big 7
  - 50%ile = £11.5M
  - 95%ile = £30.3M

In Table 2 (next page) the key project risks are listed and in Table 3 the full list of main risks, taken from the risk register. In Table 4 the consideration of Optimism Bias is presented.

**Table 2 Ranked List of Key Project Risks**

Rank	Risk ID	Mean Simulation Risk Value (£k)	Risk Item
1	Risk ID30	17938	Project is required to install piles from the railway due to environmental constraints. NR object to scheme proposals. Approval to work on NR land is initially refused. Effort and staff time to manage stakeholder engagement is higher than planned. Impact on construction costs due to programme delays and onerous conditions. Design rework.
2	Risk ID25	3690	Need for extensive rock armour
3	Risk ID13	3203	Influential stakeholder(s) object to scheme proposals. Planning, WFD compliance, EA Environmental Consent, End-user sign-off or other consent is refused due to disagreement with stakeholders on the nature or visual appearance of the scheme, environmental impact, extent of mitigation or other reasons. or stakeholders require additional data and/or analysis to enable consent. Effort and staff time to manage stakeholder engagement is higher than planned. Impact on Construction phase costs due to programme delays, additional capital works or onerous conditions.
4	Risk ID41	1640	Local source of suitable fill material cannot be found or remote sources of material cannot be provided free from cost of transportation
5	Risk ID6	1602	Adverse Weather Conditions delaying scheme construction - prolonged wet or cold conditions (this item does not account for flooding, see item 10)
6	Risk ID17	1550	Unable to agree boundary or influence of SPA with NE. NE or other stakeholders demand intertidal compensation habitat to be provided by the scheme. Application of onerous conditions where working close to the SPA boundary
7	Risk ID24	1384	Design change to avoid archaeology or to avoid heritage assets
8	Risk ID26	1312	Purpose of habitat areas changes to full or partial public access nature reserve. Significant changes to footpaths
9	Risk ID23	1128	Stakeholder feedback during detailed design requires incorporation of more expensive defence-types, habitat types or accommodation works in order to gain approvals and consents, or to satisfy consent conditions. Project is required to take on existing assets (eg. Cotteralls Pill)
10	Risk ID38	1025	Under-estimation of compensation budget for construction-related or permanent provable losses
11	Risk ID14	846	Discovery of significant archaeology or heritage assets in scheme footprint
12	Risk ID15	846	Discovery of unexpected or unrecorded protected or rare species in scheme footprint or greater than expected effort required to achieve planned mitigation
13	Risk ID5	808	Unsuitability of site-won soil for reuse in construction or need for soil treatment
14	Risk ID8	732	Discovery of UXO
15	Risk ID10	641	Flooding over the working area, but less than a 1:10 probability event, which is covered by Major Risk B7-2- Loss of material, degradation, replacement and clean-up
16	Risk ID18	513	Project is unable to identify an operator for habitat areas, or agree terms of use, possible management costs
17	Risk ID7	440	Discovery of unknown services affecting scheme design and/or injury to personnel
18	Risk ID11	320	Need for maintaining current SoP during construction phase not properly understood. Damage to completed flood defences after contractual completion but prior to establishment of vegetation
19	Risk ID2	303	Discovery of contaminated land in the port and other historic industrial areas of the project, landfill areas, together with contamination on or on adjacent to railway land. Contaminants (eg. asbestos, hydrocarbons) in areas proposed for piling or excavation works
20	Risk ID4	225	Unforeseen hard ground or obstructions (eg. gravel lenses, buried structures, buried rock armour or railway ballast) affecting construction of foundations (eg. pile installation)

Rank	Risk ID	Mean Simulation Risk Value (£k)	Risk Item
21	Risk ID3	220	Discovery of unexpectedly soft, weak or permeable ground conditions in the coastal floodplain or in the existing defences, affecting foundation design and construction methodology
22	Risk ID36	211	Land access difficulties including Bristol Port (access to works and procurement of site compounds).
23	Risk ID19	205	Insufficient natural supply of fresh water to wetland scrapes and ponds
24	Risk ID42	205	Adequacy of Site Information. Project is unable to transfer risk to contractor
25	Risk ID16	51	Discovery of unforeseen invasive species in scheme footprint or greater than expected effort required to achieve mitigation
26	Risk ID27	51	Increased footprint and changes to nature of flood defences from existing arrangements increases maintenance and requires new specialist equipment to enable safe maintenance



