Project	[redacted]	Date	[redacted]	Site / location	[redacted]	Assessor	[redacted]	Review	Draft A

Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)	Control Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction Ref	Risk Reduction Measures	Implementation Responsibility	Likelihood	Consequence	Residual Risk	Implementation Cost (£)	Implementation Cost (Actual)	Implementation Cost (Actual)	Results
1	9	9	Inundation by the waters of Poppenham Bridge	Geotech	Context - Bridge Pier - Exit / Canary Wharf Pier - > 15m Air Draught - Specimen 2					3	3	9.0		Baseline with no additional risk controls					£0.0	£1,000,000		Baseline Risk
						L1	Major injuries or single fatality	11	Human / Shipping error				1	Assume bridge pier further from authorised channel	[redacted]	3	20%	0%	0.6	£0.0	£1,000,000		9.0
						L2	Multiple fatalities (>1 vessel)	12	Pilot error						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		
						C10	Severe damage to bridge	13	Failure to adhere to local & national regulations / risk controls				2	Bearing displacement within tolerance of design	[redacted]	3	5%	0%	9.0	£0.0	£1,000,000		Baseline Level
						C11	Major impact on the environment with no lasting effects (1 in 3)	14	Mechanical defect / failure				3	Ongoing de-mask behaviour to bridge	[redacted]	3	5%	0%	9.0	£0.0	£1,000,000		Moderate
						C23	Natural adverse activity	15	Result of existing environment 3rd party vessel				4	Clear marking and lighting of bridge orifices	[redacted]	3	20%	0%	9.0	£0.0	£1,000,000		
						C24	Major disruption to riverside operations	16	Congestion in the vicinity of Bridge				5	Enforcement of bridge procedures	[redacted]	3	10%	0%	9.0	£0.0	£1,000,000		Residual Risk
								17	Adverse weather conditions / reduced visibility						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		9.0
								110	Set-aside bridge by the inland waters						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		
								111	Lock bridge						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		Residual Level
								112	Bridge Pier - in the vicinity of the authorised channel				10	Impact protection	[redacted]	3	0%	10%	9.0	£0.0	£1,000,000		
								113	Bridge procedures not in place or followed				11	Advance signs refuse may number more vessels on app port	[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		Moderate
								114	Approach of authorised channel						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		
								115	Movement passage plan						[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		Risk Reduction
															[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		
															[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		Low
															[redacted]	3	0%	0%	9.0	£0.0	£1,000,000		
2	16	16	In the vicinity of Poppenham Bridge	Geotech	Context - Bridge Pier - Exit / Canary Wharf Pier - > 15m Air Draught - Recreational					4	4	4.0		Baseline with no additional risk controls					£0.0	£0.0		Baseline Risk
						L1	Major injuries	11	Human / Shipping error				1	Assume bridge pier further from authorised channel	[redacted]	4	20%	0%	0.8	£0.0	£0.0		4.0
						L2	Multiple fatalities (>1 vessel)	12	Failure to adhere to local & national regulations / risk controls						[redacted]	4	0%	0%	4.0	£0.0	£0.0		
						C17	Minor damage to bridge	13	Mechanical failure / failure				2	Bearing displacement within tolerance of bridge	[redacted]	4	5%	0%	4.0	£0.0	£0.0		Baseline Level
						C21	Significant impact on the environment	14	Result of existing environment 3rd party vessel						[redacted]	4	0%	0%	4.0	£0.0	£0.0		Minor
						C21	Minor localised activity publicity	15	Congestion in the vicinity of Bridge				3	Clear marking and lighting of bridge orifices	[redacted]	4	20%	0%	4.0	£0.0	£0.0		
						C21	Insignificant disruption to marine operations	16	Adverse weather conditions / reduced visibility				4	Adherence to bridge procedures	[redacted]	4	10%	0%	4.0	£0.0	£0.0		Residual Risk
								17	Set-aside bridge by the inland waters						[redacted]	4	0%	0%	4.0	£0.0	£0.0		4.0
								110	Lock bridge						[redacted]	4	0%	0%	4.0	£0.0	£0.0		
								111	Bridge Pier - in the vicinity of the authorised channel						[redacted]	4	0%	0%	4.0	£0.0	£0.0		Residual Level
								112	Bridge procedures not in place or followed				10	Impact protection	[redacted]	4	0%	10%	4.0	£0.0	£0.0		
								113	Approach of authorised channel						[redacted]	4	0%	0%	4.0	£0.0	£0.0		Minor
								114	Movement passage plan						[redacted]	4	0%	0%	4.0	£0.0	£0.0		
															[redacted]	4	0%	0%	4.0	£0.0	£0.0		Risk Reduction
															[redacted]	4	0%	0%	4.0	£0.0	£0.0		
															[redacted]	4	0%	0%	4.0	£0.0	£0.0		Low
															[redacted]	4	0%	0%	4.0	£0.0	£0.0		

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessor	[redacted]	Review	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Baseline Risk - with existing risk controls in place: Consequence	Baseline Risk - with existing risk controls in place: Baseline Risk	Risk Registers: Additional Risk Reduction Measures Required	Risk Registers: Person responsible for Measures	Risk Registers: Date by which measures are to be implemented	Risk Registers: Likelihood (Residual Risk)	Risk Registers: Consequence (Residual Risk)	Risk Registers: Risk Rating (Residual Risk)	Results
3	1	1	Across or ends of Thurrock Bridge	Contract	Contract - Bridge Fire - Fail / Collapse Wharf Fire - + Can Be Caught - Class D/HGV/Ship	C1	Water / fuel in	1.1	Diesel / Dropper error	2.5	4	10.0	Baseline with no additional risk controls			2.5	£XXX,XXX	10.0	Baseline Risk
						C2	Considerably damage to vessel	1.2	Failure to adhere to local & national legislation / risk controls				1. Relocate eastern bridge pier further from active east channel	XX, XX, XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	Risk 3
						C17	Water damage to bridge	1.3	Mechanical defect / failure					XX, XX, XX, XX, XX, XX		5%	5%	2.5	£XXX,XXX	12.5	
						C23	Contract impact on the environment with pollution / long term effects (Tier 2)	1.4	Fire / Explosion arising from with third party vessel	2. Passing distance within narrow all bridge				XX, XX		5%	5%	0.2	£XXX,XXX	0.1	Baseline Level
						C29	Personal adverse publicity	1.5	Congestion in the vicinity of Bridge					XX, XX, XX, XX, XX, XX, XX, XX		5%	5%	0.2	£XXX,XXX	0.1	High
						C31	Implement disruption to marine operations	1.6	Adverse weather conditions / reduced visibility	3. Clear marking and lighting of bridge structures				XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	
								1.10	Set wires bridge to the inlet stream	4. Adherence to bridge procedures				XX, XX, XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	Residual Risk
								1.11	Lock bridge					XX, XX		5%	5%	0.3	£XXX,XXX	1.5	
								1.12	Bridge Pier in the vicinity of the authorised channel					XX, XX		5%	5%	0.3	£XXX,XXX	1.5	1.5
								1.13	Bridge procedure not in place or followed					XX, XX, XX, XX, XX, XX		5%	5%	0.3	£XXX,XXX	1.5	
								1.14	Bad vision of authorised channel	AC Impact protection				XX		5%	10%	1.0	£XXX,XXX	5.0	Residual Level
								1.15	Inner river passage plan	11. Relocate Galaxy Vessel Jetty further from eastern bridge pier				XX, XX, XX, XX, XX, XX		20%	5%	0.5	£XXX,XXX	2.5	Monitor
																5%	5%	0.3	£XXX,XXX	1.5	
																5%	5%	0.3	£XXX,XXX	1.5	Risk Reduction
																5%	5%	0.3	£XXX,XXX	1.5	
																5%	5%	0.3	£XXX,XXX	1.5	
4	4	4	In the vicinity of Thurrock Bridge	Contract	Contract - Bridge Fire - Fail / Collapse Wharf Fire - + Can Be Caught - Cross Port Trade Freight & Warehouse	C2	Water ingress	1.1	Master / Dropper error	4	4	8.0	Basic risk with no additional risk controls			4.0	£XXX,XXX	8.0	Baseline Risk
						C7	Water or superficial damage to vessel	1.2	Error error	1. Relocate eastern bridge pier further from active east channel				XX, XX, XX, XX, XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	Risk 4
						C17	Water damage to bridge	1.3	Failure to adhere to local & national legislation / risk controls					XX, XX, XX, XX, XX, XX, XX, XX		5%	5%	2.5	£XXX,XXX	12.5	
						C23	Contract impact on the environment with pollution / long term effects (Tier 2)	1.4	Mechanical defect / failure	2. Passing distance within narrow all bridge				XX, XX, XX, XX, XX		5%	5%	0.2	£XXX,XXX	0.1	Baseline Level
						C27	Water vessel adverse publicity	1.5	Fire / Explosion arising from with third party vessel					XX, XX, XX, XX, XX, XX, XX, XX		5%	5%	0.2	£XXX,XXX	0.1	Monitor
						C31	Water disruption to marine operations	1.6	Congestion in the vicinity of Bridge	3. Clear marking and lighting of bridge structures				XX, XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	
								1.10	Adverse weather conditions / reduced visibility	4. Adherence to bridge procedures				XX, XX, XX, XX, XX, XX, XX		20%	5%	1.0	£XXX,XXX	5.0	Residual Risk
								1.11	Set wires bridge to the inlet stream					XX, XX, XX		5%	5%	0.3	£XXX,XXX	1.5	
								1.12	Lock bridge					XX, XX, XX		5%	5%	0.3	£XXX,XXX	1.5	3.0
								1.13	Bridge Pier in the vicinity of the authorised channel					XX, XX, XX, XX, XX, XX, XX		5%	5%	0.3	£XXX,XXX	1.5	
								1.14	Bridge procedure not in place or followed	AC Impact protection				XX		5%	10%	1.0	£XXX,XXX	5.0	Residual Level
								1.15	Bad vision of authorised channel	11. Relocate Galaxy Vessel Jetty further from eastern bridge pier				XX, XX, XX, XX, XX, XX, XX		20%	5%	0.5	£XXX,XXX	2.5	Monitor
																5%	5%	0.3	£XXX,XXX	1.5	
																5%	5%	0.3	£XXX,XXX	1.5	Risk Reduction
																5%	5%	0.3	£XXX,XXX	1.5	
																5%	5%	0.3	£XXX,XXX	1.5	

Project:	[illegible]	Status:	[illegible]	Site / Location:	[illegible]	Assessor:	[illegible]	Review Months:	[illegible]	Version:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Reference (If Corresponding)	Credible Hazard Outcome (Consequence)	Hazard Causes (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk measures in place: Likelihood	Baseline Risk - with existing risk measures in place: Consequence	Baseline Risk - with existing risk measures in place: Baseline Risk	Risk Measures	Ref	Risk Measure Description	Risk Measure Effectiveness	Likelihood Reduction	Consequence Reduction	Risk Measure Effectiveness	Risk Measure Cost	Risk Measure Time Scale	Risk Measure Owner	Residual Risk
1	12	10	Within vicinity of Prospect Bridge	Category	124160 - Bridge Pier - East / Canary Wharf Pier - + 15m Air Draught - Recreational / Small Vessels					2.0	2	4.0			Baseline with no additional risk controls					£0.0	£10,000		Baseline Risk
														1	Reduce eastern bridge pier further from authorised channel	11, 12, 13, 14, 15, 16	Low	10%	0%	£2.7	£20,000		3.6
																11, 12, 13, 14, 15, 16	Low	0%	0%	£2.7	£10,000		
														2	Passing apportioned within vicinity of bridge	11, 12, 13, 14	Low	5%	0%	£2.5	£100,000		Baseline Level
																11, 12, 13, 14, 15, 116, 118, 120	Low	0%	0%	£2.5	£20,000		Moderate
														3	Clear marking and lighting of bridge and piers	11, 12, 13, 14	Low	10%	0%	£2.3	£20,000		
														4	Adherence to bridge procedures	11, 12, 13, 14, 116, 118	Low	5%	0%	£2.1	£20,000		Residual Risk
																11, 13	Low	0%	0%	£2.1	£20,000		3.0
																11, 13	Low	0%	0%	£2.1	£40,000		
																11, 12, 13, 14, 116, 118	Low	0%	0%	£2.1	£20,000		
														10	Vessel procedures	116	Low	0%	5%	£2.1	£5,000		Residual Level
														11	Relocate Canary Wharf Jetty further from eastern bridge pier	11, 12, 13, 14, 15, 16	Low	5%	0%	£2.0	£5,000		Minor
																	Low	0%	0%	£2.0	£4,000		
																	Low	0%	0%	£2.0	£3,000		Risk Reduction
																	Low	0%	0%	£2.0	£3,000		2.0
																	Low	0%	0%	£2.0	£6,000		
																	Low	0%	0%	£2.0	£8,000		
2	11	11	Within vicinity of Prospect Bridge	Category	Contact - Bridge Pier - West - + 15m Air Draught - Commercial					1	4	4.0			Baseline with no additional risk controls					£0.0	£1,000,000		Baseline Risk
																11, 12, 13, 114, 115, 116	Low	0%	0%	£0.0	£1,000,000		4.0
														1	Reduce eastern bridge pier further from authorised channel	11, 12, 13, 114, 115, 116	Low	10%	0%	£0.0	£1,000,000		
														2	Passing apportioned within vicinity of bridge	11, 12, 13, 14, 15, 116	Low	5%	0%	£0.0	£1,000,000		Baseline Level
														3	Tugs to be made fast over to bridge	11, 12, 13, 14, 15, 16, 115, 116, 118	Low	5%	0%	£0.0	£1,000,000		Minor
														5	Clear marking and lighting of bridge and piers	11, 12, 13, 14, 15, 111	Low	10%	0%	£0.0	£1,000,000		
														4	Adherence to bridge procedures	11, 12, 13, 14, 15, 116, 118	Low	10%	0%	£0.0	£1,000,000		Residual Risk
																11, 13, 14	Low	0%	0%	£0.0	£1,000,000		4.0
																11, 13, 14	Low	0%	0%	£0.0	£1,000,000		
																11, 12, 13, 14, 114, 116	Low	0%	0%	£0.0	£1,000,000		
														10	Vessel procedures	C16	Low	0%	10%	£0.0	£100,000		Residual Level
																11, 13, 14, 115, 116, 116	Low	0%	0%	£0.0	£500,000		Minor
																	Low	0%	0%	£0.0	£400,000		
																	Low	0%	0%	£0.0	£300,000		Risk Reduction
																	Low	0%	0%	£0.0	£200,000		4.0
																	Low	0%	0%	£0.0	£100,000		

Project:	[redacted]	Date:	[redacted]	Title / Location:	[redacted]	Assessor:	[redacted]	Review Director:	[redacted]	Revision:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Treatment: Risk Treatment Description	Risk Treatment: Risk Owner (Person Responsible for Implementing Treatment)	Risk Treatment: Likelihood Post Treatment	Risk Treatment: Consequence Post Treatment	Risk Treatment: Risk Rating Post Treatment	Risk Treatment: Additional Treatment Resources	Risk Treatment: Consequence Post Treatment	Risk Treatment: Residual Risk Rating	Results
1	12	11	In the vicinity of Pennycuik Bridge	Contact	Contact - Bridge Parapets - < 22m Air Draught - Pennycuik	C2	Major injuries	C1	Master / Skipper error	3.3	3	9.9	Remove work on additional tree overhangs	[redacted]				[redacted]	[redacted]		Baseline Risk
						C3	Moderate damage to vessel	C2	Failure to adhere to local & national legislation / risk controls				C1, C2, C3, C7, C12, C14	[redacted]	3	3	9	[redacted]	[redacted]	6.3	
						C17	Minor damage to bridge	C3	Mechanical defect / failure				C1, C2, C3, C7, C12, C14	[redacted]	2	3	6	[redacted]	[redacted]	3.3	
						C21	Insignificant impact on the environment	C4	Result of vandalism action with 3rd party vessel				C1, C2, C3, C12	[redacted]	2	3	6	[redacted]	[redacted]	3.3	Residual Level
						C22	Minor litter and vandalism	C5	Navigation in the vicinity of bridge					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
						C23	Insignificant disruption to marine operations	C6	Adverse weather conditions / reduced visibility				C1, C2, C3, C7, C12, C14	[redacted]	2	3	6	[redacted]	[redacted]	3.3	Residual Risk
								C12	Errors in bridge by the watchkeeper					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C13	Lone bridge					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C14	Bridge Plant in the vicinity of the authorised channel					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C15	Bridge procedures not in place or followed					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C16	Restriction of authorised channel					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C20	Incorrect passage plan					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
													10 Impact to shipping	C23	2	3	6	[redacted]	[redacted]	3.3	Residual Level
														C1, C2, C3, C7, C12, C14	3	3	9	[redacted]	[redacted]	6.3	
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	Risk Reduction
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	
4	14	11	In the vicinity of Pennycuik Bridge	Contact	Contact - Bridge Parapets - < 27m Air Draught - Class 6/WC/Obs	C2	Major injuries	C1	Master / Skipper error	3	3	9.9	Base risk with no additional risk controls	[redacted]				[redacted]	[redacted]		Baseline Risk
						C3	Moderate damage to vessel	C2	Failure to adhere to local & national legislation / risk controls				C1, C2, C3, C7, C12, C14	[redacted]	3	3	9	[redacted]	[redacted]	6.3	
						C17	Minor damage to bridge	C3	Mechanical defect / failure				C1, C2, C3, C7, C12, C14	[redacted]	2	3	6	[redacted]	[redacted]	3.3	
						C20	Limited impact on the environment with short term or long term effects (Tier 3)	C4	Result of vandalism action with 3rd party vessel				C1, C2, C3, C7, C12, C14, C15, C16, C20	[redacted]	2	3	6	[redacted]	[redacted]	3.3	Residual Level
						C22	Minor litter and vandalism	C5	Navigation in the vicinity of bridge					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
						C23	Insignificant disruption to marine operations	C6	Adverse weather conditions / reduced visibility				C1, C2, C3, C7, C12, C14	[redacted]	2	3	6	[redacted]	[redacted]	3.3	Residual Risk
								C12	Errors in bridge by the watchkeeper					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C13	Lone bridge					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C14	Bridge Plant in the vicinity of the authorised channel					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C15	Bridge procedures not in place or followed					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C16	Restriction of authorised channel					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
								C20	Incorrect passage plan					[redacted]	3	3	9	[redacted]	[redacted]	6.3	
													10 Impact to shipping	C23	2	3	6	[redacted]	[redacted]	3.3	Residual Level
														C1, C2, C3, C7, C12, C14	3	3	9	[redacted]	[redacted]	6.3	
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	Risk Reduction
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	
														[redacted]	3	3	9	[redacted]	[redacted]	6.3	