Statistics	
Minimum	£274,082
Maximum	£37,958,938
Mean	£15,763,658
Std Dev	£9,294,571
Variance	8.63891E+13
Skewness	0.377932895
Kurtosis	1.558161789
Median	£11,461,541
Mode	£7,815,320
Left X	£4,566,509
Left P	5%
Right X	£30,341,090
Right P	95%
Diff X	£25,774,580
Diff P	90%
#Errors	0
Filter Min	Off
Filter Max	Off
#Filtered	0

Table 3 Key Risks			Probability	Cost Impact	Time Impact	
		Consequence				
1	Discovery of contaminated land in the port and other historic industrial areas of the project, landfill areas, together with contamination on or on adjacent to railway land. Contaminants (eg. asbestos, hydrocarbons) in areas proposed for piling or excavation works	<p>Safety/Health - Operational staff or the public could suffer burns or respiratory problems, or action may be required to remove material from site tip in accordance with a previously unplanned or more expensive safe method of working</p> <p>Reputation - Discovery of contaminated material may alarm the public and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Discovery of contaminants could lead to delay as a safe method of working is identified and agreed. Safe method may be more time consuming.</p> <p>Cost - Delays and more complex and expensive method of working or on-site treatment would lead to additional costs. Increased cost of transport and disposal at appropriately licensed tip facility.</p>	Treat on site or remove to licensed tip	VL	V H	VL
2	Discovery of unexpectedly soft, weak or permeable ground conditions in the coastal floodplain or in the existing defences, affecting foundation design and construction methodology	<p>Delay to Programme - Discovery of soft ground could lead to delay as an alternative alignment, source of material, foundation design or method of working is identified and agreed. Possible need for soil treatment. These alternatives may be more time consuming to deliver.</p> <p>Cost - Delays and more complex and expensive design or method of working would lead to additional costs. Increased cost of materials, plant and labour to account for changed design.</p>	Assumed not yet included in scheme cost estimate. Excavate and replace with additional Imported material from remote site or improve in-situ	M	H	VL
3	Unforeseen hard ground or obstructions (e.g.. gravel lenses, buried structures, buried rock armour or railway ballast) affecting construction of foundations (eg. pile installation	<p>Delay to Programme - Discovery of hard ground or obstructions could lead to delay as an alternative alignment, source of material, foundation design or method of working is identified and agreed. These alternatives may be more time consuming to deliver.</p> <p>Cost - Delays and more complex and expensive design or method of working would lead to additional costs. Increased cost of materials, plant and labour to account for changed design.</p>	Excavate and remove obstructions	M	H	VL
4	Unsuitability of site-won soil for reuse in construction or need for soil treatment	<p>Delay to Programme - Discovery that excavated soil is unsuitable for use in bank construction could lead to delay as alternative source and disposal sites re found, or a change to the methodology of working with existing material is agreed. Alternative method may be more time consuming.</p> <p>Cost - Delays, or more complex and expensive method of working would lead to additional costs</p>	Ground investigation. Seek alternative sources of material. Extend testing to off-site sources. Excavate and replace with additional Imported material from alternative local site or improve in-situ	M	H	VL
5	Adverse Weather Conditions delaying scheme construction - prolonged wet or cold	Safety/Health - Operational staff could suffer from long working periods in cold or wet conditions, leading to mitigation in the form of reduced working	Aim to construct earthworks in dryer months. Build in productivity and	M	V H	H