Project	[illegible]	Date	[illegible]	Site / Location	[illegible]	Assessor	[illegible]	Approved	Doc R.A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Possible Hazard Outcome (Consequence)		Hazard Causes (Likelihood)		Baseline Risk – with existing risk controls in place			Risk Reduction							Results
										Likelihood	Consequence	Baseline Risk								
						C2	Minor injuries	L1	Master / Skipper error											
						C7	Minor or superficial damage to vessel	L2	Poor vision											
						C17	Minor damage to bridge	L3	Failure to adhere to local & national regulations / risk controls											
						C23	Minor impact on the environment with no lasting effects (Tier 1)	L5	Mechanical defect / failure											
						C27	Minor local adverse publicity	L6	Result of working alone with 3rd party vessel											
						C32	Minor disruption to marine operations	L8	Complacency in the vicinity of Bridge											
								L9	Adverse weather conditions / reduced visibility											
								L10	Set wire bridge for the tidal stream											
								L11	Limit bridge											
								L12	Bridge Piers in the vicinity of the authorised channel											
								L13	Bridge procedures not in place or followed											
								L14	Restriction of authorised channel											
								L15	Incorrect passage plan											
						C2	Minor injuries	L1	Master / Skipper error											
						C7	Minor or superficial damage to vessel	L2	Failure to adhere to local & national regulations / risk controls											
						C18	Insignificant cost or no damage to bridge	L4	Inexperience of mechanical staff crew on the Field Trainer											
						C23	Insignificant impact on the environment	L5	Mechanical defect / failure											
						C27	Minor local adverse publicity	L6	Result of working alone with 3rd party vessel											
						C31	Insignificant disruption to marine operations	L8	Complacency in the vicinity of Bridge											
								L9	Adverse weather conditions / reduced visibility											
								L10	Set wire bridge for the tidal stream											
								L11	Limit bridge											
								L12	Bridge Piers in the vicinity of the authorised channel											
								L13	Bridge procedures not in place or followed											
								L14	Restriction of authorised channel											
								L15	Wash from passing river traffic											
								L16	Incorrect passage plan											
								L21	Passing Tow traffic passing through bridge navigating with the tidal stream											

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessors	[redacted]	Revision	Draft A

Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)		Hazard Causes (Likelihood)		Baseline Risk – with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Controls: Risk Control Title / Description	Risk Control Owner	Risk Control Type	Risk Control Effectiveness	Risk Control Cost	Risk Control Time	Risk Control Effectiveness Score	Results
12	9	12	In the vicinity of Haywood Bridge	Vehicle	Contact – Bridge Span – Too Low For Draught - Commercial	C2	Major injuries or multiple fatalities	C1	Human / Human error	3	4	9.0		Resident were not advised of risk controls								Baseline Risk
						C3	Major damage to vessel	C2	Property					C1, C2, C8, C10, C12, C13		9%	0%				9.0	
						C10	Severe damage to bridge	C3	Failure to adhere to local & national legislation / risk controls					C1, C2, C8, C10, C12, C13, C14		4%	0%					
						C11	Limited impact on the environment with short term or long term effects (Tier 1)	C4	Mechanical defect / failure					C1, C2, C8, C10, C13		9%	0%				Baseline Level	
						C12	Impassable adverse publicity	C5	Breach of working patterns with third party vessel				4	Tugs review mapping prior to bridge	C1, C2, C3, C5, C6, C7, C11, C12, C13	10%	0%				3.0	Effectiveness
						C14	Major disruption to marine operations	C8	Navigation in the vicinity of Bridge				5	Clear marking and lighting of bridge and piers	C1, C2, C3, C8, C12	5%	0%					
								C9	Adverse weather conditions / reduced visibility				6	Enforcement speed procedures	C1, C2, C3, C5, C8, C11, C12	20%	0%				2.0	Residual Risk
								C10	Set onto bridge by the tidal stream				7	Increase vessel height	C2, C3, C8	50%	0%					
								C11	Limit bridge				8	Increase number of openings	C2, C3, C8	20%	0%				5.0	
								C12	Bridge procedures not in place or followed				9	Co-ordination with Tower Bridge / adjacent users when required	C2, C3, C5, C8, C10, C11, C12	20%	0%					
								C13	Restriction of authorised channel								0%	0%				Residual Level
								C14	Reversing height of bridge						C2, C3, C8, C10, C12, C13, C14		0%	0%				5.0	Effectiveness
								C15	Restricted passage width								0%	0%				Risk Reduction
																	0%	0%				4.0
13	10	11	In the vicinity of Haywood Bridge	Vessel	Contact – Bridge Span – Too Low For Draught - Maintenance	C2	Major injuries	C1	Master / Human error	2	4	8.0	Baseline with no additional risk controls									Baseline Risk
						C8	Moderate damage to vessel	C2	Failure to adhere to local & national legislation / risk controls					C1, C8, C10, C12, C14		9%	0%				8.0	
						C12	Major damage to bridge	C3	Mechanical defect / failure					C1, C2, C12, C13, C14		9%	0%					
						C22	Insignificant impact on the environment	C4	Weight of loading when not in ballast vessel					C1, C2, C3, C8, C10, C12, C13		9%	0%				Baseline Level	
						C28	Regional adverse publicity	C5	Navigation in the vicinity of Bridge					C1, C2, C3, C8, C10, C12, C13, C14		9%	0%					
						C30	Insignificant disruption to marine operations	C6	Adverse weather conditions / reduced visibility				5	Clear marking and lighting of bridge and piers	C1, C2, C8, C12	5%	0%				Effectiveness	
								C13	Set onto bridge by the tidal stream				6	Enforcement speed procedures	C1, C2, C8, C10, C12, C13	20%	0%					
								C11	Limit bridge				7	Increase vessel height	C2, C8	50%	0%				4.0	Residual Risk
								C12	Bridge procedures not in place or followed				8	Increase number of openings	C2, C8	20%	0%					
								C14	Restriction of authorised channel				9	Co-ordination with Tower Bridge / adjacent users when required	C2, C3, C8, C10, C12	20%	0%					
								C13	Reversing height of bridge								0%	0%				Residual Level
								C15	Restricted passage width						C2, C8, C10, C12, C13		0%	0%				4.0	Effectiveness
																	0%	0%				Risk Reduction
																	0%	0%				3.0

Project		Date		Site / Location		Assessor		Review Date(s)		Revision	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Reduction: Additional Risk Controls / Risk Treatment	Risk Reduction: Responsible Person / Organisation	Risk Reduction: Likelihood	Risk Reduction: Consequence	Risk Reduction: Residual Risk	Risk Reduction: Residual Risk Rank	Risk Reduction: Additional Risk Controls Cost	Results
13	20	20	Is the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge – > 12m for Drought / Commercial RIV/ Other Vessel					3.3	3	9.9		Bareline with no additional risk controls					9211	£300,000	9.9	Baseline Risk
													1	Relocate eastern bridge pier further from authorised channel	11, 12, 13, 113, 122, 124	Low	20%	0%	7.92	£250,000	7.92	9.9
													2	Relocate western bridge pier further from authorised channel	11, 12, 13, 113, 122, 124	Low	20%	0%	8.58	£300,000	8.58	
													3	Raising the lower soffit or vicinity of bridge	11, 12, 13, 18, 124	Low	20%	0%	7.92	£300,000	7.92	Baseline Level
													4	Tugs to be made fast prior to bridge	11, 12, 13, 15, 18, 19, 100, 110, 119	Low	20%	0%	8.58	£300,000	8.58	9.9
													5	Clear marking and lighting of bridge and piers	11, 12, 13, 18, 121	Low	20%	0%	8.58	£400,000	8.58	Minor
													6	Adherence to bridge procedures	11, 12, 13, 18, 123, 124	Low	20%	0%	8.58	£400,000	8.58	Residual Risk
													7	Increase span height	11, 12, 19	Low	10%	0%	3.96	£300,000	3.96	8.6
													8	Increase number of openings	11, 12, 19	Low	10%	0%	3.96	£300,000	3.96	
													9	Co-ordination with Tower Bridge / Alert yacht when inbound	11, 12, 13, 18, 124, 131	Low	10%	0%	3.96	£250,000	3.96	
																Low	0%	0%	3.96	£300,000	3.96	Residual Level
													10	Relocate Canary Wharf jetty further from eastern bridge pier	11, 12, 18, 113, 122, 124	Low	10%	0%	3.96	£300,000	3.96	Minor
																Low	0%	0%	3.96	£300,000	3.96	
																Low	0%	0%	3.96	£300,000	3.96	Risk Reduction
																Low	0%	0%	3.96	£300,000	3.96	8.6
																Low	0%	0%	3.96	£300,000	3.96	
																Low	0%	0%	3.96	£300,000	3.96	
14	11	11	Is the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge – > 12m for Drought / Commercial RIV/ Other Vessel					3.3	3	9.9		Bareline with no additional risk controls					9211	£300,000	9.9	Baseline Risk
													1	Relocate eastern bridge pier further from authorised channel	11, 12, 113, 122, 124	Low	20%	0%	7.92	£250,000	7.92	9.9
													2	Relocate western bridge pier further from authorised channel	11, 12, 113, 122, 124	Low	20%	0%	8.58	£300,000	8.58	
													3	Raising the lower soffit or vicinity of bridge	11, 12, 18, 124	Low	20%	0%	7.92	£300,000	7.92	Baseline Level
													4	Tugs to be made fast prior to bridge	11, 12, 13, 15, 18, 19, 100, 110, 119	Low	20%	0%	8.58	£300,000	8.58	9.9
													5	Clear marking and lighting of bridge and piers	11, 12, 13, 18, 121	Low	20%	0%	8.58	£400,000	8.58	Minor
													6	Adherence to bridge procedures	11, 12, 13, 18, 123, 124	Low	20%	0%	8.58	£400,000	8.58	Residual Risk
													7	Increase span height	11, 12, 19	Low	10%	0%	3.96	£300,000	3.96	8.6
													8	Increase number of openings	11, 12, 19	Low	10%	0%	3.96	£300,000	3.96	
													9	Co-ordination with Tower Bridge / Alert yacht when inbound	11, 12, 13, 18, 124, 131	Low	10%	0%	3.96	£250,000	3.96	
																Low	0%	0%	3.96	£300,000	3.96	Residual Level
													10	Relocate Canary Wharf jetty further from eastern bridge pier	11, 12, 113, 122, 124	Low	10%	0%	3.96	£300,000	3.96	Minor
																Low	0%	0%	3.96	£300,000	3.96	
																Low	0%	0%	3.96	£300,000	3.96	Risk Reduction
																Low	0%	0%	3.96	£300,000	3.96	8.6
																Low	0%	0%	3.96	£300,000	3.96	

Project:	[illegible]	Date:	[illegible]	Title / Location:	[illegible]	Assessor:	Alastair Sharlow	Revision:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Baseline Risk - with existing risk controls in place: Consequence	Baseline Risk - with existing risk controls in place: Baseline Risk	Risk Reduction: Additional Risk Control Measures (ARCMs) Required	Risk Reduction: Probability of Occurrence Reduction	Risk Reduction: Severity Reduction	Risk Reduction: Risk Reduction	Risk Reduction: Residual Risk: Cost of Risk Reduction Measures (£)	Risk Reduction: Residual Risk: Consequence Cost (£)	Risk Reduction: Residual Risk: Residual Risk Value	Results
14	3	3	In the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge - >135m Air Draught - Class 1/HGV Re-/Dir Other Vessel					4	4	8.0								
						C8	Major marine or freight fatality	11	Master / Steersman error				1	Assume with no additional risk controls					£0	£100,000	£0	Baseline Risk
						C9	Major loss or damage to vessel	12	Failure to adhere to local & national operational / risk controls				2	Relocate marker buoys per further from authorised channel	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	8.0
						C10	Moderate damage to vessel or key vessel	13	Mechanical failure / failure				3	Relocate marker buoys per further from authorised channel	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	8.0
						C11	Minor damage to vessel or key vessel	14	Poor seamanship / failure				4	Passing displacement restriction of bridge	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	Baseline Level
						C12	Minor impact to the environment with no lasting effects (Tier 1)	15	Breach of existing waters with 3rd party vessels						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		40%	0%	£0	£100,000	£0	8.0
						C13	Reputational adverse publicity	16	Poor / unsafe navigation				5	Clear marking and lighting of bridge and spans	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		10%	0%	£0	£100,000	£0	8.0
						C14	Moderate disruption to marine operations	17	Small vessel not easily visible (e.g. no navigation lights)				6	Adherence to bridge procedures	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		10%	0%	£0	£100,000	£0	Residual Risk
								18	Congestion in the vicinity of Bridge						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	7.0
								19	Adverse weather conditions / reduced visibility						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	7.0
								110	Bridge Piers in the vicinity of the authorised channel						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	7.0
								111	Bridge protection not in place or removed								0%	0%	£0	£100,000	£0	Residual Level
								112	Restriction of authorised channel				11	Vessels Category 6/Port sets further from support bridge pier	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	7.0
								113	Vessels from passing main traffic								0%	0%	£0	£100,000	£0	Moderate
								114	Vessel not correctly secured								0%	0%	£0	£100,000	£0	7.0
								115	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	Risk Reduction
								116	Vessel not correctly secured								0%	0%	£0	£100,000	£0	6.0
								117	Vessel not correctly secured								0%	0%	£0	£100,000	£0	7.0
								118	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	Risk Reduction
								119	Vessel not correctly secured								0%	0%	£0	£100,000	£0	6.0
								120	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	Risk Reduction
								121	Vessel not correctly secured								0%	0%	£0	£100,000	£0	6.0
								122	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	Risk Reduction
								123	Vessel not correctly secured								0%	0%	£0	£100,000	£0	6.0
14	3	3	In the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge - >135m Air Draught - Class 1/HGV Re-/Dir Other Vessel					3	3	6.0								
						C8	Major injuries	11	Master / Steersman error				1	Assume with no additional risk controls					£0	£100,000	£0	Baseline Risk
						C9	Moderate damage to vessel	12	Poor error				2	Relocate eastern bridge pier further from authorised channel	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	6.0
						C10	Moderate damage to vessel or key vessel	13	Failure to adhere to local & national operational / risk controls				3	Relocate eastern bridge pier further from authorised channel	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		20%	0%	£0	£100,000	£0	6.0
						C11	Minor impact to the environment with no lasting effects (Tier 1)	14	Mechanical failure / failure				4	Passing displacement restriction of bridge	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	Baseline Level
						C12	Regional adverse publicity	15	Breach of existing waters with 3rd party vessels						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	6.0
						C13	Moderate disruption to marine operations	16	Poor / unsafe navigation				5	Clear marking and lighting of bridge and spans	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		10%	0%	£0	£100,000	£0	6.0
								17	Small vessel not easily visible (e.g. no navigation lights)				6	Adherence to bridge procedures	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		10%	0%	£0	£100,000	£0	Residual Risk
								18	Congestion in the vicinity of Bridge						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	5.0
								19	Adverse weather conditions / reduced visibility						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	5.0
								110	Bridge Piers in the vicinity of the authorised channel						11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		0%	0%	£0	£100,000	£0	5.0
								111	Bridge protection not in place or removed								0%	0%	£0	£100,000	£0	Residual Level
								112	Restriction of authorised channel				11	Vessels Category 6/Port sets further from eastern bridge pier	11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 23, 24		5%	0%	£0	£100,000	£0	Moderate
								113	Vessels from passing main traffic								0%	0%	£0	£100,000	£0	5.0
								114	Vessel not correctly secured								0%	0%	£0	£100,000	£0	Risk Reduction
								115	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	4.0
								116	Vessel not correctly secured								0%	0%	£0	£100,000	£0	
								117	Vessels from passing through bridge navigation / fixed obstacles								0%	0%	£0	£100,000	£0	

Project		Date		Site / Location		Assessor		Review Date(s)		Checked	

Hazard ID	Baseline Hazard Rate	Residual Hazard Rate	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Treatment							Results
													Risk Treatment ID	Risk Treatment Plan Control (RTP) Measure(s)	Risk Control Plan Implementation Confidence	Likelihood Reduction	Consequence Reduction	Risk Treatment Plan Cost	Likelihood Reduction Percentage	Consequence Reduction Percentage	Residual Risk Score	
12	5	4	Vessel Impact on Proposed Bridge	Collision	Collision as a result of Bridge – x [Dm &/or Draught – Not Met Limit / Vessel Velocity (DW) 100m Vessel	C3	Vessel Impact	11	Master / Skipper error	3.3	3	9.9		Baseline with no additional risk controls				£0	0%		Baseline Risk
						C5	Major damage to vessel	12	Failure to adhere to local & national legislation / risk controls				1	Reinforce upstream bridge pier fenders from upstream channel	12, 13, 110, 112, 114		10%	2%	£0	£0	£0	9.9	
						C12	Minor or superficial damage to secondary vessel	13	Mechanical defect / failure				2	Reinforce downstream bridge pier fenders from upstream channel	12, 13, 110, 112, 114		10%	2%	£0	£0	£0	9.9	
						C21	Insignificant impact on the environment	14	Result of mooring failure with 3rd party vessel				3	Signage displayed within vicinity of bridge	12, 13, 14, 114		5%	0%	£0	£0	£0	9.9	Baseline Level
						C27	Minor local adverse publicity	15	Small vessel not easily visible (e.g. no navigation lights)						11, 13, 14, 19, 110, 113, 119		5%	0%	£0	£0	£0	9.9	Moderate
						C31	Insignificant disruption to the marine operations	16	Congestion in the vicinity of Bridge				5	Clear marking and lighting of bridge arch/piers	11, 13, 15, 111		10%	0%	£0	£0	£0	9.9	
								17	Adverse weather conditions / reduced visibility	3.3	3	9.9	6	Adherence to bridge procedures	11, 12, 13, 113, 119		5%	0%	£0	£0	£0	9.9	Residual Risk
								111	Bridge Plans in the vicinity of the authorised channel						11, 19		5%	0%	£0	£0	£0	9.9	
								113	Bridge procedures not in place or followed						11, 18		5%	0%	£0	£0	£0	9.9	
								114	Restriction of authorised channel						11, 15, 16, 114, 119		5%	0%	£0	£0	£0	9.9	
								115	Vessel Impact on fixed bridge structure								5%	0%	£0	£0	£0	9.9	Residual Level
								117	Vessel movements restricted				11	Increase Caisson Vessel Jetty further from eastern bridge pier	11, 19, 110, 112, 119		10%	5%	£0	£0	£0	9.9	
								121	Waiting for traffic passing through bridge – crossing with the tidal stream								5%	0%	£0	£0	£0	9.9	Minimum
								123	Pipe work near/crossing bridge								5%	0%	£0	£0	£0	9.9	
								129	Visibility restricted by bridge								5%	0%	£0	£0	£0	9.9	Risk Reduction
																	5%	0%	£0	£0	£0	9.9	
32	32	19	Vessel Impact on Proposed Bridge	Grounding	Grounding – x [Dm &/or Draught – Dam Vessel at	C3	Vessel capsize	11	Master / Skipper error	3.3	3	9.9		Baseline with no additional risk controls				£0	0%		Baseline Risk
						C5	Major damage to vessel	12	Navigation error						11, 12, 18, 110, 111, 113		5%	0%	£0	£0	£0	9.9	
						C12	Minor impact on the environment with no lasting effects (Tier 1)	13	Failure to adhere to local & national legislation / risk controls						11, 12, 18, 109, 111, 114		5%	0%	£0	£0	£0	9.9	
						C29	National adverse publicity	15	Mechanical defect / failure				3	Signage displayed within vicinity of bridge	11, 13, 18, 18, 114		5%	0%	£0	£0	£0	9.9	Baseline Level
						C34	Major disruption to marine operations	16	Result of mooring failure with 3rd party vessel				4	Signage displayed within vicinity of bridge	11, 13, 18, 19, 111, 113, 119		10%	0%	£0	£0	£0	9.9	Minor
								18	Congestion in the vicinity of Bridge				5	Clear marking and lighting of bridge arch/piers	11, 13, 18, 111		5%	0%	£0	£0	£0	9.9	
								19	Adverse weather conditions / reduced visibility				6	Adherence to bridge procedures	11, 12, 13, 18, 113, 119		10%	0%	£0	£0	£0	9.9	Residual Risk
								111	Lock ramps				7	Increase size to 21	11, 12, 18		10%	0%	£0	£0	£0	9.9	
								112	Bridge Plans in the vicinity of the authorised channel				8	Increase number of openings	11, 12, 18		5%	0%	£0	£0	£0	9.9	
								113	Bridge procedures not in place or followed				9	Co-ordination with Tower Bridge / short vessels while inbound	11, 12, 13, 18, 114, 119		5%	0%	£0	£0	£0	9.9	
								114	Restriction of authorised channel								5%	0%	£0	£0	£0	9.9	Residual Level
								115	Navigating height of tide						11, 12, 18, 110, 111, 119		5%	0%	£0	£0	£0	9.9	
								119	Insufficient passage plan								5%	0%	£0	£0	£0	9.9	Minor
																	5%	0%	£0	£0	£0	9.9	
																	5%	0%	£0	£0	£0	9.9	Risk Reduction
																	5%	0%	£0	£0	£0	9.9	
																	5%	0%	£0	£0	£0	9.9	

Project:	[redacted]	Date:	[redacted]	Site / Location:	[redacted]	Assessor:	[redacted]	Revision:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Causation Hazard Outcome (if Consequence)	Causation Hazard Outcome (if pathway/cause)	Hazard Cause ID (if pathway)	Hazard Cause (if pathway)	Inherent Risk - with existing risk controls in place			Risk Assessment							Results
										Likelihood	Consequence	Inherent Risk	Ref	Additional Risk Controls / Mitigation	Cost of Risk Control (per annum)	Likelihood Reduction	Consequence Reduction	Risk Reduction	Residual Risk Rank (1-5 / 1-5)	Likelihood Reduction Factor (%)	Consequence Reduction Factor (%)	Cumulative Risk Reduction (%)	
10	14	11	In the vicinity of Proposed Bridge	Grounding	Grounding - > 25m Air Draught - Permanent	C1	Minor injuries	L1	Master / Skipper error	3	3	4.0		Residual risk no additional risk controls					250.0	250,000	0.0	Baseline Risk
						C2	Multiple damage to vessel	L2	Failure to adhere to local & national regulations / risk controls				1	Relocate eastern bridge pier further from eastern road channel	£1,1A,1C1,1C2,1C4	Low	10%	0%	225.0	250,000	0.0	4.0
						C2C	Insignificant impact on the environment	L3	Mechanical failure / failure				2	Relocate western bridge pier further from eastern road channel	£1,1A,1C1,1C2,1C4	Low	5%	0%	237.5	250,000	0.0	
						C2D	Minor local adverse publicity	L4	Result of working person work (3rd party cause)				3	Raising bow vessel entry vehicle of bridge	£1,1A,1A,1C4	Low	5%	0%	237.5	£250,000	0.0	Baseline Level
						C2E	Minor disruption to marine operations	L5	Collision in the vicinity of Bridge						£1,1A,1C,1C1,1C2,1C3,1C4,1C5	Low	0%	0%	250.0	£250,000	0.0	Minimum
								L6	Adverse weather conditions / reduced capacity				4	Clear marking and lighting of bridge arch/piers	£1,1A,1C,1C2	Low	5%	0%	237.5	£250,000	0.0	
								L22	Solid bridge				5	Adherence to bridge clearance	£1,1A,1B,1C1,1C2,1C3	Low	10%	0%	225.0	£250,000	0.0	Residual Risk
								L23	Bridge Piers in the vicinity of the watercraft channel				6	Increase vessel height	£1,1A	Low	10%	0%	225.0	£250,000	0.0	
								L24	Bridge arrangement not in place or removed				7	Increase number of openings	£1,1A	Low	5%	0%	237.5	£250,000	0.0	4.0
								L25	Main chain of authorised channel				8	De-commissioned Tower Bridge / adopt permit when required	£1,1A,1B,1A1,1A2	Low	5%	0%	237.5	£250,000	0.0	
								L26	Varying height of tide							Medium	0%	0%	250.0	£250,000	0.0	Residual Level
								L27	Incorrect signage plan						£2,1B,1C1,1C2,1C3	Medium	0%	0%	250.0	£250,000	0.0	Minimum
																Medium	0%	0%	250.0	£250,000	0.0	
																Medium	0%	0%	250.0	£250,000	0.0	Risk Reduction
																Medium	0%	0%	250.0	£250,000	0.0	
																Medium	0%	0%	250.0	£250,000	0.0	
10	9	8	In the vicinity of Proposed Bridge	Grounding	Grounding - > 25m Air Draught - Class 1vessel/Mile	C1	Major injuries	L1	Master / Skipper error	3	3	4.0		Residual risk no additional risk controls					250.0	£250,000	0.0	Baseline Risk
						C2	Multiple damage to vessel	L2	Failure to adhere to local & national regulations / risk controls				1	Relocate eastern bridge pier further from eastern road channel	£1,1A,1C1,1C2,1C4	Low	10%	0%	225.0	£250,000	0.0	4.0
						C2C	Insignificant impact on the environment	L3	Mechanical failure / failure				2	Relocate western bridge pier further from eastern road channel	£1,1A,1C1,1C2,1C4	Low	5%	0%	237.5	£250,000	0.0	
						C2D	Minor local adverse publicity	L4	Result of working person work (3rd party cause)				3	Raising bow vessel entry vehicle of bridge	£1,1A,1A,1C4	Low	5%	0%	237.5	£250,000	0.0	Baseline Level
						C2E	Minor disruption to marine operations	L5	Collision in the vicinity of Bridge						£1,1A,1C,1C1,1C2,1C3,1C4,1C5	Low	0%	0%	250.0	£250,000	0.0	Minimum
								L6	Adverse weather conditions / reduced capacity				4	Clear marking and lighting of bridge arch/piers	£1,1A,1C,1C2	Low	5%	0%	237.5	£250,000	0.0	
								L22	Solid bridge				5	Adherence to bridge clearance	£1,1A,1B,1C1,1C2,1C3	Low	10%	0%	225.0	£250,000	0.0	Residual Risk
								L23	Bridge Piers in the vicinity of the watercraft channel						£2,1B,1C1,1C2,1C3	Medium	0%	0%	250.0	£250,000	0.0	
								L24	Bridge arrangement not in place or removed							Medium	0%	0%	250.0	£250,000	0.0	4.0
								L25	Main chain of authorised channel							Medium	0%	0%	250.0	£250,000	0.0	
								L26	Varying height of tide							Medium	0%	0%	250.0	£250,000	0.0	Residual Level
								L27	Incorrect signage plan				11	Relocate Canary Wharf berth further from eastern bridge pier	£1,1A,1C1,1C2,1C4	Low	0%	0%	262.5	£250,000	0.0	Minimum
																Medium	0%	0%	250.0	£250,000	0.0	
																Medium	0%	0%	250.0	£250,000	0.0	Risk Reduction
																Medium	0%	0%	250.0	£250,000	0.0	
																Medium	0%	0%	250.0	£250,000	0.0	

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessor	[redacted]	Reviewer	[redacted]

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Title	Hazard Category	Hazard Type	Existing Hazard Outcome (Unmitigated)	Existing Hazard Outcome (Unmitigated)	Hazard Cause(s) (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Assessment	Results
11	11	11	[redacted]	Grounding	Grounding – < 15m Air Draught – Arms Port Trade Freight & Merchants					2.5	4	9.0	Baseline risk no additional risk controls	Baseline Risk
						C2	Minor injuries	L1	Human / Operator error				1 Remove access to bridge pier further from authorised channel	9.0
						C7	Minor or superficial damage to vessel	L2	Pilot error				2 Increase exclusion bridge pier further from authorised channel	
						C11	Minor impact on the environment with no lasting effects (Tier 1)	L3	Failure to adhere to local & national regulations / risk controls				3 Fencing disallowed access vicinity of bridge	Residual Level
						C18	Negative Adverse publicity	L5	Mechanical defect / failure					Adequate
						C21	Moderate disruption to marine operations	L6	Result of working alone with 3rd party vessel				4 Clear marking and lighting of bridge arch/piers	
								L8	Congestion in the vicinity of Bridge				5 Adherence to bridge procedures	Residual Risk
								L9	Adverse weather conditions / reduced visibility					
								L11	Limb bridge					
								L12	Bridge Fend- in the vicinity of the authorised channel					
								L13	Bridge procedures not in place or followed					
								L14	Restriction of authorised channel					
								L15	Misjudging height of risk					
								L16	Incorrect passage plan					
12	1	1	[redacted]	Grounding	Grounding – < 15m Air Draught – Recreational / Small Vessels					4	1	4.0	Baseline risk no additional risk controls	Baseline Risk
						C2	Minor injuries	L1	Human / Operator error				1 Relocate support further from authorised channel	4.0
						C7	Minor or superficial damage to vessel	L2	Pilot error				2 Increase exclusion bridge pier further from authorised channel	
						C11	Insignificant impact on the environment	L3	Failure to adhere to local & national regulations / risk controls				3 Fencing disallowed access vicinity of bridge	Residual Level
						C27	Minor local adverse publicity	L5	Mechanical defect / failure					Adequate
						C31	Insignificant disturbance to marine operations	L6	Result of working alone with 3rd party vessel				4 Clear marking and lighting of bridge arch/piers	
								L8	Congestion in the vicinity of Bridge				5 Adherence to bridge procedures	Residual Risk
								L9	Adverse weather conditions / reduced visibility					
								L11	Limb bridge					
								L12	Bridge Fend- in the vicinity of the authorised channel					
								L13	Bridge procedures not in place or followed					
								L14	Restriction of authorised channel					
								L15	Misjudging height of risk					
								L16	Vessel from passing over traffic					
								L17	Incorrect passage plan					

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Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Consequence)	Baseline Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Consequence	Baseline Risk
1	4	4	In the vicinity of Proposed Bridge	Caravan	Caravan - Bridge Pier Strike (Lorry / Abnormal Load) + 20m Air Draught Clearance	10	Major injuries or single fatality	11	Human / Driver error	2	4	8.0
						11	Moderate damage to vessel	12	Poor crew			
						120	Severe damage to bridge	13	Failure to adhere to local & national legislation / risk controls			
						121	Minor impact on the environment such as leaving effects (Cat. 1)	15	Mechanical defect / failure			
						129	National adverse publicity	16	Result of working alone with third party vessel			
						130	Major disruption to marine operations	18	Congestion in the vicinity of Bridge			
								19	Adverse weather conditions / reduced visibility			
								120	Set one bridge by for total closure			
								121	Lorry in bridge			
								122	Bridge Piers in the vicinity of the authorised channel			
								123	Bridge procedures not in place or followed			
								124	Restriction of authorised channel			
								125	Incident damage plan			
4	15	16	In the vicinity of Proposed Bridge	Tankers	Tankers - Bridge Pier Strike (Lorry / Abnormal Load) + 20m Air Draught - Restriction	10	Major injuries	11	Human / Driver error	3	3	9.0
						11	Moderate damage to vessel	12	Failure to adhere to local & national legislation / risk controls			
						117	Minor damage to bridge	15	Mechanical defect / failure			
						120	Major disruption to the environment	19	Result of working alone with third party vessel			
						127	Minor local adverse publicity	18	Congestion in the vicinity of Bridge			
						130	Major health & safety incidents to marine operations	19	Adverse weather conditions / reduced visibility			
								120	Set one bridge by for total closure			
								121	Lorry in bridge			
								122	Bridge Piers in the vicinity of the authorised channel			
								123	Bridge procedures not in place or followed			
								124	Restriction of authorised channel			
								125	Incident damage plan			

Risk Reduction	Additional Risk Controls (For Reference)	Control Effectiveness Assessment	Likelihood	Consequence	Residual Risk	Results
	Baseline with no additional risk controls					Baseline Risk
1	Vessels warned to stay over further from southern bank (marker buoys)	11, 12, 13, 120, 121, 122	2	4	8.0	
		11, 12, 13, 120, 121, 122	2	4	8.0	
2	Passing over speed within vicinity of bridge	11, 12, 13, 18, 124	2	4	8.0	Baseline Level
3	Tugs to be made available as per risk assessment	11, 12, 13, 15, 18, 121, 122, 123	2	4	8.0	Maintenance
4	Clear marking and lighting of bridge and piers	11, 12, 15, 18, 121	2	4	8.0	
5	Adherence to bridge procedures	11, 12, 13, 18, 124, 125	2	4	8.0	Residual Risk
		11, 12, 18	2	4	8.0	
		11, 12, 18	2	4	8.0	
		11, 12, 13, 18, 124, 125	2	4	8.0	
10	Impact protection	120	2	4	8.0	Residual Level
11	Vessels Caravan Wharf sets further from eastern embankment	11, 12, 18, 120, 121, 123	2	4	8.0	Maintenance
			2	4	8.0	
			2	4	8.0	Risk Reduction
			2	4	8.0	
			2	4	8.0	
			2	4	8.0	
	Baseline with no additional risk controls					Baseline Risk
1	Vessels warned to stay over further from southern bank (marker buoys)	11, 18, 120, 121, 123	3	3	9.0	
		11, 18, 120, 121, 123	3	3	9.0	
2	Passing over speed within vicinity of bridge	11, 18, 18, 124	3	3	9.0	Baseline Level
		11, 12, 13, 18, 124, 125	3	3	9.0	Maint.
3	Clear marking and lighting of bridge and piers	11, 18, 18, 123	3	3	9.0	
5	Adherence to bridge procedures	11, 18, 18, 123, 125	3	3	9.0	Residual Risk
		11, 18	3	3	9.0	
		11, 18	3	3	9.0	
		11, 12, 18, 124, 125	3	3	9.0	
10	Impact protection	120	3	3	9.0	Residual Level
11	Vessels Caravan Wharf sets further from eastern embankment	11, 18, 120, 121, 123	3	3	9.0	Maint.
			3	3	9.0	
			3	3	9.0	Risk Reduction
			3	3	9.0	
			3	3	9.0	

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Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Existing Hazard Outcome (s) [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Element (s) [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Treatment: No.	Additional Risk Treatment and Measures	Control Measure Implementation Confidence	Likelihood Reduction	Consequence Reduction	Residual Likelihood	Residual Consequence	Residual Risk Value	Results
3	1	1	Is the owner of Proposed Bridge	Contract	Contract - Bridge Fire - Fire / Canary Wharf Fire - / Climate Drought - Dark/Lit/Night					3.1	3	18.5		Residual with no additional risk controls				3.2			Baseline Risk
						C3	Major injuries	11	Human / Shipping error				1	Relocate eastern bridge pier further from authorised channel	11, 18, 110, 112, 114	25%	0%	3.6			Medium
						C5	Moderate damage to vessel	13	Failure to adhere to local & national regulations / risk controls						11, 18, 110, 112, 117	0%	0%	3.9			
						C17	Minor damage to bridge	11	Mechanical defect / failure				4	Placing situational safety survey of bridge	11, 16, 18, 119	50%	0%	3.2			Baseline Level
						C21	Vessel impact on the eastern most side to varying affects (Tier 1)	16	Result of working vessel with 3rd party vessel						11, 12, 16, 18, 110, 112, 119	0%	0%	4.2			High
						C25	External adverse economy	18	Congestion in the vicinity of Bridge				5	Clear marking and lighting of bridge arch/piers	11, 16, 18, 111	50%	0%	4.6			
						C31	Moderate deviation to marine operations	19	Adverse weather conditions / reduced visibility				6	Adherence to bridge procedures	11, 12, 18, 114, 119	50%	0%	3.9			Residual Risk
								110	Set vessels bridge by the navigation team						11, 18	0%	0%	3.8			
								111	Lifted bridge						11, 18	0%	0%	3.8			3.2
								112	Bridge Piers in the vicinity of the authorised channel						11, 12, 18, 119, 119	0%	0%	3.8			
								113	Bridge procedures not in place or followed				10	Impact protection	117	0%	25%	3.8			Residual Level
								114	Restriction of authorised channel				11	Relocate Canary Wharf ferry further from eastern bridge pier	11, 18, 110, 112, 117	50%	0%	3.8			Acceptable
								119	Incorrect passage plan							0%	0%	3.8			
																0%	0%	3.8			Risk Reduction
																0%	0%	3.8			
																0%	0%	3.8			3.2
4	1	1	Is the owner of Proposed Bridge	Contract	Contract - Bridge Fire - Fire / Canary Wharf Fire - / Climate Drought - Dark/Lit/Night & Manifests					4	3	24.5		Residual with no additional risk controls				3.9			Baseline Risk
						C2	Minor injuries	11	Human / Shipping error				1	Relocate eastern bridge pier further from authorised channel	11, 12, 18, 110, 112, 114	25%	0%	3.9			Medium
						C7	Minor or superficial damage to vessel	17	Pilot error						11, 12, 18, 110, 112, 119	0%	0%	3.8			
						C17	Minor damage to bridge	16	Failure to adhere to local & national regulations / risk controls				3	Passing situational safety survey of bridge	11, 12, 18, 18, 119	50%	0%	3.8			Baseline Level
						C21	Vessel impact on the eastern most side to varying affects (Tier 1)	11	Mechanical defect / failure						11, 12, 12, 16, 18, 111, 112, 119	0%	0%	3.8			Acceptable
						C27	Minor local adverse authority	18	Result of working vessel with 3rd party vessel				5	Clear marking and lighting of bridge arch/piers	11, 12, 16, 18, 111	50%	0%	3.8			
						C32	Minor disruption to marine operations	18	Congestion in the vicinity of Bridge				6	Adherence to bridge procedures	11, 12, 12, 18, 114, 119	50%	0%	3.8			Residual Risk
								19	Adverse weather conditions / reduced visibility						11, 12, 18	0%	0%	3.8			
								110	Set vessels bridge by the navigation team						11, 12, 18	0%	0%	3.8			3.2
								111	Lifted bridge						11, 12, 16, 18, 114, 119	0%	0%	3.8			
								112	Bridge Piers in the vicinity of the authorised channel				10	Impact protection	117	0%	25%	3.8			Residual Level
								113	Bridge procedures not in place or followed				11	Relocate Canary Wharf ferry further from eastern bridge pier	11, 12, 18, 110, 112, 114	50%	0%	3.8			Acceptable
								114	Restriction of authorised channel							0%	0%	3.8			
								119	Incorrect passage plan							0%	0%	3.8			Risk Reduction
																0%	0%	3.8			
																0%	0%	3.8			3.2