Table 3 Key Risks			Probability	Cost Impact	Time Impact
	Consequence	Mitigation			
	conditions (this item does not account for flooding, see item 10)	hours. Delay to Programme - Wet or cold weather could obstruct some construction activities (eg. surface water flooding preventing access, wet weather affecting earthworks or cold weather affecting concrete and brickwork). Cost - Delays could cause increased cost of standing plant and labour.			
6	Discovery of unknown services affecting scheme design and/or injury to personnel	Safety/Health - Operational staff or the public could suffer as a result of a services strike (burns, explosion, sewage discharge), or action may be required to mitigate in accordance with a previously unplanned or more expensive safe method of working Reputation - Discovery of unrecorded services or a services strike may alarm the public and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Discovery of unrecorded services could lead to delay as a diversion is put in place or a safe method of working is identified and agreed. Safe method may be more time consuming. Cost - Delays, diversions or more complex and expensive method of working would lead to additional costs.	L	V H	VL
7	Discovery of UXO	Safety/Health - Operational staff or the public could suffer as a result of an explosion, or action may be required to mitigate in accordance with a previously unplanned or more expensive safe method of working Reputation - Discovery of unrecorded UXO may alarm the public and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Discovery of unrecorded UXO could lead to delay as a safe recovery or clearance is put in place or a safe method of working is identified and agreed. Safe method may be more time consuming. Cost - Delays or more complex and expensive method of working would lead to additional costs. Cost of UXO clearance.	L	V H	VL
8	Flooding over the working area, but less than a 1:10 probability event, which is covered by Major Risk B7-2- Loss of material, degradation, replacement and clean-up	Safety/Health - Operational staff could be forced to evacuate the working area in flooding conditions, leading to reduced working hours Reputation - Flooding may alarm the public and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Flooding could obstruct some construction activities (eg. flooding preventing access, degradation of earthworks) Cost - Delays could cause increased cost of standing plant and labour.	L	V H	H

Table 3 Key Risks			Probability	Cost Impact	Time Impact	
		Consequence				
		Flooding could cause loss or damage to materials.				
9	Need for maintaining current SoP during construction phase not properly understood. Damage to completed flood defences after contractual completion but prior to establishment of vegetation	<p>Delays to programme - EA Asset Protection will expect current SoPs to be maintained by the contractor during the construction period. If this is not fully understood by the contractor, then this issue could lead to a reduction in Sop or delays</p> <p>Cost - Delays or change to construction methodology or rework could lead to increased cost.</p>	Ensure ESE contractor and tendering permanent works contractors understand the requirements of the scheme. Assumed not yet included in scheme cost estimate. Allow for reduced productivity in programme and budget	L	V H	VL
10	Influential stakeholder(s) object to scheme proposals. Planning, WFD compliance, EA Environmental Consent, End-user sign-off or other consent is refused due to disagreement with stakeholders on the nature or visual appearance of the scheme, environmental impact, extent of mitigation or other reasons. or stakeholders require additional data and/or analysis to enable consent. Effort and staff time to manage stakeholder engagement is higher than planned. Impact on Construction phase costs due to programme delays, additional capital works or onerous conditions	<p>Reputation - Disputes with stakeholders could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty as to whether the project will proceed. Disputes could obstruct consenting, and thus delay commencement on site. Attempts to resolve disputes may require additional design work, data collection and analysis. Delay to programme to prepare statutory EIA &amp; planning application</p> <p>Cost - Delays in obtaining consents or in agreeing designs could cause increased design costs or construction costs of standing plant and labour. Cost due to redesign of options or appealing decision</p>	Clarify uncertainties & scheme details with NE, SGC, BCC, HE, IDB and others, prior to submitting formal planning application. Implement a staged or Iterative design approach to ensure project is 'right-first-time' on submission of consent applications and at start of construction. Allow for delays to the overall project, and additional design and consultation costs. Note other items linking to this key risk	H	V H	V H
11	Discovery of significant archaeology or heritage assets in scheme footprint	<p>Delay to Programme - Discovery of protective species could lead to delay as an appropriate method of working or translocation is identified and agreed with biodiversity stakeholders. Agreed method may be more time consuming.</p> <p>Cost - Delays and more complex and expensive method of working or translocation would lead to additional costs. Additional analysis and reporting.</p>	Archaeological desk study completed at appraisal stage. Geotechnical investigations have included archaeological watching brief. Further site investigations planned in detailed design. Allow for cost and cost of delay due to unforeseen archaeology in risk budget. Warning - overall scheme cost estimate may not yet allow for archaeological supervision costs	H	V H	VL
12	Discovery of unexpected or unrecorded protected or rare species in scheme footprint or greater than expected effort required to achieve planned mitigation	<p>Delay to Programme - Discovery of protective species could lead to delay as an appropriate method of working or translocation is identified and agreed with biodiversity stakeholders. Agreed method may be more time consuming.</p> <p>Cost - Delays and more complex and expensive method of working or</p>	Carry out comprehensive protected species surveys and continue to liaise with NE and other biodiversity stakeholders. Minimise scheme footprint on known habitats. Allow for cost and cost of delay due to unforeseen	M	V H	VL