Project	[illegible]	Date	[illegible]	Site / Location	[illegible]	Assessor	[illegible]	Review Status	[illegible]	DRAFT

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Consequence)	Baseline Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Baseline Risk - with existing risk controls in place: Consequence	Baseline Risk - with existing risk controls in place: Baseline Risk	Risk Evaluation: Risk Reduction Measures	Results
9	12	11	In the vicinity of Proposed Bridge	Isolated	Contact - Bridge Pier - Over / Canary Wharf Fac - < 10m Air Draught - Recreational / Road Users					2.5	3	8.0	Baseline with no additional risk controls	Baseline Risk
						03	Major injuries	11	Master / Skipper error				1 Relocate eastern bridge pier further from eastern navigational channel	8.0
						07	Minor or superficial damage to vessel	12	Failure to adhere to local & statutory navigation rules and aids					
						120	Significant or no damage to bridge	14	Inadequate or inexperienced staff crew on the Tidal Thames				4 Passing arrangements and navigation signage	Baseline Level
						121	Significant impact on the environment	15	Mechanical defect / failure					Moderate
						122	Minor road closure publicity	16	Result of deviating action with third party vessel				5 Clear marking and lighting of bridge and piers	
						123	Navigation disruption to marine operations	18	Completion in the vicinity of Bridge				6 Adherence to bridge procedures	Residual Risk
								19	Adverse weather conditions / reduced visibility					
								120	Set over bridge by the tidal stream					4.0
								121	Wind Bridge					
								122	Bridge Pier in the vicinity of the approved channel				12 Vessel protection	Residual Level
								123	Bridge procedures not in place or not followed				13 Relocate Canary Wharf ferry further from eastern bridge pier	Minor
								124	Restriction of authorised channel					
								125	Vessel from passing over cables					Risk Reduction
								126	Insurance damage claim					
								127	Vessel passing too close to pier					
8	4	4	In the vicinity of Proposed Bridge	Isolated	Contact - Bridge Pier - River - < 10m Air Draught - Commercial	03	Major injuries to single fatality	11	Master / Skipper error	1	4	4.0	Baseline with no additional risk controls	Baseline Risk
						05	Moderate damage to vessel	12	Pilot error				1 Relocate eastern bridge pier further from eastern navigational channel	8.0
						120	Severe damage to bridge	13	Failure to adhere to local & statutory navigation rules and aids				3 Passing arrangements and navigation signage	Baseline Level
						121	Minor impact on the environment with no lasting effects (Tier 1)	15	Mechanical defect / failure				4 Pilot navigation passage plan	Moderate
						122	Minor road closure publicity	16	Result of deviating action with third party vessel				5 Clear marking and lighting of bridge and piers	
						123	Major disruption to marine operations	18	Completion in the vicinity of Bridge				6 Adherence to bridge procedures	Residual Risk
								19	Adverse weather conditions (restrictions / reduced visibility)					
								120	Set over bridge by the tidal stream					6.0
								121	Wind Bridge					
								122	Bridge Pier in the vicinity of the approved channel				12 Vessel protection	Residual Level
								123	Bridge procedures not in place or not followed					
								124	Restriction of authorised channel					Moderate
								125	Vessel from passing over cables					
														Risk Reduction

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Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome (Consequence)	Possible Hazard Outcome (Consequence)	Hazard Cause (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Reduction: Risk Control Ref	Risk Reduction: Risk Control Measures	Risk Reduction: Risk Control Measures	Risk Reduction: Likelihood	Risk Reduction: Consequence	Risk Reduction: Risk Rank	Risk Reduction: Residual Risk	Results: Residual Risk
7	11	11	In the vicinity of Proposed Bridge	Outside	Contact - Bridge Pier Wall -> 11m to Straight - Permanent	[redacted]	[redacted]	11	Marine / Vessel Error	1.1	1	1.1		Baseline risk is no additional risk controls				£14.6	£14,000	1.1	Baseline Risk
						[redacted]	[redacted]	12	Failure to adhere to local & national legislation / risk controls					[redacted]	11, 18, 110, 111, 114	Red	5%	5%	£14.5	£10,000	1.1	1.1
						[redacted]	[redacted]	13	Mechanical defect / failure				1	Reduce vessel to bridge pier further from authorised channel	11, 18, 110, 112, 114	Green	10%	5%	£14.4	£10,000	1.1	
						[redacted]	[redacted]	19	Mechanical defect / failure				2	Keeping to of front outer vicinity of bridge	11, 18, 19, 114	Green	5%	5%	£15.2	£10,000	1.1	Tolerable Level
						[redacted]	[redacted]	20	Breach of working procedure & 3rd party vessel							Red	5%	4%	£17.1	£10,000	1.1	Within
						[redacted]	[redacted]	21	Collision in the vicinity of Bridge				1	Clear marking and lighting of bridge arch/pier	11, 18, 19, 111	Green	10%	5%	£18.9	£10,000	1.1	
						[redacted]	[redacted]	99	Adverse weather conditions / reduced visibility				0	Adherence to bridge procedures	11, 12, 18, 113, 119	Green	10%	5%	£18.8	£10,000	1.1	Residual Risk
								110	Set onto bridge by the tidal stream							Red	5%	5%	£19.9	£10,000	1.1	
								111	Side bridge							Red	5%	5%	£20.9	£10,000	1.1	1.1
								112	Bridge Piers in the centre of the authorised channel							Red	5%	5%	£21.9	£10,000	1.1	
								113	Bridge procedures not in place or followed				10	Impact protection	117	Green	5%	5%	£22.0	£9,500	1.1	Residual Level
								114	Restriction of authorised channel						11, 18, 110, 111, 114	Red	5%	5%	£23.0	£9,500	1.1	Negligible
								115	Incorrect passage plan							Red	5%	5%	£24.0	£9,500	1.1	
																Red	5%	5%	£25.0	£9,500	1.1	Risk Reduction
																Red	5%	5%	£26.0	£9,500	1.1	
																Red	5%	5%	£27.0	£9,500	1.1	Low
8	11	17	In the vicinity of Proposed Bridge	Systems	Contact - Bridge Pier - Wash - < 15m Air Draught - 15m Until Kills	[redacted]	[redacted]	1	Master / Human error	1	1	1.1		Baseline with no additional risk controls				£20.0	£10,000	1.1	Baseline Risk
						[redacted]	[redacted]	12	Failure to adhere to local & national legislation / risk controls					[redacted]	11, 18, 110, 112, 114	Red	5%	5%	£20.0	£10,000	1.1	1.1
						[redacted]	[redacted]	13	Mechanical defect / failure				1	Reduce vessel to bridge pier further from authorised channel	11, 18, 19, 114	Green	10%	5%	£20.1	£10,000	1.1	
						[redacted]	[redacted]	19	Mechanical defect / failure				2	Keeping to of front outer vicinity of bridge	11, 18, 19, 114	Green	10%	5%	£20.2	£10,000	1.1	Tolerable Level
						[redacted]	[redacted]	20	Breach of working procedure with 3rd party vessel						11, 13, 15, 19, 110, 111, 118	Red	5%	5%	£20.3	£10,000	1.1	Within
						[redacted]	[redacted]	21	Collision in the vicinity of Bridge				1	Clear marking and lighting of bridge arch/piers	11, 18, 19, 111	Green	10%	5%	£20.4	£10,000	1.1	
						[redacted]	[redacted]	99	Adverse weather conditions / reduced visibility				0	Adherence to bridge procedures	11, 12, 18, 113, 119	Green	10%	5%	£20.5	£10,000	1.1	Residual Risk
								110	Set onto bridge by the tidal stream						11, 18	Red	5%	5%	£20.5	£10,000	1.1	
								111	Side bridge						11, 18	Red	5%	5%	£20.6	£10,000	1.1	1.1
								112	Bridge Piers in the centre of the authorised channel						11, 12, 18, 118, 119	Red	5%	5%	£20.7	£10,000	1.1	
								113	Bridge procedures not in place or followed				10	Impact protection	117	Green	5%	10%	£20.8	£9,000	1.1	Residual Level
								114	Restriction of authorised channel						11, 18, 110, 111, 114	Red	5%	5%	£20.9	£9,000	1.1	Within
								119	Incorrect passage plan							Red	5%	5%	£20.9	£9,000	1.1	
																Red	5%	5%	£21.0	£9,000	1.1	Risk Reduction
																Red	5%	5%	£21.1	£9,000	1.1	
																Red	5%	5%	£21.2	£9,000	1.1	Low

Project	[illegible]	Date	[illegible]	Site / Location	[illegible]	Assessors	[illegible]	Review Interval	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Treatment: Risk Controls	Risk Treatment: Risk Control Type	Risk Treatment: Risk Control Effectiveness	Risk Treatment: Likelihood	Risk Treatment: Consequence	Risk Treatment: Residual Risk	Results
9	7	9	In the vicinity of Proposed Bridge	Context	Context - Bridge Pier - Wash - 4.12m Air Draught - Mid Port Trade Freight & Commodity					3	2	6.0							
						01	Minor injuries	11	Master / Steersman error				Electric rail to be assessed as risk controls							Baseline Risk
						07	Minor or superficial damage to vessel	12	Pilot error				11, 12, 18, 113, 113, 114		5%	5%				6.0
						212	Minor damage to bridge	13	Failure to adhere to local & national regulations / risk controls				11, 12, 18, 113, 113, 114		10%	5%				
						222	Minor impact on the design light with by bat-ing effects (Tier 1)	15	Mechanical defect / Failure				Exercise vessel in bridge over further from authorised channel		10%	5%				Baseline Level
						227	Minor local adverse publicity	16	Result of working vessel with inducing vessel				11, 12, 13, 15, 18, 113, 113, 114		5%	5%				
						232	Minor disruption to marine operations	18	Congestion in the vicinity of Bridge				Clear marking and lighting of bridge piers/piers		10%	5%				Residual Risk
								19	Adverse weather conditions / reduced visibility				Adherence to bridge procedures		10%	5%				
								110	Vessel to bridge by the vessel owner				11, 12, 18		5%	5%				6.0
								111	Limit to bridge				11, 12, 18		5%	5%				
								112	Bridge Pier in the vicinity of the authorised channel				11, 12, 15, 18, 114, 115		5%	5%				
								113	Bridge procedures not in place or in error				Vessel		10%	5%				Residual Level
								114	Restriction of authorised channel				11, 12, 18, 113, 113, 114		5%	5%				
								115	Incorrect passage chart						5%	5%				Mitigation
															5%	5%				
															5%	5%				Risk Reduction
															5%	5%				
															5%	5%				3.0
10	11	10	In the vicinity of Proposed Bridge	Context	Context - Bridge Pier - West - 4.12m Air Draught - Recreational / Small Vessels					3	3	9.0							
						01	Minor injuries	11	Master / steersman error				Bridge with no additional risk controls							Baseline Risk
						07	Minor or superficial damage to vessel	12	Pilot error				11, 18, 110, 111, 113		5%	5%				9.0
						212	Insignificant or no damage to bridge	14	Inadequate or inexperienced crew on the Tidal Waters				Reduced vessel to bridge over further from authorised channel		5%	5%				
						221	Insignificant impact on the environment	15	Mechanical defect / failure				Exercise vessel in bridge over further from authorised channel		5%	5%				Baseline Level
						227	Minor local adverse publicity	16	Result of working vessel with inducing vessel				Clear marking and lighting of bridge piers/piers		5%	5%				
						232	Insignificant disruption to marine operations	18	Congestion in the vicinity of Bridge				11, 18, 19, 111		10%	5%				Residual Risk
								19	Adverse weather conditions / reduced visibility				Adherence to bridge procedures		5%	5%				
								110	Vessel to bridge by the vessel owner				11, 18		5%	5%				6.0
								111	Limit to bridge				11, 18		5%	5%				
								112	Bridge Pier in the vicinity of the authorised channel				11, 13, 18, 114, 118		5%	5%				
								113	Bridge procedures not in place or followed				Vessel		10%	5%				Residual Level
								114	Restriction of authorised channel				11, 13, 18, 113, 113, 114		5%	5%				
								115	Inherent fault causing vessel traffic						5%	5%				Mitigation
								117	Incorrect passage plan						5%	5%				
								121	Passing of traffic passing through bridge is not aligned with the tidal stream						5%	5%				Risk Reduction
															5%	5%				
															5%	5%				3.0
															5%	5%				

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessor	[redacted]	Review Date	[redacted]

Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Unmitigated)	Baseline Hazard Outcome (Unmitigated)	Hazard Cause ID (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk – with existing risk controls in place			Risk Control Measures							Results
										Likelihood	Consequence	Baseline Risk	Risk Control Measure No.	Risk Control Measure Description	Risk Control Measure Implementation Timeframe	Risk Control Measure Implemented?	Likelihood	Consequence	Residual Risk	Residual Risk Owner	
12	7	14	In the vicinity of Proposed Bridge	Civil Works	Contract - Bridge Strike - 45m Air Draught - Commercial					3.5	4	14.0		Operations with no additional risk controls							Baseline Risk
						C1	Minor injuries or multiple fatalities	11	Human / Supervision error				11, 12, 13, 110, 111, 112, 113		0%	0%	[redacted]	[redacted]			
						C2	Minor damage to vessel	12	Poor crew				14, 15, 16, 102, 103, 104		0%	0%	[redacted]	[redacted]			
						C20	Severe damage to bridge	13	Failure to adhere to local & national regulations / HA controls				11, 12, 15, 18, 114		0%	0%	[redacted]	[redacted]			Baseline Level
						C21	Limited impact on the environment with short-term or long-term effects (Tier 2)	15	Mechanical defect / Failure				11, 12, 13, 15, 18, 110, 113, 119		10%	0%	[redacted]	[redacted]			Mitigation
						C30	International adverse publicity	16	Result of working action with 3rd party vessel				11, 12, 16, 18, 111		5%	0%	[redacted]	[redacted]			
						C34	Major disruption to marine operations	18	Congestion in the vicinity of Bridge				11, 12, 15, 18, 113, 117		20%	0%	[redacted]	[redacted]			Residual Risk
								19	Adverse weather conditions / reduced visibility				11, 12, 18		5%	0%	[redacted]	[redacted]			
								110	Set wrong bridge by the tidal stream				11, 12, 18		10%	0%	[redacted]	[redacted]			
								111	Limit bridge				11, 12, 15, 18, 114, 117		20%	0%	[redacted]	[redacted]			
								112	Bridge procedures not in place or followed						0%	0%	[redacted]	[redacted]			Residual Level
								113	Restriction of authorised channel				11, 12, 18, 110, 113, 114		0%	0%	[redacted]	[redacted]			Mitigation
								114	Incorrect passage plan						0%	0%	[redacted]	[redacted]			
															0%	0%	[redacted]	[redacted]			Risk Reduction
															0%	0%	[redacted]	[redacted]			
13	11	11	In the vicinity of Proposed Bridge	Civil Works	Contract - Bridge Strike - 45m Air Draught - Recreational					3	4	4.0		Operations with no additional risk controls							Baseline Risk
						C2	Major injuries	11	Master / Human error				11, 18, 110, 111, 117		0%	0%	[redacted]	[redacted]			
						C3	Moderate damage to vessel	12	Failure to adhere to local & national regulations / HA controls				12, 18, 110, 111, 113		0%	0%	[redacted]	[redacted]			
						C17	Minor damage to bridge	13	Mechanical defect / Failure				11, 14, 18, 114		0%	0%	[redacted]	[redacted]			Baseline Level
						C21	Insignificant impact on the environment	16	Result of working action with 3rd party vessel				11, 12, 18, 18, 110, 113, 117		0%	0%	[redacted]	[redacted]			Mitigation
						C33	Regional adverse publicity	18	Congestion in the vicinity of Bridge				11, 15, 18, 111		5%	0%	[redacted]	[redacted]			
						C51	Insignificant disruption to marine operations	19	Adverse weather conditions / reduced visibility				11, 12, 18, 110, 119		10%	0%	[redacted]	[redacted]			Residual Risk
								110	Set wrong bridge by the tidal stream				11, 18		10%	0%	[redacted]	[redacted]			
								111	Limit bridge				11, 18		10%	0%	[redacted]	[redacted]			
								113	Bridge procedures not in place or followed				11, 12, 18, 110, 119		20%	0%	[redacted]	[redacted]			
								114	Restriction of authorised channel						0%	0%	[redacted]	[redacted]			Residual Level
								115	Incorrect passage plan				11, 18, 110, 112, 114		0%	0%	[redacted]	[redacted]			Mitigation
								119	Incorrect passage plan						0%	0%	[redacted]	[redacted]			
															0%	0%	[redacted]	[redacted]			Risk Reduction
															0%	0%	[redacted]	[redacted]			

Project:	ERP01263 - Rydhelikke Preliminary HAZ	Date:	[redacted]	Site / Location:	[redacted]	Assessor:	Marine Marina	Revision:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk
13	10	10	In the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge - v (Ship to Draught - Commercial ROPAX Ship Vessel)	C2	Major injuries	L1	Master / Deputy error	1.1	4	4.4
						C3	Minor to superficial damage to vessel	L2	Poor sense			
						C14	Major damage to environment vessel	L3	Failure to adhere to local & national regulations / new controls			
						C12	Minor impact on the environment with no lasting effects (Tier 1)	L5	Mechanical defect / failure			
						C28	Reputational damage publically	L6	Result of vessel being driven with the same policy			
						C23	Navigational difficulties	L7	Vessel vessel not safely working (e.g. no navigation lights)			
								L8	Congestion in the vicinity of Bridge			
								L9	Adverse weather conditions / reduced visibility			
								L12	Bridge Piers in the vicinity of the authorised channel			
								L13	Bridge protection not in place or failed			
								L10	Restriction of authorised channel			
								L16	Vessel not paying close traffic			
								L17	Vessel movements canceled			
								L21	Waiting for traffic passing through bridge travelling with the tidal stream			
								L22	Approach restricted to bridge			
								L23	Air traffic restricted by bridge			
14	12	12	In the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge - v (Ship to Draught - Recreational RCP Ship Vessel	C2	Major injuries	L1	Master / Deputy error	1.1	4	4.4
						C3	Moderate damage to vessel	L3	Failure to adhere to local & national regulations / new controls			
						C12	Minor impact on the environment with no lasting effects (Tier 1)	L5	Mechanical defect / failure			
						C23	Navigational difficulties	L6	Result of vessel being driven with the same policy			
						C28	Negative adverse publicity	L7	Vessel vessel not safely working (e.g. no navigation lights)			
						C23	Minor disruption to marine operations	L8	Congestion in the vicinity of Bridge			
								L9	Adverse weather conditions / reduced visibility			
								L12	Bridge Piers in the vicinity of the authorised channel			
								L13	Bridge protection not in place or failed			
								L10	Restriction of authorised channel			
								L16	Vessel not paying close traffic			
								L17	Vessel movements canceled			
								L21	Waiting for traffic passing through bridge travelling with the tidal stream			
								L22	Approach restricted to bridge			
								L23	Air traffic restricted by bridge			

	Risk Description	Control Measures in place	Likelihood	Consequence	Risk Rating	Residual Risk - with new controls in place: Likelihood	Consequence	Risk Rating	Results
	Baseline with no additional risk controls								Baseline Risk
1	Relocate vessels to bridge gap further from authorised channel	L1, L2, L8, L12, L15, L16		20%	0%				4.4
2	Relocate vessels to gap gap further from authorised channel	L1, L2, L8, L12, L15, L16		20%	0%				
3	Marking of vessels with clearance of bridge	L1, L2, L8, L9, L19		20%	0%				Baseline Level
4	Push to talk Radio Set up to bridge	L1, L2, L8, L9, L9, L12, L15, L19		20%	0%				Mitigation
5	Clear marking and lighting of bridge and spans	L1, L2, L8, L9, L21		20%	0%				
6	Enforcement to bridge restrictions	L1, L2, L8, L9, L16, L21		20%	0%				Residual Risk
7	Increase vessel height	L1, L2, L9		10%	0%				3.3
8	Increase number of openings	L1, L2, L9		10%	0%				
9	Co-ordination with Tower Bridge / vessel passing when required	L1, L2, L5, L8, L16, L21		10%	0%				
				0%	0%				Residual Level
11	Relocate Canary Wharf ferry further from eastern bridge gap	L2, L3, L8, L12, L13, L14		10%	0%				Mitigation
				0%	0%				
				0%	0%				Risk Reduction
				0%	0%				
				0%	0%				
				0%	0%				
	Baseline with no additional risk controls								Baseline Risk
1	Relocate vessels to bridge gap further from authorised channel	L1, L8, L10, L12, L14		10%	0%				4.4
2	Relocate vessels to bridge gap further from authorised channel	L1, L8, L10, L12, L15		10%	0%				
3	Marking of vessels with clearance of bridge	L1, L8, L8, L16		5%	0%				Baseline Level
		L1, L2, L8, L9, L10, L15, L19		0%	0%				Mitigation
6	Clear marking and lighting of bridge and spans	L1, L8, L8, L21		10%	0%				
8	Adherence to bridge procedures	L1, L5, L8, L15, L19		10%	0%				Residual Risk
7	Increase vessel height	L1, L8		10%	0%				3.3
8	Increase number of openings	L1, L8		10%	0%				
9	Co-ordination with Tower Bridge / vessel passing when required	L1, L5, L8, L16, L19		10%	0%				
				0%	0%				Residual Level
11	Relocate Canary Wharf ferry further from eastern bridge gap	L2, L8, L10, L12, L14		5%	0%				Mitigation
				0%	0%				
				0%	0%				Risk Reduction
				0%	0%				
				0%	0%				

Project		Name		Risk Evaluation		Assessor		Review Date		Checked	

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome #1 (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes #1 (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Assessment: Risk Controls	Risk Assessment: Risk Control Effectiveness	Risk Assessment: Likelihood	Risk Assessment: Consequence	Risk Assessment: Residual Risk Score (RR)	Risk Assessment: Cost Benefit Analysis	Risk Assessment: Cost Benefit Analysis (CBA)	Results
11	1	1	In the vicinity of Proposed Bridge	Offshore	Collision as a result of Bridge – Vessel Interaction – Drought – Other Port Trade Freight & Recreational (Cat V) Vessel					3	3	9.0								
						1A	Major / human or single fatality	11	Master / Skipper error											Baseline Risk
						1B	Moderate damage to vessel	12	Failure to adhere to local & national legislation / rail controls				1	1A, 1B, 1C, 1D, 1E, 1F	10%	5%	9.5			9.0
						1C	Moderate damage to secondary vessel	13	Mechanical defect / failure				2	1A, 1B, 1C, 1D, 1E, 1F	10%	5%	9.5			9.0
						1D	Minor impact on the environment with no lasting effects (Tier 1)	14	Result of speeding vessel with 3rd party vessel				3	1A, 1B, 1C	10%	5%	9.5			Tolerable Level
						1E	Regional adverse publicity	15	Small vessel not easily visible (e.g. no navigation lights)				4	1A, 1B, 1C, 1D, 1E, 1F	10%	5%	9.5			Monitor
						1F	Moderate disruption to marine operations	16	Navigation in the vicinity of Bridge				5	1A, 1B, 1C	10%	5%	9.5			Monitor
								17	Adverse weather conditions / reduced visibility				6	1A, 1B, 1C, 1D, 1E, 1F	10%	5%	9.5			Residual Risk
								18	Bridge fixes in the vicinity of the authorised channel											
								19	Bridge procedures not in place or followed											
								1A	Restrictions of authorised channel											
								1B	Wash from passing over traffic											
								1C	Vessel insecurely secured											
								1D	Working for traffic passing through bridges navigating with the tidal stream											
								1E	Approach restricted by bridge											
								1F	Visibility restricted by bridge											
12	1	1	In the vicinity of Proposed Bridge	Offshore	Collision as a result of Bridge – Vessel Interaction – Drought – Other Port Trade Freight & Recreational (Cat V) Vessel					3	3	9.0								
						2A	Major / human	21	Master / Skipper error											Baseline Risk
						2B	Moderate damage to vessel	22	Pilot error				1	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			9.0
						2C	Moderate damage to secondary vessel	23	Failure to adhere to local & national legislation / rail controls				2	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			9.0
						2D	Minor impact on the environment with no lasting effects (Tier 1)	24	Mechanical defect / failure				3	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			Tolerable Level
						2E	Regional adverse publicity	25	Result of speeding vessel with 3rd party vessel				4	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			Monitor
						2F	Moderate disruption to marine operations	26	Small vessel not easily visible (e.g. no navigation lights)				5	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			Monitor
								27	Navigation in the vicinity of Bridge				6	2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H	10%	5%	9.5			Residual Risk
								28	Adverse weather conditions / reduced visibility											
								29	Bridge fixes in the vicinity of the authorised channel											
								2A	Bridge procedures not in place or followed											
								2B	Restrictions of authorised channel											
								2C	Wash from passing over traffic											
								2D	Vessel insecurely secured											
								2E	Working for traffic passing through bridges navigating with the tidal stream											
								2F	Approach restricted by bridge											
								2G	Visibility restricted by bridge											

Project:	[redacted]	Date:	[redacted]	Site / location:	[redacted]	Assessor:	[redacted]	Revision:	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes (Cause) ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction: Reference	Risk Reduction: Risk Reduction Measure (Additional Risk Controls)	Risk Reduction: Control Type	Risk Reduction: Likelihood	Risk Reduction: Consequence	Risk Reduction: Cost	Risk Reduction: Cumulative Cost	Risk Reduction: Cumulative Risk Reduction	Results
23	9	5	In the vicinity of Proposed Bridge	Collision	[redacted]					3.3	3	9.9		Baseline risk as additional risk controls					£		Baseline Risk
						C2	Major injuries	1.1	Impact / Shipper error				1	Pedestrian walker in bridge over former from authorised channel		15%	6%	£	£		9.9
						C3	Major damage to vessel	1.2	Failure to adhere to local & national regulations / risk controls				2	Pedestrian walker in bridge over further from authorised channel		15%	6%	£	£		
						C11	Minor or superficial damage to secondary vessel	1.3	Maintenance failure / Failure				3	Passing distributed within vicinity of bridge		5%	6%	£	£		Baseline Level
						C21	Insignificant impact on the environment	1.4	Result of breaking action with third party vessel							5%	6%	£	£		
						C27	Minor visible effects [illegible]	1.7	Direct result not work-related (e.g. no navigation)				5	User training and lighting of bridge ends/area		15%	6%	£	£		Moderate
						C31	Insignificant disruption to human activities	1.8	Competence in the vicinity of Bridge				6	Awareness of bridge restrictions		5%	6%	£	£		Residual Risk
								1.9	Adverse weather conditions / reduced visibility							5%	6%	£	£		
								1.12	Bridge Plans in the vicinity of the authorised channel							5%	6%	£	£		3.3
								1.13	Bridge procedures not in place or followed							5%	6%	£	£		
								1.14	Restriction of authorised channel							5%	6%	£	£		Residual Level
								1.15	Work / Low passing river traffic				11	Relocate Canary Wharf ferry Pontoon from eastern bridge span		10%	6%	£	£		
								1.17	Vessel improperly secured							5%	6%	£	£		Moderate
								1.21	Waiting for traffic passing through bridge (should not with the tidal stream)							5%	6%	£	£		
								1.22	Approach restricted by bridge							5%	6%	£	£		Risk Reduction
								1.23	Vessel be restricted by bridge							5%	6%	£	£		
28	20	20	In the vicinity of Proposed Bridge	Grounding	Grounding – > 20m by Draught – Recreational					3.3	6	19.8		Baseline risk as additional risk controls					£		Baseline Risk
						C1	Major injuries	1.1	Impact / Shipper error							5%	6%	£	£		
						C2	Major damage to vessel	1.2	Pilot error							5%	6%	£	£		19.8
						C21	Minor impact on the environment with no clean-up efforts (Tier 1)	1.3	Failure to adhere to local & national regulations / risk controls				4	Passing distributed within vicinity of bridge		5%	6%	£	£		Baseline Level
						C24	National adverse publicity	1.5	Maintenance failure / Failure				5	Tugs as we many/per vessel to bridge		10%	6%	£	£		
						C34	Major disruption to marine operations	1.8	Result of breaking action with third party vessel				6	User training and lighting of bridge ends/area		5%	6%	£	£		Minor
								1.9	Competence in the vicinity of Bridge				7	Air warning to bridge procedures		10%	6%	£	£		Residual Risk
								1.10	Adverse weather conditions / reduced visibility				8	Increased span height		20%	6%	£	£		
								1.11	Work / Low passing river traffic				9	Increase number of warnings		5%	6%	£	£		9.9
								1.12	Bridge Plans in the vicinity of the authorised channel				10	Co-ordination with Tower Bridge / other pieces with a vessel		5%	6%	£	£		
								1.13	Bridge procedures not in place or followed							5%	6%	£	£		Residual Level
								1.14	Restriction of authorised channel							5%	6%	£	£		
								1.15	Misjudging height of tide							5%	6%	£	£		Minor
								1.16	Inherent passage plan							5%	6%	£	£		
																5%	6%	£	£		Risk Reduction
																5%	6%	£	£		

Project:		Date:		Site / Location:		Assessor:		Reviewer:	Draft X

Hazard ID	Business Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Causes (Likelihood)	Existing Risk Controls			Risk Reduction							Remarks
										Likelihood	Consequence	Baseline Risk	Risk Reduction Measure	Likelihood Reduction	Consequence Reduction	Residual Risk	Likelihood Reduction	Consequence Reduction	Residual Risk	
10	10	10	Is the security of Tsunami Bridge	Operating	Insecurity – > 25m Air Draught – Operational	01	Minor injuries	11	Impact / Abrasion error	1	1	1.0	Baseline with no additional risk controls							Baseline Risk
						02	Moderate damage to vessel	12	Failure to adhere to local & national regulations / risk controls				1 Install navigation bridge span further from eastern end channel	11, 12, 121, 122, 123	Yes	15%	0%	0.85	1.0	0.85	15%
						021	Significant impact on the environment	13	Mechanical defect / failure				2 Relocate western bridge span further from eastern end Channel	11, 12, 121, 122, 123	Yes	15%	0%	0.85	1.0	0.85	15%
						022	Minor local chronic pollution	14	Result of existing action with 3rd party vessel				3 Raising pavement section outside of bridge	11, 12, 13, 14, 121	Yes	0%	0%	1.00	1.0	1.00	0%
						023	Minor damaged to marine habitat	15	Congestion in the vicinity of Bridge					11, 12, 13, 14, 121, 123, 124	No	0%	0%	1.00	1.0	1.00	0%
								16	Adverse weather conditions / reduced visibility				4 Clear marking and lighting of bridge arch/piers	11, 12, 13, 121	Yes	0%	0%	1.00	1.0	1.00	0%
								111	Main bridge				5 Adherence to bridge procedures	11, 12, 13, 122, 123	Yes	10%	0%	0.90	1.0	0.90	10%
								112	Bridge Piers in the vicinity of the authorised channel				6 Increase span height	1.1, 1.2	Yes	15%	0%	0.85	1.0	0.85	15%
								113	Bridge procedures not in place or followed				7 Increase number of openings	1.1, 1.2	Yes	5%	0%	0.95	1.0	0.95	5%
								114	Poor maintenance of authorised channel				8 Co-ordination with Tsunami Bridge Control Centre to be improved	1.1, 1.2, 1.3, 1.4, 1.5	Yes	5%	0%	0.95	1.0	0.95	5%
								115	Navigating height of tide						No	0%	0%	1.00	1.0	1.00	0%
								116	Insufficient passage width					11, 12, 121, 122, 123	No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
10	1	10	Is the security of Tsunami Bridge	Operating	Insecurity – > 25m Air Draught – Operational Risks	01	Minor injuries	11	Impact / Abrasion error	1	1	1.0	Baseline with no additional risk controls							Baseline Risk
						02	Moderate damage to vessel	12	Failure to adhere to local & national regulations / risk controls				1 Relocate eastern bridge span further from eastern end Channel	11, 12, 121, 122, 123, 124	Yes	10%	0%	0.90	1.0	0.90	10%
						021	Significant impact on the environment	13	Mechanical defect / failure				2 Relocate western bridge span further from eastern end channel	11, 12, 121, 122, 123, 124	Yes	10%	0%	0.90	1.0	0.90	10%
						022	Minor local chronic pollution	14	Result of existing action with 3rd party vessel				3 Raising pavement section outside of bridge	11, 12, 13, 14, 121, 123, 124	Yes	5%	0%	0.95	1.0	0.95	5%
						023	Minor damaged to marine habitat	15	Congestion in the vicinity of Bridge						No	0%	0%	1.00	1.0	1.00	0%
								16	Adverse weather conditions / reduced visibility				4 Clear marking and lighting of bridge arch/piers	11, 12, 13, 121	Yes	5%	0%	0.95	1.0	0.95	5%
								111	Main bridge				5 Adherence to bridge procedures	11, 12, 13, 122, 123	Yes	10%	0%	0.90	1.0	0.90	10%
								112	Bridge Piers in the vicinity of the authorised channel					11, 12	No	0%	0%	1.00	1.0	1.00	0%
								113	Bridge procedures not in place or followed					11, 12	No	0%	0%	1.00	1.0	1.00	0%
								114	Poor maintenance of authorised channel					11, 12, 13, 14, 123	No	0%	0%	1.00	1.0	1.00	0%
								115	Navigating height of tide						No	0%	0%	1.00	1.0	1.00	0%
								116	Insufficient passage width				11 Relocate Canary Wharf Jetty further from eastern bridge span	1.1, 1.2, 1.21, 1.22, 1.23	Yes	10%	0%	0.90	1.0	0.90	10%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%
															No	0%	0%	1.00	1.0	1.00	0%

Project:	[illegible]	Date:	[illegible]	Site / Location:	[illegible]	Assessor:	[illegible]	Revision:	Draft A

Hazard ID	Baseline Hazard Point	Baseline Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Consequence)	Baseline Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Assessment: Additional Risk Control Measures	Risk Control Measure Implementation Responsibility	Risk Control Measure Effectiveness	Residual Likelihood	Residual Consequence	Residual Risk Score	Results
11	11	11	Within the vicinity of Proposed Bridge	Groundbreaking	Groundbreaking – Collision, Derailment, Drought – Heavy Rain, Flood, Snow, Thaw, Fought & Windblown	C1	Minor injuries	L1	Human / Shipping error	3.9	3	8.8	Baseline with no additional risk controls							Baseline Risk
						C2	Minor or superficial damage to vessel	L2	Risk error				1. Relocate eastern bridge pier further from authorised channel	C1, C2, C8, C10, C11, C12, C13	25%	0%	5.1	3	3.9	8.8
						C10	Minor damage to the environment and long-lasting effects (Tier 1)	L3	Failure to adhere to local & national legislation / case controls				2. Relocate western bridge pier further from authorised channel	C1, C2, C8, C10, C11, C12, C13	25%	0%	5.1	3	3.9	
						C11	Reported statutory authority	L5	Maintenance defect / failure				3. Placing disclosures within vicinity of bridge	C1, C2, C8, C9, C10	50%	0%	4.4	3	3.3	Low/Tier Level
						C12	Whistle and sub-catch to marine operations	L6	Result of incoming action with 3rd party vessel					C1, C2, C8, C9, C10, C11, C12, C13	75%	0%	2.2	3	1.7	Moderate
								L8	Congestion in the vicinity of Bridge				4. Clear marking and lighting of bridge and piers	C1, C2, C8, C9, C10	50%	0%	4.4	3	3.3	
								L9	Adverse weather conditions / reduced visibility				5. Adherence to Bridge Procedures	C1, C2, C3, C8, C10, C11, C12	50%	0%	4.4	3	3.3	Residual Risk
								L11	Lorry bridge					C1, C2, C8	5%	0%	7.6	3	5.7	5.7
								L12	Bridge Piers in the vicinity of the authorised channel					C1, C2, C8	5%	0%	7.6	3	5.7	
								L13	Bridge structure not in place as Forecast					C1, C2, C3, C8, C10, C11, C12	5%	0%	7.6	3	5.7	
								L14	Restriction of sail areas of vessel						0%	0%	8.8	3	6.6	Residual Level
								L15	Encroaching height of ship				12. Relocate Canary Wharf Lorry Control from eastern bridge pier	C1, C2, C8, C10, C11, C12	5%	0%	8.3	2	4.2	4.2
								L16	Insufficient passage plan						0%	0%	8.8	2	4.4	Above
															0%	0%	8.8	2	4.4	Risk Reduction
															0%	0%	8.8	2	4.4	
															0%	0%	8.8	2	4.4	
11	9	9	Within the vicinity of Proposed Bridge	Groundbreaking	Groundbreaking – Collision, Derailment, Drought – Heavy Rain, Flood, Snow, Thaw, Fought & Windblown	C1	Minor injuries	L1	Human / Shipping error	4	1	8.0	Baseline with no additional risk controls							Baseline Risk
						C2	Minor or superficial damage to vessel	L2	Risk error				1. Relocate eastern bridge pier further from authorised channel	L1, L8, L10, L12, L14	25%	0%	3.9	1	2.9	8.0
						C10	Minor damage to the environment and long-lasting effects (Tier 1)	L3	Failure to adhere to local & national legislation / case controls				2. Relocate western bridge pier further from authorised channel	L1, L8, L12, L14, L16	25%	0%	3.9	1	2.9	
						C11	Reported statutory authority	L5	Maintenance defect / failure				3. Placing disclosures within vicinity of bridge	L1, L8, L9, L14	0%	0%	4.0	1	3.0	Low/Tier Level
						C12	Whistle and sub-catch to marine operations	L6	Result of incoming action with 3rd party vessel					L1, L2, L3, L8, L9, L10, L12, L14, L16	0%	0%	4.0	1	3.0	
								L8	Congestion in the vicinity of Bridge				4. Clear marking and lighting of bridge and piers	L1, L8, L9, L10	0%	0%	4.0	1	3.0	Moderate
								L9	Adverse weather conditions / reduced visibility				5. Adherence to Bridge Procedures	L1, L8, L10, L12, L14	0%	0%	4.0	1	3.0	
								L11	Lorry bridge					L1, L8	0%	0%	4.0	1	3.0	Residual Risk
								L12	Bridge Piers in the vicinity of the authorised channel					L1, L8	0%	0%	4.0	1	3.0	6.1
								L13	Bridge procedures not in place as Forecast					L1, L3, L8, L14, L16	0%	0%	4.0	1	3.0	
								L14	Restriction of sail areas of vessel						0%	0%	4.0	1	3.0	Residual Level
								L15	Encroaching height of ship				11. Relocate Canary Wharf Lorry Control from eastern bridge pier	L1, L8, L13, L15, L16	50%	0%	2.0	1	1.5	3.0
								L16	Insufficient passage plan						0%	0%	4.0	1	3.0	Above
															0%	0%	4.0	1	3.0	Risk Reduction
															0%	0%	4.0	1	3.0	
															0%	0%	4.0	1	3.0	