Table 3 Key Risks			Probability	Cost Impact	Time Impact
		Consequence			
		translocation would lead to additional costs. Additional analysis and reporting			
		protected species in risk budget. Warning - overall scheme cost estimate may not yet allow for planned protected species mitigation costs. This risk item relates to new protected species encountered post-planning or during construction			
13	Discovery of unforeseen invasive species in scheme footprint or greater than expected effort required to achieve mitigation	<p>Delay to Programme - Discovery of invasive species could lead to delay as an appropriate method of working or disposal is identified and agreed with biodiversity stakeholders. Agreed method may be more time consuming.</p> <p>Cost - Delays and more complex and expensive method of working or disposal would lead to additional costs. Additional analysis and reporting.</p>	Carry out comprehensive invasive species surveys and continue to liaise with NE and other biodiversity stakeholders. Minimise scheme footprint on known habitats. Allow for cost and cost of delay due to unforeseen invasive species in risk budget. Warning - overall scheme cost estimate may not yet allow for planned invasive species mitigation costs. This risk item relates to new invasive species encountered post-planning or during construction	L	M VL
14	Unable to agree boundary or influence of SPA with NE. NE or other stakeholders demand intertidal compensation habitat to be provided by the scheme. Application of onerous conditions when working close to the SPA boundary	<p>Reputation - Disputes with NE could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty in boundaries or need for intertidal mitigation habitat could lead to delayed agreement of HRA and WFD compliance</p> <p>Cost - Resolution of any dispute may require change of alignment of flood defences, change in defence-type, or changes to construction methodology, leading to increased costs</p>	Clarify uncertainties & scheme details with NE and others, prior to submitting formal planning application. Allow for delays to the overall project, and additional design and consultation costs. This item does not include for procurement of additional intertidal habitat	M	V H V H
15	Project is unable to identify an operator for habitat areas, or agree terms of use, possible management costs	<p>Reputation - Disputes with NE over viability of consented habitat if unmanaged could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty in quality and sustainability of habitat. This could lead to delayed agreement of HRA and WFD compliance. If adequate habitat cannot be provided, this could delay the main ASEA project or development within it.</p>	Commence early negotiations with potential site operators. Allow a budget for initial period of monitoring and maintenance. Allow for costs of initial management, monitoring and maintenance	M	VH VL

Table 3 Key Risks			Probability	Cost Impact	Time Impact
		Consequence			
		Cost - Resolution of any dispute may require change of the nature of the habitat, leading to increased costs			
16	Insufficient natural supply of fresh water to wetland scrapes and ponds	<p>Reputation - Disputes with NE over viability of consented habitat if unmanaged could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty in quality and sustainability of habitat. This could lead to delayed agreement of HRA and WFD compliance. If adequate habitat cannot be provided, this could delay the main ASEA project or development within it. Delays as pumping arrangements designed and operation and maintenance regime is agreed.</p> <p>Cost - Resolution of any dispute may require change of the nature of the habitat or additional pumping and associated maintenance, leading to increased costs</p>	Budget for purchasing, installation and operation of pumps post-completion. Allow for costs of pumping, monitoring and maintenance	M	H VL
17	Adequacy of proposed habitat as compensation is questioned by NE and others	<p>Reputation - Disputes with NE over effectiveness and overall area provided of consented habitat if unmanaged could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty in quality and sustainability of habitat. This could lead to delayed agreement of HRA and WFD compliance. If adequate habitat cannot be provided, this could delay the main ASEA project or development within it.</p> <p>Cost - Resolution of any dispute may require change of the nature of the habitat, leading to increased costs</p>	Take a cautious approach to viability of habitat. Procure more than minimum land area for habitat in case some of it does not establish properly. Budget for post-completion purchasing, installation and operation of pumps		
18	Stakeholders demand for project to address groundwater flood risk	<p>Reputation - Disputes with stakeholders over effectiveness of defences could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to uncertainty in quality and sustainability of flood defences. This could lead to delayed planning consent or commencement of construction.</p> <p>Cost - Resolution of any dispute may require change of design, leading to increased costs</p>	Project cannot protect against groundwater flooding due to naturally permeable soils and likely obstructions along defence alignment preventing sheet-pile cutoffs below defences.		
19	Stakeholder feedback during detailed design requires incorporation of more expensive	Reputation - Disputes with stakeholders about finishes or appearance of project could damage long-term relations between organisations. The	Clarify uncertainties & scheme details with NE, SGC, BCC, HE, IDB and	M	VH VL



Table 3 Key Risks			Probability	Cost Impact	Time Impact
	Consequence	Mitigation			
	<p>defence-types, habitat types or accommodation works in order to gain approvals and consents, or to satisfy consent conditions. Project is required to take on existing assets (eg. Cotteralls Pill)</p> <p>general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Delay due to need for redesign work and uncertainty as to whether the project will proceed if it cannot meet newly stated stakeholder requirements. Disputes could obstruct consenting, and thus delay commencement on site. Resolution may require additional design work and consultation.</p> <p>Cost - Delays in obtaining consents or in agreeing designs could cause increased design costs or construction costs of standing plant and labour. Cost of revised defence types could be more expensive.</p>	<p>others, prior to commencing detailed design. Also plan for iteration of options &amp; re-working of some aspect</p>			
20	<p>Design change to avoid archaeology or to avoid heritage assets</p> <p>Delay to Programme - Delay due to time taken to redesign the scheme to avoid archaeology or heritage assets. Disputes over requirements for additional investigation could obstruct consenting, and thus delay commencement on site. Attempts to resolve disputes may require additional design work, data collection and analysis. Delay to programme to prepare statutory EIA &amp; planning application</p> <p>Cost - Delays in obtaining additional survey information, consents or in agreeing designs could cause increased design costs, survey costs or construction costs relating to alternative methodology. Cost due to redesign of options or appealing decision.</p>	<p>Undertake pre-planning geophysical surveys wherever possible. Additional surveys may be required prior to completion of the design for construction.</p>	M	VH	VL
21	<p>Need for extensive rock armour</p> <p>Reputation - Additional rock armouring would impact on the SPA, and likely to be a cause of objection from environmental stakeholder. Disputes with stakeholders about finishes or appearance of project could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations</p> <p>Delay to Programme - Cost of additional rock armouring. Delay due to need for redesign work and uncertainty as to whether the project will proceed if it cannot meet newly stated requirements. Disputes could obstruct consenting, and thus delay commencement on site. Resolution may require additional design work and consultation.</p> <p>Cost - Delays in obtaining consents or in agreeing designs could cause increased design costs or construction costs of standing plant and labour. Cost of revised defence types could be more expensive.</p>	<p>Overtopping analysis indicates that rock armour is not required. Remain alert to potential changes in guidance. Allow for additional design and consenting costs. Also allow for cost of more expensive defences at embankments.</p>	L	VH	VL
22	<p>Purpose of habitat areas changes to full or</p> <p>Delay to programme - delays caused by need to obtain additional funding</p>	<p>Be vigilant to potential scope creep.</p>	M	VH	VL