Project		Date		Assessment	Site / Location		Assessor	Review Meeting	Sanctions	Check &

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (1) (Unmitigated)	Credible Hazard Outcome (1) (Unmitigated)	Hazard Causes (1) (Unmitigated)	Hazard Causes (Unmitigated)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk
1	3	4	Within vicinity of Proposed Bridge	Contact	Contact - Bridge Pier - Pier – + Vessel Strength - Commercial	C1	Major crushing or single fatality	C1	Bridge / Bridge area	3.8	4	15.2
						C2	Multiple fatalities or casualties	C2	Pier area			
						C20	Severe damage to bridge	C1	Failure to adhere to local & national legislation / risk controls			
						C21	Minor impact on the environment with no lasting effects (Tier 3)	C2	Structural defect / failure			
						C24	Natural adverse activity	C3	Result of vessel to collide with the party vessel			
						C24	Major disruption to marine operations	C4	Congestion in the vicinity of Bridge			
								C5	Adverse weather conditions / reduced visibility			
								C20	Sea cross bridge by low tidal stream			
								C21	Limit bridge			
								C22	Bridge Piers in the vicinity of the authorised channel			
								C23	Bridge procedures not in place or followed			
								C24	Restriction of Authorised channel			
								C25	Incorrect passage plan			
2	12	10	Within vicinity of Proposed Bridge	Contact	Contact - Bridge Pier - Pier – + Vessel Strength - Commercial	C2	Major injuries	C1	Master / Pilot error areas	3	3	9.0
						C8	Moderate damage to vessel	C5	Failure to adhere to local & national legislation / risk controls			
						C17	Minor damage to bridge	C6	Mechanical defect / failure			
						C21	Major fluid impact on the environment	C8	Result of vessel to collide with the party vessel			
						C21	Minor local nuisance publicity	C8	Congestion in the vicinity of Bridge			
						C24	Major fluid disruption to marine operations	C9	Adverse weather conditions / reduced visibility			
								C20	Sea cross bridge by low tidal stream			
								C21	Limit bridge			
								C22	Bridge Piers in the vicinity of the authorised channel			
								C23	Bridge procedures not in place or followed			
								C24	Restriction of authorised channel			
								C25	Incorrect passage plan			

	Risk Reduction Measures (RRM) Description	Credible Hazard Outcome (1) (Unmitigated)	Risk Reduction Measure Likelihood	Risk Reduction Measure Consequence	Risk Reduction Measure Risk	Likelihood Reduction Measure	Consequence Reduction Measure	Residual Risk Rating	Results
	Baseline with no additional risk controls					3.8 C	£1,000,000	15	Baseline Risk
1	Advise any pilots to dive over further than authorised channel	C1, C2, C8, C20, C21, C24	Low	20%	0%	3.0 C	£1,000,000	4.4	9.2
		C1, C2, C8, C20, C21, C24	Low	0%	0%	3.0 C	£1,000,000	4.4	
2	Passing draft must notify owners of Vessel	C1, C2, C8, C20, C24	Low	5%	0%	3.8 C	£1,000,000	4.4	Baseline Level
3	Tugs to be made available to bridge	C1, C2, C8, C20, C21, C24, C25, C26	Low	5%	0%	3.8 C	£1,000,000	4.4	Minimum
4	Clear marking and lighting of bridge and piers	C1, C2, C8, C20, C24	Low	10%	0%	3.8 C	£1,000,000	4.4	
5	Adherence to bridge procedures	C1, C2, C8, C20, C24, C25	Low	10%	0%	3.8 C	£1,000,000	4.4	Residual Risk
		C1, C2	Low	0%	0%	3.8 C	£1,000,000	4.4	9.6
		C1, C2	Low	0%	0%	3.8 C	£1,000,000	4.4	
		C1, C2, C8, C20, C24, C25	Low	0%	0%	3.8 C	£1,000,000	4.4	
10	Impact protection	C20	Low	0%	50%	3.8 C	£500,000	2.2	Residual Level
			Low	0%	0%	3.8 C	£1,000,000	4.4	Minimum
			Low	0%	0%	3.8 C	£1,000,000	4.4	
			Low	0%	0%	3.8 C	£1,000,000	4.4	
			Low	0%	0%	3.8 C	£1,000,000	4.4	
			Low	0%	0%	3.8 C	£1,000,000	4.4	
						3.0 C	£1,000,000	4.4	Baseline Risk
1	Advise any pilots to dive over further than authorised channel	C1, C2, C8, C20, C21, C24	Low	20%	0%	2.4 C	£800,000	3.5	8.0
		C1, C2, C8, C20, C21, C24	Low	0%	0%	2.4 C	£800,000	3.5	
2	Passing draft must notify owners of Vessel	C1, C2, C8, C20	Low	5%	0%	2.4 C	£800,000	3.5	Baseline Level
		C1, C2, C8, C20, C21, C24, C25, C26	Low	0%	0%	2.4 C	£800,000	3.5	Minimum
4	Clear marking and lighting of bridge and piers	C1, C2, C8, C20	Low	10%	0%	2.4 C	£800,000	3.5	
5	Adherence to bridge procedures	C1, C2, C8, C20, C24	Low	10%	0%	2.4 C	£800,000	3.5	Residual Risk
		C1, C2	Low	0%	0%	2.4 C	£800,000	3.5	8.0
		C1, C2	Low	0%	0%	2.4 C	£800,000	3.5	
		C1, C2, C8, C20, C24	Low	0%	0%	2.4 C	£800,000	3.5	
10	Impact protection	C20	Low	0%	50%	2.4 C	£400,000	1.8	Residual Level
			Low	0%	0%	2.4 C	£800,000	3.5	Minimum
			Low	0%	0%	2.4 C	£800,000	3.5	
			Low	0%	0%	2.4 C	£800,000	3.5	
			Low	0%	0%	2.4 C	£800,000	3.5	
			Low	0%	0%	2.4 C	£800,000	3.5	

Project:	[redacted]	Date:	[redacted]	Site / Location:	[redacted]	Assessor:	[redacted]	Review:	Check #:

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk
1	1	11	[redacted]	Contract	Contract - Bridge Hut - Exit - +10m AHD Drought - Dam B/WEIR/Pile	C1	Major injuries	11	Master / Skipper error	1	1	0.9
						C2	Vessel and Bridge to sever	12	Failure to adhere to local & regional regulations / risk controls			
						C17	Minor damage to bridge	13	Mechanical safety / failure			
						C23	Limited impact on the environment with short term or long term effects (Tier 1)	14	Result of working alone with 3rd party vessel			
						C29	Reputation adverse publicity	18	Congestion on the vicinity of Bridge			
						C33	Moderate disruption to marine operations	19	Adverse weather conditions / reduced capacity			
								110	Set cross bridge by the tidal stream			
								111	yacht bridge			
								112	Bridge Piers in the vicinity of the authorised channel			
								113	Bridge procedures not in place or followed			
								114	Restriction of authorised channel			
								115	Inclement damage plan			
1	1	7	[redacted]	Contract	Contract - Bridge Hut - Exit - +10m AHD Drought - Dam B/WEIR/Pile Project & Maintenance	C1	Major injuries	11	Master / Skipper error	1	1	0.9
						C7	Minor or superficial damage to vessel	12	Pilot error			
						C17	Minor damage to bridge	13	Failure to adhere to local & regional regulations / risk controls			
						C23	Water shown on the environment with no lasting effects (Tier 1)	15	Mechanical safety / failure			
						C27	Water loss adverse publicity	16	Result of working alone with 3rd party vessel			
						C33	Minor disruption to marine operations	18	Congestion on the vicinity of Bridge			
								19	Adverse weather conditions / reduced capacity			
								110	Set cross bridge by the tidal stream			
								111	yacht bridge			
								112	Bridge Piers in the vicinity of the authorised channel			
								113	Bridge procedures not in place or followed			
								114	Restriction of authorised channel			
								115	Inclement damage plan			

	Risk Treatment	Likelihood	Consequence	Residual Risk	Residual Risk Assessment (RE: no harm)			Results
	Baseline with no additional risk controls				[redacted]	[redacted]	0.9	Baseline Risk
1	Restrict/re-address bridge exclusion from authorised channel	[redacted]	10%	0%	[redacted]	[redacted]	0.1	0.9
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
4	Training Boundaries within vicinity of bridge	[redacted]	5%	0%	[redacted]	[redacted]	0.1	Baseline Level
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Maintenance
5	Clear marking and lighting of bridge and beam	[redacted]	20%	0%	[redacted]	[redacted]	0.2	
6	Adherence to bridge procedures	[redacted]	20%	0%	[redacted]	[redacted]	0.2	Residual Risk
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	0.0
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
10	Impact protection	[redacted]	0%	60%	[redacted]	[redacted]	0.0	Residual Level
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Maintenance
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Risk Reduction
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
	Baseline with no additional risk controls				[redacted]	[redacted]	0.9	Baseline Risk
1	Restrict/re-address bridge exclusion from authorised channel	[redacted]	10%	0%	[redacted]	[redacted]	0.1	0.9
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
4	Training Boundaries within vicinity of bridge	[redacted]	5%	0%	[redacted]	[redacted]	0.1	Baseline Level
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Maintenance
5	Clear marking and lighting of bridge and beam	[redacted]	20%	0%	[redacted]	[redacted]	0.2	
6	Adherence to bridge procedures	[redacted]	20%	0%	[redacted]	[redacted]	0.2	Residual Risk
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	0.0
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
10	Impact protection	[redacted]	0%	60%	[redacted]	[redacted]	0.0	Residual Level
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Maintenance
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	Risk Reduction
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	
		[redacted]	0%	0%	[redacted]	[redacted]	0.0	

Project		Date:		Site / Location:		Assessors:		Review Date:	Sheet #

HAZARD	Receptor Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Form of Risk	Positive Hazard Outcome ID (Consequence)	Positive Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction: Additional Risk Controls or Mitigations	Control Effectiveness (Low/Medium/High)	Likelihood Before Mitigation	Likelihood After Mitigation	Consequence After Mitigation	Consequence After Mitigation	Residual Risk After Mitigation	Results
1	11	11	In the vicinity of Proposed Bridge	Complex	Contact - Bridge Pier Over - < 12m for Drought - Navigational / Small Vessels					3	3	9.0	Baseline risk with no additional risk controls				£250 k	£600,000	Very High	Baseline Risk
													1 Relocate eastern bridge pier further from eastbound channel	11, 12, 13, 14	High	80%	0%	£40 k	£120,000	Low	Low
														11, 12, 13, 14	High	0%	0%	£40 k	£120,000	Very High	
													2 Raising abutment with 4 m/s risk of bridge	11, 12, 13, 14	High	0%	0%	£40 k	£120,000	Very High	Baseline Level
														11, 12, 13, 28, 110, 113, 119	High	0%	0%	£40 k	£120,000	Very High	Minor
													3 Clear marking and lighting of bridge arch/piers	11, 12, 13, 111	High	10%	0%	£36 k	£108,000	Very High	
													4 Adherence to bridge procedures	11, 12, 13, 113, 119	High	0%	0%	£36 k	£108,000	Very High	Residual Risk
														11, 12	High	0%	0%	£36 k	£108,000	Very High	
														11, 12	High	0%	0%	£36 k	£108,000	Very High	9.0
														11, 12, 13, 114, 119	High	0%	0%	£36 k	£108,000	Very High	
													10 Vessel protection	9,10	High	0%	0%	£36 k	£108,000	Very High	Residual Level
															High	0%	0%	£36 k	£108,000	Very High	
															High	0%	0%	£36 k	£108,000	Very High	Minor
															High	0%	0%	£36 k	£108,000	Very High	
															High	0%	0%	£36 k	£108,000	Very High	Risk Reduction
															High	0%	0%	£36 k	£108,000	Very High	
															High	0%	0%	£36 k	£108,000	Very High	9.0
															High	0%	0%	£36 k	£108,000	Very High	
4	4	4	In the vicinity of Proposed Bridge	Complex	Contact - Bridge Pier - Wash - > 12m for Drought - Commercial					3	3	9.0	Baseline risk with no additional risk controls				£250 k	£1,000,000	Very High	Baseline Risk
														12, 13, 14, 110, 111, 114	High	0%	0%	£40 k	£1,000,000	Very High	Low
													1 Relocate eastern bridge pier further from eastbound channel	12, 13, 14, 110, 111, 114	High	60%	0%	£40 k	£1,000,000	Very High	
													2 Raising abutment within vicinity of bridge	11, 12, 13, 14, 114	High	0%	0%	£40 k	£1,000,000	Very High	Baseline Level
													3 Tugs to be made fast prior to bridge	11, 12, 13, 15, 19, 110, 113, 119	High	0%	0%	£40 k	£1,000,000	Very High	Moderate
													5 Clear marking and lighting of bridge arch/piers	11, 12, 13, 111	High	10%	0%	£36 k	£1,000,000	Very High	
													9 Adherence to bridge procedures	11, 12, 13, 14, 113, 119	High	10%	0%	£36 k	£1,000,000	Very High	Residual Risk
														11, 12, 13	High	0%	0%	£36 k	£1,000,000	Very High	
														11, 12, 13	High	0%	0%	£36 k	£1,000,000	Very High	3.0
														11, 12, 13, 14, 113, 119	High	0%	0%	£36 k	£1,000,000	Very High	
													10 Vessel protection	9,10	High	0%	0%	£36 k	£1,000,000	Very High	Residual Level
															High	0%	0%	£36 k	£1,000,000	Very High	
															High	0%	0%	£36 k	£1,000,000	Very High	Moderate
															High	0%	0%	£36 k	£1,000,000	Very High	
															High	0%	0%	£36 k	£1,000,000	Very High	Risk Reduction
															High	0%	0%	£36 k	£1,000,000	Very High	
															High	0%	0%	£36 k	£1,000,000	Very High	3.0

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessor	[redacted]	Revision	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Causes (if applicable)	Hazard Causes (if applicable)	Baseline Risks - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction Measures: Action No.	Action to Take / Risk Control Measure	Comp. reference / risk control reference	Baseline Risk	Likelihood	Consequence	Residual Risk	Residual Risk Score (after risk control measures have been implemented)	Risk Owner	Risk Review Date	Results
7	12	12	In the vicinity of Proposed Bridge	Contractor	Contact - Bridge Pier - Wind - > 11m/s Air Draught - Risk Control Measures	C3	Major injuries	11	Human / Shipper error	3	3	6.0		Baseline with no additional risk controls						£100.0	£10,000	6.0	Baseline Risk
						C8	Moderate damage to vessel	12	Failure to adhere to local Bi-wayne log (advice) / risk controls						11, 18, 110, 111, 119	6.0	0%	0%		£99.0	£10,000	6.0	6.0
						C17	Minor damage to bridge	13	Mechanical defect / failure				2	Reinforce western bridge pier further from authorised channel	11, 18, 110, 111, 119	6.0	80%	0%		£60.0	£10,000	6.0	
						C21	Insignificant impact on the environment	14	Result of existing collision with 3rd party vessel				1	Placing buoyband on the outside of bridge	11, 18, 18, 114	6.0	0%	0%		£99.0	£10,000	6.0	Baseline Level
						C27	Minor local adverse publicity	15	Congestion in the access of Bridge							6.0	0%	0%		£99.0	£10,000	6.0	Minor
						C31	Insignificant deviation to marine operations	16	Adverse weather conditions / reduced visibility				3	Clear marking and lighting of bridge structure	11, 18, 18, 121	6.0	20%	0%		£97.0	£10,000	6.0	
								110	Set onto bridge by the tidal stream				4	Adherence to bridge procedures	11, 12, 18, 122, 1.19	6.0	10%	0%		£99.0	£10,000	6.0	Residual Risk
								111	Set to bridge	1	1	6.0				6.0	0%	0%		£99.0	£10,000	6.0	
								112	Bridge Pier in the vicinity of the authorised channel							6.0	0%	0%		£99.0	£10,000	6.0	6.0
								113	Bridge procedures not in place or followed							6.0	0%	0%		£99.0	£10,000	6.0	
								114	Restriction of authorised channel							6.0	0%	0%		£99.0	£10,000	6.0	Residual Level
								115	Incorrect passage plan				10	Vessel collision	C17	6.0	0%	0%		£99.0	£10,000	6.0	
																6.0	0%	0%		£99.0	£10,000	6.0	Minor
																6.0	0%	0%		£99.0	£10,000	6.0	
																6.0	0%	0%		£99.0	£10,000	6.0	Risk Reduction
																6.0	0%	0%		£99.0	£10,000	6.0	
																6.0	0%	0%		£99.0	£10,000	6.0	
8	15	15	In the vicinity of Proposed Bridge	Contractor	Contact - Bridge Pier - Wind - > 11m/s Air Draught - Risk Control Measures	C3	Major injuries	11	Master / Shipper error	3	3	9.0		Baseline with no additional risk controls						£100.0	£10,000	9.0	Baseline Risk
						C8	Moderate damage to vessel	12	Failure to adhere to local Bi-wayne log (advice) / risk controls						11, 18, 110, 111, 119	9.0	0%	0%		£99.0	£10,000	9.0	9.0
						C17	Minor damage to bridge	13	Mechanical defect / failure				2	Reinforce western bridge pier further from authorised channel	11, 18, 110, 111, 119	9.0	80%	0%		£60.0	£10,000	9.0	
						C21	Limited impact on the environment, with short-term or long-term effects (Tier 2)	14	Result of existing collision with 3rd party vessel				1	Placing buoyband on the outside of bridge	11, 18, 18, 114	9.0	20%	0%		£99.0	£10,000	9.0	Baseline Level
						C27	Minor local adverse publicity	15	Congestion in the access of Bridge						11, 12, 13, 18, 1.16, 118, 119	9.0	0%	0%		£99.0	£10,000	9.0	Minor
						C31	Insignificant deviation to marine operations	16	Adverse weather conditions / reduced visibility				3	Clear marking and lighting of bridge structure	11, 18, 18, 121	9.0	20%	0%		£79.0	£10,000	9.0	
								110	Set onto bridge by the tidal stream				4	Adherence to bridge procedures	11, 12, 18, 122, 1.19	9.0	20%	0%		£99.0	£10,000	9.0	Residual Risk
								111	Set to bridge	2	1	9.0			11, 19	9.0	0%	0%		£99.0	£10,000	9.0	
								112	Bridge Pier in the vicinity of the authorised channel						11, 18	9.0	0%	0%		£99.0	£10,000	9.0	9.0
								113	Bridge procedures not in place or followed						11, 18, 18, 1.14, 1.19	9.0	0%	0%		£99.0	£10,000	9.0	
								114	Restriction of authorised channel				10	Vessel collision	C17	9.0	0%	10%		£99.0	£9,900	8.9	Residual Level
								115	Incorrect passage plan							8.9	0%	0%		£99.0	£9,900	8.9	
																8.9	0%	0%		£99.0	£9,900	8.9	Minor
																8.9	0%	0%		£99.0	£9,900	8.9	
																8.9	0%	0%		£99.0	£9,900	8.9	Risk Reduction
																8.9	0%	0%		£99.0	£9,900	8.9	
																8.9	0%	0%		£99.0	£9,900	8.9	

Project	[redacted]	Date	[redacted]	Site / Location	[redacted]	Assessor	[redacted]	Review Interval	[redacted]	Ref/Rev

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Cause (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction: Risk Reduction Measures	Risk Reduction: Risk Reduction Measures	Risk Reduction: Risk Reduction Measures	Risk Reduction: Risk Reduction Measures	Risk Reduction: Risk Reduction Measures	Risk Reduction: Risk Reduction Measures	Results
9	9	9	Within vicinity of Proposed Bridge	Transport	Contact - Bridge Pier - Vessel – < 15m Air Draught – Inner Port Trade Freight & Port Vessels					3	3	9.0		Baseline with no additional risk controls						Baseline Risk
													2	Vehicle-mounted bridge pier further from authorised channel	[redacted]					
													5	Ensure [redacted] vicinity of bridge	[redacted]					Baseline Level
													9	Clear marking and lighting of bridge arch/span	[redacted]					
													8	Adherence to bridge procedures	[redacted]					Residual Risk
													10	Impact protection	[redacted]					Residual Level
10	10	10	In the vicinity of Proposed Bridge	Contact	Contact - Bridge Pier - Vessel – < 15m Air Draught – Recreational / Small Vessels					3	3	9.0		Baseline with no additional risk controls						Baseline Risk
													2	Vehicle-mounted bridge pier further from authorised channel	[redacted]					
													5	Ensure [redacted] vicinity of bridge	[redacted]					Baseline Level
													9	Clear marking and lighting of bridge arch/span	[redacted]					
													8	Adherence to bridge procedures	[redacted]					Residual Risk
													10	Impact protection	[redacted]					Residual Level

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Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place: Likelihood	Consequence	Baseline Risk	Risk Reduction: Additional Risk Controls (RRC) Measures	Risk Reduction: Responsible Person / Department	Risk Reduction: Likelihood	Risk Reduction: Consequence	Risk Reduction: Residual Risk	Residual Risk: Likelihood	Residual Risk: Consequence	Residual Risk: Residual Risk	Results
11	9	11	In the vicinity of Proposed Bridge	Land use	Derived - Bridge Span - (Set Air Draught - Commercial					3	3	9.0	Baseline with no additional risk controls								Baseline Risk
						C5	Major injuries or multiple fatalities	11	Master / Skipper error				11, 13, 18, 110, 113, 114		5%	3%					
						C4	Major damage to vessel	12	Wind action				11, 13, 18, 110, 113, 114		5%	3%					9.0
						C3/1	Severe damage to bridge	13	Failure to adhere to local & maritime legislation / risk controls				11, 13, 18, 18, 114		5%	3%					Baseline Level
						C2/1	Limited impact on the environment, with short term or long term effects (Tier 1)	14	Mechanical defect / failure				11, 13, 18, 110, 113, 114, 115, 116		10%	5%					Mitigations
						C3/2	International security notices	15	Result of bonding action with third party vessel				11, 13, 15, 18, 113, 114		5%	3%					Residual Risk
						C3/3	Major diversions to normal operations	16	Congestion in the vicinity of Bridge				11, 13, 15, 18, 113, 114		20%	3%					
								17	Adverse weather conditions / reduced visibility				11, 13, 18		10%	3%					9.0
								112	Vessel under bridge by mistake or error				11, 13, 18		10%	3%					
								121	Land bridge				11, 13, 18, 114, 116		10%	3%					
								122	Bridge protection not in place or removed						5%	3%					Residual Level
								124	Reduction of safe navigational channel						5%	3%					
								123	Misjudging height of ship						5%	3%					Mitigations
								125	Incorrect passage plan						5%	3%					
															5%	3%					Risk Reduction
															5%	3%					
															5%	3%					
12	10	12	In the vicinity of Proposed Bridge	Tourism	Derived - Bridge Span - (Set Air Draught - Recreational					2	3	6.0	Baseline with no additional risk controls								Baseline Risk
						C4	Major injuries	11	Master / Skipper error				11, 18, 110, 113, 114		5%	3%					
						C3	Moderate damage to vessel	12	Failure to adhere to local & maritime legislation / risk controls				11, 18, 110, 113, 114		5%	3%					6.0
						C2/1	Minor damage to bridge	13	Mechanical defect / failure				11, 18, 18, 114		5%	3%					Baseline Level
						C2/2	Insignificant impact on the environment	14	Result of bonding action with third party vessel				11, 13, 18, 18, 113, 114		5%	3%					Mitigations
						C2/3	Negligible external publicity	15	Congestion in the vicinity of Bridge				11, 15, 17, 111		5%	3%					
						C2/4	Insignificant management time and expenditure	16	Adverse weather conditions / reduced visibility				11, 13, 18, 113, 114		10%	3%					Residual Risk
								110	Jetty or bridge by the tidal stream				11, 18		10%	3%					
								111	Land bridge				11, 18		10%	3%					6.0
								112	Bridge protection not in place or removed				11, 13, 18, 114, 114		10%	3%					
								114	Reduction of safe navigational channel						5%	3%					Residual Level
								113	Misjudging height of ship						5%	3%					
								115	Incorrect passage plan						5%	3%					Mitigations
															5%	3%					
															5%	3%					Risk Reduction
															5%	3%					
															5%	3%					

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Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place: Likelihood	Baseline Risk - with existing risk controls in place: Consequence	Baseline Risk - with existing risk controls in place: Baseline Risk	Risk Controls: Risk Control No.	Risk Controls: Existing Risk Controls / Mitigations	Risk Controls: Control Effectiveness	Risk Controls: Likelihood Reduction	Risk Controls: Consequence Reduction	Risk Controls: Residual Likelihood	Risk Controls: Residual Consequence	Risk Controls: Residual Risk	Results
11	11	11	Infrastructure of Proposed Bridge	Collision	Collision as a result of Bridge – 1 Ton Arr Draught - Commercial Craft Other Vessel					1.3	1	1.3		Opening with no additional risk controls				100.0	£100,000	£0	Baseline Risk
						C1	Vessel capsize	11	Master / Master error				1	Reduce speed in bridge pier further from authorised channel	Low	15%	0%	42.5	£42,500	£0	1.3
						C2	Minor or superficial damage to vessel	11	Mate error				2	Reduce speed in bridge pier further from authorised channel	Low	15%	0%	36.1	£36,000	£0	
						C3A	Major damage to secondary vessel	13	Failure to adhere to local & national legislation / risk controls				3	Flowing all inbound within vicinity of bridge	Low	20%	0%	170.1	£170,000	£0	Baseline Level
						C3J	Minor impact on the environment with no lasting effects (Tier 3)	15	Mechanical failure / failure				4	Toggle to be made fast prior to bridge	Low	20%	0%	170.1	£170,000	£0	Minor
						C4A	Localised adverse publicity	16	Result of avoiding actions with 3rd party vessel				5	Clear marking and lighting of bridge on bypass	Low	20%	0%	170.1	£170,000	£0	
						C4J	Regional adverse publicity	17	Small vessel not easily visible (e.g. no navigation lights)				6	Adherence to bridge procedures	Low	20%	0%	170.1	£170,000	£0	Residual Risk
								18	Temporary re-line access of Bridge				7	Increase span height	Low	20%	0%	170.1	£170,000	£0	
								19	Adverse weather conditions / reduced visibility				8	Increase number of openings	Low	20%	0%	170.1	£170,000	£0	0.7
								110	Bridge Piers in the vicinity of the authorised channel				9	Co-ordination with Tower Bridge / alert [illegible] while closed to	Low	20%	0%	170.1	£170,000	£0	
								111	Bridge procedures not in place or followed						Low	0%	0%	170.1	£170,000	£0	Residual Level
								112	Restriction of authorised channel						Low	0%	0%	170.1	£170,000	£0	Minor
								113	Mast from passing river traffic						Low	0%	0%	170.1	£170,000	£0	
								114	Vessel overshoots secured						Low	0%	0%	170.1	£170,000	£0	Risk Reduction
								115	Waiting for traffic passing through bridge navigating with the tidal stream						Low	0%	0%	170.1	£170,000	£0	
								116	Approach restricted to Bridge						Low	0%	0%	170.1	£170,000	£0	0.7
								117	Visibility restricted by bridge						Low	0%	0%	170.1	£170,000	£0	
12	12	12	Infrastructure of Proposed Bridge	Collision	Collision as a result of Bridge – 1 Ton Arr Draught - Recreational Craft Other Vessel					2.3	1	2.3		Opening with no additional risk controls				100.0	£100,000	£0	Baseline Risk
						C1	Vessel capsize	11	Master / Skipper error				1	Reduce speed in bridge pier further from authorised channel	Low	15%	0%	42.5	£42,500	£0	2.3
						C2	Minor or superficial damage to vessel	12	Failure to adhere to local & national legislation / risk controls				2	Reduce speed in bridge pier further from authorised channel	Low	10%	0%	36.1	£36,000	£0	
						C3A	Major damage to secondary vessel	13	Poor navigation / failure				3	Flowing all inbound within vicinity of bridge	Low	5%	0%	17.5	£17,500	£0	Baseline Level
						C3J	Minor impact on the environment with no lasting effects (Tier 3)	14	Result of avoiding actions with 3rd party vessel						Low	0%	0%	17.5	£17,500	£0	Minor
						C4A	Regional adverse publicity	17	Small vessel not easily visible (e.g. no navigation lights)				5	Clear marking and lighting of bridge and beam	Low	10%	0%	38.5	£38,500	£0	
						C4J	Minor disruption to marine operations	18	Congestion in the vicinity of Bridge				6	Adherence to bridge procedures	Low	10%	0%	38.5	£38,500	£0	Residual Risk
								19	Adverse weather conditions / reduced visibility				7	Increase span height	Low	10%	0%	38.5	£38,500	£0	
								110	Bridge Piers in the vicinity of the authorised channel				8	Include number of openings	Low	10%	0%	38.5	£38,500	£0	0.5
								111	Bridge procedures not in place or followed				9	Co-ordination with Tower Bridge / alert [illegible] while closed to	Low	10%	0%	38.5	£38,500	£0	
								114	Restriction of authorised channel						Low	0%	0%	38.5	£38,500	£0	Residual Level
								116	Mast from passing river traffic						Low	0%	0%	38.5	£38,500	£0	
								117	Vessel overshoots secured						Low	0%	0%	38.5	£38,500	£0	Minor
								115	Waiting for traffic passing through bridge navigating with the tidal stream						Low	0%	0%	38.5	£38,500	£0	
								116	Approach restricted to Bridge						Low	0%	0%	38.5	£38,500	£0	Risk Reduction
								117	Visibility restricted by bridge						Low	0%	0%	38.5	£38,500	£0	0.5

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Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)	Undesirable Hazard Outcome (Consequence)	Hazard Variant ID (if Additional)	Hazard Causes (if Additional)	Baseline Risk – with existing risk controls in place: Likelihood	Consequence	Baseline Risk
11	1	1	Incursion of Powered Craft	Collision	Loss of craft as a result of Bridge – e.g. Fire Air Draught – Cross 10-40/70kts, ESP, Other Vessel					1	1	0.0
						14	Major injuries or single fatality	11	Master / Skipper error
						13	Moderate damage to vessel	12	Failure to adhere to local & national legislation / risk controls
						113	Moderate damage to secondary vessel	13	Mechanical failure / failure
						111	Minor impact on the environment with no lasting effects (Tier 1)	14	Result of 3rd party (not easily visible e.g. no navigation lights)
						109	Reputational damage to Authority	17	Vessel / craft not easily visible (e.g. no navigation lights)
						110	Moderate disruption to marine operations	18	Navigation in the vicinity of Bridge
								19	Adverse weather conditions / reduced visibility
								112	Bridge Piers in the vicinity of the authorised channel
								113	Bridge procedures not in place or followed
								114	Non-known or authorised craft
								115	Wash from passing river traffic
								117	Vessel incorrectly secured
								121	Waiting for traffic passing through bridge navigating with the tide or wind
								122	Approach vessel made by bridge
								123	Vessel not raised by bridge
10	4	4	In the vicinity of Powered Bridge	Collision	Loss of craft as a result of Bridge – e.g. Fire Air Draught – Cross Pipe Track & Height & Workboats, ESP, Other Vessel					1	1	0.0
						C1	Major injuries	11	Master / Skipper error
						02	Moderate damage to vessel	12	Poor crew
						111	Minor impact on the environment with no lasting effects (Tier 1)	13	Failure to adhere to local & national legislation / risk controls
						113	Moderate disruption to marine operations	14	Mechanical failure / failure
								16	Result of 3rd party (not easily visible e.g. no navigation lights)
								17	Vessel / craft not easily visible (e.g. no navigation lights)
								18	Navigation in the vicinity of Bridge
								19	Adverse weather conditions / reduced visibility
								112	Bridge Piers in the vicinity of the authorised channel
								113	Bridge procedures not in place or followed
								114	Non-known or authorised craft
								115	Wash from passing river traffic
								117	Vessel incorrectly secured
								121	Waiting for traffic passing through bridge navigating with the tide or wind
								122	Approach vessel made by bridge
								123	Vessel not raised by bridge

	Risk Assessment						Results
	Additional Risk Controls (if Required)	Risk Likelihood (with additional controls)	Risk Likelihood	Risk Consequence	Risk Severity (with additional controls)	Risk Severity	
	Baseline with no additional risk controls						Baseline Risk
1	Re-build eastern bridge pier further from authorised channel	11, 18, 122, 111, 113	10%	0%			0.0
2	Re-build western bridge pier further from authorised channel	11, 18, 122, 111, 113	10%	0%			
3	Placing [redacted] within vicinity of bridge	11, 18, 18, 114	10%	0%			Baseline Level
		11, 12, 15, 18, 122, 113, 114	0%	0%			Workboats
4	Clear marking and lighting of bridge arch/piers	11, 18, 18, 111	10%	0%			
5	Maintenance to bridge protection	11, 12, 18, 122, 123	10%	0%			Residual Risk
		11, 18	0%	0%			0.0
		11, 18	0%	0%			
		11, 15, 18, 118, 119	0%	0%			
			0%	0%			Residual Level
			0%	0%			Workboats
			0%	0%			
			0%	0%			Risk Reduction
			0%	0%			
			0%	0%			0.0
	Date: [redacted] additional risk controls						Baseline Risk
1	Re-build eastern bridge pier further from authorised channel	11, 12, 18, 122, 123, 114	10%	0%			0.0
2	Remove western bridge pier further from authorised channel	11, 12, 18, 118, 122, 123	10%	0%			
3	Placing [redacted] within vicinity of bridge	11, 12, 18, 18, 114	0%	0%			Baseline Level
		11, 12, 18, 18, 18, 114, 113, 119	0%	0%			Workboats
5	Clear marking and lighting of bridge arch/piers	11, 12, 18, 18, 111	10%	0%			
6	Maintenance to bridge protection	11, 12, 18, 18, 113, 114	10%	0%			Residual Risk
		11, 12, 18	0%	0%			0.0
		11, 12, 18	0%	0%			
		11, 12, 17, 18, 114, 113	0%	0%			
			0%	0%			Residual Level
			0%	0%			Workboats
			0%	0%			
			0%	0%			Risk Reduction
			0%	0%			
			0%	0%			0.0
			0%	0%			