Table 3 Key Risks			Probability	Cost Impact	Time Impact
		Consequence			
	partial public access nature reserve. Significant changes to footpaths	for additional visitor facilities Cost - Delays in obtaining consents or in agreeing designs could cause increased design costs or construction costs of standing plant and labour. Cost due to redesign of options. Cost of additional visitor facilities	Allow risk budget for additional footpaths, parking, bird-hides, fencing, water control structures, signage, interpretation information, dog-waste bins, etc.		
23	Increased footprint and changes to nature of flood defences from existing arrangements increases maintenance and requires new specialist equipment to enable safe maintenance	Cost - Cost of specialist equipment to be procured by the project	Allow budget for purchasing specialist mowing equipment	VH	M VL
24	NR unable to provide funding contribution	Delay to Programme - If project is developed on the assumption that NR will make a contribution, and it does not, then this could lead to a funding shortfall. NR is subject to a spending review cycle, and their planned study into the Avonmouth and Severn Beach branch line is not due in this spending period. Cost - Cost of items due for NR contribution may need to be funded from the project.	Allow for cost of all railway-related flood defence works within the scheme, assuming no 3rd party funding from NR.		
25	Project is required to install piles from the railway due to environmental constraints. NR object to scheme proposals. Approval to work on NR land is initially refused. Effort and staff time to manage stakeholder engagement is higher than planned. Impact on construction costs due to programme delays and onerous conditions. Design rework.	Reputation - Disputes with NR could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Delay due to uncertainty as to whether the project will proceed. Disputes could obstruct NR technical approvals, and thus delay commencement on site. Attempts to resolve disputes may require additional design work, data collection and analysis. Cost - Delays in obtaining consents or in agreeing designs could cause increased design costs or construction costs of standing plant and labour. Cost due to redesign of options or appealing decision	Clarify uncertainties & scheme details with NR, NE, SGC, BCC, HE, IDB and others, prior to submitting formal planning application. Attempt to install all defences from outside of railway land, thus minimising interface with NR. Implement a staged or iterative design approach to ensure project is 'right-first-time' on submission of consent applications and at start of construction.	M	VH VL
26	NR object to landward defence alignment due to non-protection of railway	Reputation - Disputes with Network Rail and others could damage long-term relations between organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Delay due to uncertainty as to whether the project will proceed. Disputes could obstruct NR approvals process and thus delay commencement on site. Attempts to resolve disputes may require additional design work. Cost - Delays in obtaining approvals or in agreeing designs could cause	Ongoing discussions with NR		

Table 3 Key Risks			Probability	Cost Impact	Time Impact
		Consequence	Mitigation		
		increased design costs or construction costs of standing plant and labour.			
27	Rail network service disruption incident	Cost - NR require EA to operate under a BAPA & APA, requiring EA to provide insurance against NR incurring costs arising from the scheme	Project must enter into APA and BAPA agreements to enable work on or next to the railway		
28	Track possessions / access	Delay to Programme - There is inherent uncertainty in obtaining track possessions. NR reserve the right to cancel these Cost - NR will require the projet to pay for track possessions to allow construction works on or close to the railway. This often requires shift-work and redundancy in personnel and plant to ensure effective handover at the end of the line possession	Appoint a contractor / designer with experience of working in the rail industry, with rail safety and access planning specialists		
29	Land required for habitat not available for use or landowners/tenants make unreasonable conditions on use as habitat. Includes risk of obstruction by manorial rights at Northwick	Reputation - Disputes with landowners could damage long-term relations with client organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Delay due to uncertainty as to whether land purchase or change in tenancy agreements will proceed. Disputes could obstruct technical and environmental approvals, and thus delay design stages or commencement on site. Attempts to resolve disputes may require additional design work, data collection and analysis. Cost - Delays in obtaining agreeing land purchase or tenancy agreements could cause increased design costs or construction costs of standing plant and labour. Land purchase costs could rise if parcels are treated as 'ransom' areas to make the project viable	Project aims to provide more habitat area than the minimum recommended in the Cresswell Report.		
30	Land access difficulties including Bristol Port (access to works and procurement of site compounds)	Delay to Programme - Obstructed access could delay construction activities Cost - Delays could cause increased cost of standing plant and labour	Early liaison with landowners. Issue notice of entry.	M	VH VL
31	Landowners demand design changes to suit their requirements, possibly obstructing access until agreement is reached. Eg. size and height of defences, footpaths, landscaping, property access, views, selection of materials	Reputation - Disputes with landowners could damage long-term relations with client organisations. The general public may become aware and this could manifest as criticism of the scheme and the promoting organisations Delay to Programme - Obstructed access could delay consenting, design and construction activities Cost - Delays could cause increased cost of design and construction			
32	Under-estimation of compensation budget for construction-related or permanent provable losses	Cost - compensation may increase		M	VH VL
33	Unreasonable request for accommodation	Disproportional impacts on Reputation, Cost, Delay to Programme			

<b>Table 3 Key Risks</b>			<b>Probability</b>	<b>Cost Impact</b>	<b>Time Impact</b>
	<b>Consequence</b>	<b>Mitigation</b>			
	works or compensation claim				
34	Local source of suitable fill material cannot be found or remote sources of material cannot be provided free from cost of transportation	Cost - Additional cost of material and transportation from remote site. See also item 5 above	L	H	VL
35	Adequacy of Site Information. Project is unable to transfer risk to contractor	Cost - Project costs may increase if risk has been undervalued or cannot be transferred	M	H	VL
36	Loan from LEP is found not to be interest free	Cost - Value of interest added to project costs			
37	Basis of LEP or FDGIA funding award change	Reputation -delays to funding approvals could impact of reputation Delay to Programme - Obstructed access to funding could delay consenting, design and construction activities Cost - Delays could cause increased cost of design and construction.			
38	Project is expected to fund long-term monitoring and maintenance of Areas 4 & 5	Cost - Value of monitoring and maintenance added to project costs			
39	Waste management regulations change	Cost - Value of additional monitoring and administration added to project costs			
40	EIA regulations change, or need for strategic level EIA	Programme - Delays to consents Cost - Value of re-work of environmental documents			

**Table 4 Optimism Bias factor**

OPTIMISM BIAS FACTOR								
Following the issue of an updated Green Book by HM Treasury in January 2003, Defra issued guidance on the application of changes to economic appraisals of flood and coastal defence projects. This guidance noted:								
"There is a widely recognised tendency for appraisers of all kinds of projects to be overly optimistic in their early assessment of project costs, time scales and benefits, when these are compared with final outturn values. This is termed "Optimism Bias".								
<b>Level of Appraisal</b>								
Has a detailed design been completed in the calculation of option costs?					no			
<b>Starting Value</b>								
Starting Value for Optimism Bias Factor					60%			
Risk components contributing to above factors (% , summing to 100 – see next page for definitions)		Average % for FCD projects	ASEA					
			Mitigation Factor (0-1)	Reason	Average % for THIS Project	Degree of inclusion in MC analysis (0-1)	Comments	Reduced average % for this project
Procurement	Late contractor involvement in design	1	1	ESE contractor involved in project from outline design	0	0	-	0
	Dispute and claims occurred	11	0	Alignment of procurement processes required, risk remains	11	0	-	11
	Other	1	0	No mitigation measures available.	1	0	-	1
Project-specific	Design complexity	4	0.6	Design is not complex. Only complexity is management of Areas 4 and 5	1.6	1	Various design-related risks have been quantified in MC analysis eg Risk ID 13, 19, 25, 26 See Risk ID 17, 30	0
	Degree of innovation	4	0	Uncertainty in Areas 4 and 5 working close to railway and SPA could require innovative methods to be used	4	1		0
	Environmental impact	13	0.8	Minimal environmental impact anticipated.	2.6	1	Risk ID 14-16	0
	Other	9	0	No mitigation measures available	9	0		9
Client specific	Inadequacy of the business case	23	0.8	Robust business case at this stage	4.6	0	Not quantified in MC analysis, but mitigation actions noted	4.6
	Funding availability	2	0.8	Funding available through LEP and FDGIA	0.4	0	Not quantified in MC analysis, but mitigation actions noted	0.4
	Project management team	1	0	Risk remains due to complexity of project (various disciplines, multi-client) GI and other ecological surveys carried out	1	0	Not quantified in MC analysis, but mitigation actions noted	1
	Poor project intelligence	8	0.6	Uncertainty in hydrology for Areas 4 and 5 remains	3.2	1	42	0
	Public relations	5	0.2	Largely supportive, but issues around poplar trees and wall	4	1	13	0
	Environment Site characteristics	4	0	Archaeology remains a risk	4	1	Risk ID 14	0
External influences	Economic	5	0	Brexit uncertainties	5	0	Not quantified in MC analysis, but mitigation actions noted	5
	Legislation/regulations	4	0	Planning consent required, legislation could be changed due to Brexit	4	0	Not quantified in MC analysis, but mitigation actions noted	4
	Technology	4	0	Job creation could be reduced due to technological advances	4	0	Not quantified in MC analysis, but mitigation actions noted	4
	Other	1	0	No mitigation measures available.	1	0		1
<b>TOTAL</b>		<b>100</b>			<b>60.4</b>			<b>41</b>
Optimism Bias Factor to apply to this project					36%	25%		