Project	[redacted]	Date	[redacted]	Risk / Initiation	[redacted]	Guidance	[redacted]	Revision	Draft A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome (Consequence)	Credible Hazard Outcome (Consequence)	Hazard Cause (Likelihood)	Hazard Cause (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Controls: No.	Risk Controls: Additional Risk Controls and Mitigations	Risk Controls: Risk Reduction Value	Risk Controls: Likelihood	Risk Controls: Consequence	Risk Controls: Residual Risk Value	Results
17	4	3	At the vicinity of Proposed Bridge	Collision	Collision as a result of Bridge - 4 Obstacle Draught - Permanent / Small vessels and other vessel	C1	Minor injuries	L1	Master / Skipper error	3.3	3	9.9		Baseline with no additional risk controls				3.3	Baseline Risk
						C2	Minor damage to vessel	L2	Failure to adhere to local & navigational regulations / restrictions				1	Relocate western bridge pier further from authorised channel	L1, L2, L3, L11, L12, L13	3	1.01	0%	3.3	3.3
						C2.2	Minor or superficial damage to passenger vessel	L3	Mechanical defect / failure				2	Relocate eastern bridge pier further from authorised channel	L1, L2, L3, L11, L12, L13	3	2.25	0%	3.3	3.3
						C3.1	Major/Multi impact on the environment	L4	Result of assisting vessel with 3rd party vessel				3	Passing navigational within vicinity of bridge	L1, L2, L3, L8, L14	3	3%	0%	3.3	Tolerable Level
						C3.2	Minor local adverse publicity	L5	Aircraft related safety issue (e.g. no radio/wrong						L1, L2, L3, L5, L8, L10, L11, L12, L13	3	3%	0%	3.3	Moderate
						C3.3	Single/Multi impact on marine operations	L6	Congestion in the vicinity of Bridge				4	Other marking and lighting of bridge arch/piers	L1, L2, L3, L11	3	2.25	0%	3.3	
								L7	Adverse weather conditions / reduced visibility				5	Adherence to bridge procedures	L1, L2, L3, L11, L12, L13	3	3%	0%	3.3	Residual Risk
								L11	Vessel - Power in the vicinity of the authorised channel						L1, L2	3	3%	0%	3.3	
								L12	Bridge procedures not in place or followed						L1, L2	3	3%	0%	3.3	3.3
								L13	Restriction of authorised channel						L1, L2, L3, L11, L12	3	3%	0%	3.3	
								L14	Vessel / tow unable to stop							3	3%	0%	3.3	Residual Level
								L15	Vessel unexpectedly powered							3	3%	0%	3.3	Moderate
								L16	Working for traffic passing through bridges exceeding safe / the rated stream							3	3%	0%	3.3	
								L22	Boat/craft removed by bridge							3	3%	0%	3.3	Risk Reduction
								L23	Visibility over road by bridge							3	3%	0%	3.3	0.0
18	11	11	At the vicinity of Proposed Bridge	Grounding	Grounding – 4 Obstacle Draught - Commercial	C1	Minor injuries	L1	Master / Skipper error	3.3	4	13.2		Baseline with no additional risk controls				13.2	Baseline Risk
						C2	Major damage to vessel	L2	Poor lookout						L1, L2, L3, L11, L12, L13	3	1.01	0%	13.2	13.2
						C2.1	Minor impact on EU environment with no lasting effects (Tier 1)	L3	Failure to adhere to local & navigational regulations / restrictions						L1, L2, L3, L11, L12, L13	3	1.01	0%	13.2	
						C2.2	Extensive adverse publicity	L4	Mechanical defect / failure				3	Passing navigational within vicinity of bridge	L1, L2, L3, L8, L14	3	3%	0%	13.2	Tolerable Level
						C3.4	Major disruption to marine operations	L6	Congestion in the vicinity of Bridge				4	Tugs to be made fast or not to bridge	L1, L2, L3, L5, L8, L10, L11, L12, L13, L14	3	2.25	0%	13.2	Minor
								L7	Adverse weather conditions / reduced visibility				5	Other marking and lighting of bridge arch/piers	L1, L2, L3, L8, L11	3	3%	0%	13.2	
								L11	Vessel - Power in the vicinity of the authorised channel				6	Adherence to bridge procedures	L1, L2, L3, L4, L11, L12, L13	3	3%	0%	13.2	Residual Risk
								L12	Bridge procedures not in place or followed				7	Increase span height	L1, L2, L8	3	2.25	0%	13.2	
								L14	Restriction of authorised channel				8	Increase number of openings	L1, L2, L8	3	3%	0%	13.2	13.2
								L15	Unexpected height of tide				9	Co-ordination with Tower Bridge / vessel priority which inbound	L1, L2, L3, L8, L14, L15	3	3%	0%	13.2	
								L19	Incorrect passage plan							3	3%	0%	13.2	Restricted Level
																3	3%	0%	13.2	Minor
																3	3%	0%	13.2	
																3	3%	0%	13.2	Risk Reduction
																3	3%	0%	13.2	
																3	3%	0%	13.2	0.0

Project	[redacted]	Client	[redacted]	Site / Location	[redacted]	Assessor	Marine Marine	Assessment	Draft A

Hazard ID	Baseline Hazard Risk	Residual Hazard Risk	Hazard Area	Hazard Category	Hazard Title	Baseline Hazard Outcome ID (Consequence)	Baseline Hazard Outcome (Consequence)	Hazard Causes ID (Likelihood)	Hazard Causes (Likelihood)	Baseline Risk – with existing risk controls in place: Likelihood	Baseline Risk – with existing risk controls in place: Consequence	Baseline Risk – with existing risk controls in place: Baseline Risk	Risk Reduction: Risk Control Measures	Risk Reduction: Control Measure Ref	Risk Reduction: Control Measure Type	Risk Reduction: Likelihood Reduction	Risk Reduction: Consequence Reduction	Risk Reduction: Residual Risk	Results
19	16	12	In the vicinity of the [redacted] Bridge	Grounding	Grounding – 1.15m Air Draught - Representative					4	4	4.0	Baseline with no additional risk controls						Baseline Risk
						C1	Work injuries	L1	Master / Skipper error				1 Navigate eastern bridge span further from authorised channel	C1, C8, C10, C12, C19	Navigational	25%	25%	3.1	4.0
						C8	Vessel and damage to vessel	L2	Failure to assess vessel & maintain navigational / site controls				2 Navigate western bridge span further from authorised channel	C1, C8, C10, C12, C19	Navigational	25%	25%	3.1	
						C11	Insignificant impact on the environment	L5	Mechanical defect / Failure				3 Passing displacement within vicinity of bridge	C1, C8, C8, C19	Navigational	5%	5%	3.8	Baseline Level
						C17	Minor local adverse publicity	L6	Result of anchoring incident with 3rd party vessel					C1, C2, C3, C5, C8, C10, C12, C19	Navigational	5%	5%	3.8	Minor
						C21	Minor disruption to the navigation	L8	Congestion in the vicinity of Bridge				4 Clear marking and lighting of bridge pinnacles	C1, C8, C9, C21	Navigational	5%	5%	3.8	Residual Risk
								L9	Adverse weather conditions / reduced visibility				5 Adherence to bridge procedures	C1, C5, C8, C19, C20	Navigational	10%	5%	3.6	
								L11	Lock bridge				7 Increased air height	C1, C8	Navigational	10%	5%	3.6	3.6
								L12	Bridge Piers in the vicinity of the authorised channel				8 Increased number of passings	C1, C8	Navigational	5%	5%	3.8	
								L13	Bridge pinnacles not in place or removed				9 Co-ordination with Tower Bridge / down stream vessel passing	C1, C5, C8, C24, C25	Navigational	5%	5%	3.8	
								L14	Restriction of authorised channel							5%	5%	3.8	Residual Level
								L15	Encroaching height of tide							5%	5%	3.8	Minor
								L19	Incorrect passage plan							5%	5%	3.8	
																5%	5%	3.8	Risk Reduction
																5%	5%	3.8	
																5%	5%	3.8	
21	9	9	In the vicinity of Tower Bridge	Grounding	Grounding – 1.15m Air Draught - Class 1/WD/RCBs					4	4	4.0	Baseline with no additional risk controls						Baseline Risk
						C1	Major injuries	L1	Master / Skipper error				1 Navigate eastern bridge span further from authorised channel	C1, C8, C10, C12, C24	Navigational	25%	25%	3.1	4.0
						C8	Minor site damage to vessel	L2	Failure to adhere to look & navigational / site controls				2 Navigate western bridge span further from authorised channel	C1, C8, C10, C12, C24	Navigational	25%	25%	3.1	
						C11	Insignificant impact on the environment	L5	Mechanical defect / Failure				3 Passing displacement within vicinity of bridge	C1, C8, C8, C19	Navigational	5%	5%	3.8	Baseline Level
						C17	Minor local adverse publicity	L6	Result of anchoring incident with 3rd party vessel					C1, C2, C3, C5, C8, C10, C12, C19	Navigational	5%	5%	3.8	Minor
						C21	Minor disruption to the navigation	L8	Congestion in the vicinity of Bridge				4 Clear marking and lighting of bridge pinnacles	C1, C8, C9, C21	Navigational	5%	5%	3.8	
								L9	Adverse weather conditions / reduced visibility				5 Adherence to bridge procedures	C1, C5, C8, C19, C20	Navigational	10%	5%	3.6	Residual Risk
								L11	Lock bridge					C1, C8	Navigational	5%	5%	3.8	3.6
								L12	Bridge Piers in the vicinity of the authorised channel					C1, C8	Navigational	5%	5%	3.8	
								L13	Bridge pinnacles not in place or removed					C1, C5, C8, C19, C20	Navigational	5%	5%	3.8	
								L14	Restriction of authorised channel							5%	5%	3.8	Residual Level
								L15	Encroaching height of tide							5%	5%	3.8	Minor
								L19	Incorrect passage plan							5%	5%	3.8	
																5%	5%	3.8	Risk Reduction
																5%	5%	3.8	

Project		Date		Site / Location		Assessor		Review	Sheet A

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Existing Hazard Outcome ID (Consequence)	Existing Hazard Outcome (Consequence)	Hazard Causes ID (Activity)	Hazard Causes (Activity)	Baseline Risk - with existing risk controls in place: Likelihood	Baseline Risk - with existing risk controls in place: Consequence	Baseline Risk - with existing risk controls in place: Baseline Risk	Risk Treatment: Risk Ref	Risk Treatment: Additional Risk Control Measures	Risk Treatment: Likelihood	Risk Treatment: Consequence	Risk Treatment: Residual Risk	Risk Treatment: Residual Risk after risk controls (£)	Risk Treatment: Cost of Risk Control (£)	Risk Treatment: Cost Benefit Analysis	Results
11	11	11	In the vicinity of Proposed Bridge	Grounding	Grounding – Vehicle Draught – Interaction Trade Freight & Workboats					3.3	3	9.9		Baseline risk with no additional risk controls				10.9	£140,000		Baseline Risk
						C1	Minor injuries	11	Master / Skipper error				1	Provide extra buoys to keep vessel further from authorised channel	11, 13, 16, 18, 110, 111, 119	3	33%	9%	10.9	£140,000		9.9
						C2	Minor or superficial damage to vessel	12	Pilot error				2	Provide extra buoys to keep vessel further from authorised channel	11, 13, 16, 18, 110, 111, 119	3	33%	9%	10.9	£140,000		
						C21	Minor impact on the environment with no lasting effects (Tier 1)	13	Failure to adhere to local & navigational regulations / constraints				3	Pop up deployment within vicinity of bridge	11, 13, 16, 18, 124	3	33%	9%	10.9	£140,000		Baseline Level
						C22	Regional adverse publicity	14	Mechanical defect / failure						11, 13, 16, 18, 19, 111, 112, 113	5	55%	9%	55.4	£140,000		Tolerance
						C23	Moderate disruption to marine operations	16	Result of providing advice with third party vessel				5	Clear marking and lighting of bridge arch/piers	11, 13, 16, 19, 111	3	33%	9%	10.9	£140,000		
								18	Congestion in the vicinity of Bridge				6	Adherence to bridge procedures	11, 13, 14, 16, 112, 113, 114	3	33%	9%	10.9	£140,000		Residual Risk
								19	Adverse weather conditions / reduced visibility						11, 13, 16	3	33%	9%	10.9	£140,000		
								111	Lock bridge						11, 13, 16	3	33%	9%	10.9	£140,000		9.9
								112	Bridge fixes in the vicinity of the authorised channel						11, 13, 16, 19, 114, 115	3	33%	9%	10.9	£140,000		
								113	Bridge procedures not in place or followed							3	33%	9%	10.9	£140,000		Residual Level
								114	Restriction of authorised channel							3	33%	9%	10.9	£140,000		
								115	Not applying height of tide							3	33%	9%	10.9	£140,000		Tolerance
								116	Vessel from passing river traffic							3	33%	9%	10.9	£140,000		
								119	Incorrect passage plan							3	33%	9%	10.9	£140,000		Risk Reduction
																3	33%	9%	10.9	£140,000		
11	1	1	In the vicinity of Proposed Bridge	Grounding	Grounding – Vehicle Draught – Permanent / Environment					4	1	4.0		Baseline risk with no additional risk controls				1.0	£100,000		Baseline Risk
						C1	Minor injuries	11	Master / Skipper error				1	Provide extra buoys to keep vessel further from authorised channel	11, 13, 110, 112, 119	3	33%	3%	1.0	£100,000		3.3
						C2	Minor or superficial damage to vessel	12	Pilot error				2	Relocate buoys to keep vessel further from authorised channel	11, 13, 110, 112, 114	3	33%	3%	1.0	£100,000		
						C21	Insignificant impact on the environment	13	Failure to adhere to local & navigational regulations / constraints				3	Passing deployment within vicinity of bridge	11, 13, 16, 111	3	3%	3%	1.0	£100,000		Baseline Level
						C27	Minor social behavior Activity	14	Mechanical defect / failure						11, 13, 16, 19, 110, 112, 119	5	5%	3%	1.0	£100,000		Tolerance
						C31	Insignificant damage to marine operations	15	Result of providing advice with 3rd party vessel				5	Clear marking and lighting of bridge arch/piers	11, 13, 16, 111	3	33%	3%	1.0	£100,000		
								16	Congestion in the vicinity of Bridge				6	Adherence to bridge procedures	11, 13, 16, 113, 119	3	3%	3%	1.0	£100,000		Residual Risk
								18	Adverse weather conditions / reduced visibility						11, 13	3	3%	3%	1.0	£100,000		
								111	Lock bridge						11, 13	3	3%	3%	1.0	£100,000		3.3
								112	Bridge fixes in the vicinity of the authorised channel						11, 13, 16, 119, 119	3	33%	3%	1.0	£100,000		
								113	Bridge procedures not in place or followed							3	3%	3%	1.0	£100,000		Residual Level
								114	Restriction of authorised channel							3	3%	3%	1.0	£100,000		
								115	Not applying height of tide							3	3%	3%	1.0	£100,000		Tolerance
								116	Vessel from passing river traffic							3	3%	3%	1.0	£100,000		
								119	Incorrect passage plan							3	3%	3%	1.0	£100,000		Risk Reduction
																3	3%	3%	1.0	£100,000		

Transport for London

SURFACE TRANSPORT

CONTRACT

FOR

Rotherhithe to Canary Wharf River Crossing – Marine Engineering Support

QUALITY SUBMISSION

Project Reference Number: tfl_scp_001762

Transport for London
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MARICO MARINE

TRANSPORT FOR LONDON

PROPOSAL: ROTHERHITHE TO CANARY WHARF RIVER CROSSING - MARINE ENGINEERING SUPPORT: QUALITY ASSESSMENT

Report Number: 18UK1421
Issue: 01
Date: 19 March 2018

MARINE AND RISK CONSULTANTS LTD

TRANSPORT FOR LONDON

PROPOSAL: ROTHERHITHE TO CANARY WHARF RIVER CROSSING - MARINE ENGINEERING SUPPORT: QUALITY ASSESSMENT

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19 March 2018

CONTENTS

ANNEXES

1 APPROACH, UNDERSTANDING AND METHODOLOGY

1.1 REQUIREMENT 1: STAKEHOLDER NEGOTIATION

a. Describe your proposed understanding, approach and methodology in delivering the requirements detailed in Volume 2, The Scope, Section 3.1, Requirement 1

1.1.1 Understanding of PLA Process including Licensing / approvals

Marico Marine has undertaken more navigation risk assessments on the tidal Thames than any other provider, all of which have met the requirements of the PLA (as the navigation regulator) and, where submitted, have been granted for approval. The experience Marico Marine has, along with the staff expertise and the reputation it has developed, means that, if awarded the contract, Transport for London can be assured of best in class services that will meet and exceed statutory requirements. A table of Thames related projects Marico Marine has been awarded is given in **Annex A**.

Marico Marine has an exceptional geographic specific knowledge of the proposed bridge location through providing the following services to the Rotherhithe to Canary Wharf Bridge to date:

- Vessel Traffic survey using innovative CCTV system – May 2017- May 2018
- Conducting the Preliminary NRA
- Providing Stakeholder Negotiation support to the project to date allowing effective and timely communication and liaison with the PLA Harbour Master Upper Department

1.1.2 Experienced Mariner

Marico Marine employs a unique blend of experienced marine practitioners and scientists. With around half the company resource having extensive experience in practical and senior roles across the marine and ports industry, the company is able to fully deliver to the project requirements for experienced mariners. No other marine safety consultancy employs more marine qualified personnel. Project personnel include, mariners from commercial, military and recreational backgrounds, including:

- Cmdr. [redacted] – Former Class 1 Marine Pilot from UK's busiest port – Dover Harbour Board and Former RN Destroyer Commander
- Capt. [redacted] – Master Mariner
- Capt. [redacted] – Master Mariner
- Cmdr. [redacted] – Former RN Submarine Commander
- Lt. Cmdr. [redacted] – Former RN Minesweeper Commander
- [redacted] – Royal Yachting Association Commercial Yacht Master
- Dr [redacted] – Former Royal Yachting Association Senior Sailing Instructor
- [redacted] – Former Royal Yachting Association Sailing Instructor

1.1.3 Experience of carrying out Navigation Risk Assessments

Marico Marine has the enviable track record of carrying out more NRA's in the UK over recent years compared to any other organisation. Marico Marine carry out NRA's for the following sectors:

- Ports and Harbours
- Infrastructure Developments
- Offshore Renewable Energy Installations
- Offshore Oil and Gas Installations and Activities
- Government and National Regulators

A list of selected recent assessments undertaken by Marico Marine is presented in **Annex A**.

1.1.4 Harbour Master Role

Harbour Masters are officials responsible for enforcing the regulations of a particular port/harbour, in order to ensure the safety of navigation. Essentially Transport for London require a consultant who understands how the Port of London Authority manages navigation safety and mitigate risks. Marico Marine is fortunate to have a number of Harbour Masters and Professionals, some with direct experience of Harbour Mastering from the PLA (see *), they include:

- Cmdr. [redacted] – Former Dover Harbour Board Harbour Master
- Capt. [redacted] – Former ABP – Southampton - Deputy Harbour Master
- Cmdr. [redacted] – Former PLA Chief Harbour Master & Harbour Master Upper*
- Lt. Cmdr. [redacted] – Former PLA Harbour Master Upper*
- [redacted] – Former Marine Safety Advisor to ABP

1.1.5 Knowledge of Large/wide navigable River

Most UK ports are located in sheltered estuarine locations, and as such are within large / wide navigable rivers. The Operations Director for Marico Marine Dr [redacted] conducted his doctoral research into quantification of navigation risk on the Humber Estuary for Associated British Ports, the largest port owner / operator in the UK in early 2000's. This was the first time such in-depth research had been undertaken, and the outputs of his research had been published in peer reviewed academic papers and form the basis for much of the quantitative risk and safety modelling techniques now employed across the UK ports industry.

Within Marico Marine analytical expertise is also provided in the context of:

- Maritime Civil Engineering and Coastal Processes – [redacted]
- Vessel Traffic Risk and Safety Modelling – [redacted]
- Hydrography – [redacted] – Chartered Hydrographer

The depth of knowledge Marico Marine is able to deliver on the scientific / analytical side is complimented by the experience of the Harbour Masters and Mariners we employ (see above).

1.2 REQUIREMENT 2: MARINE MODELLING

b. Describe your proposed understanding, approach and methodology in delivering the requirements detailed in Volume 2, The Scope, Section 3.1, Requirement 2.

1.2.1 Marine Modelling

Transport for London have specified the requirement for marine simulation modelling to inform the design and specifically the geometry of bridge pier locations and soffit heights. This was a recommendation of the Preliminary NRA report which has been agreed by the PLA as being necessary.

The tasks involved in the Marine Modelling would be as follows:

- Review final design and outline construction methodology/layouts for inclusion in simulation plan
- Develop simulation model for bridge designs & hydrodynamics
- Undertake simulation workshops
- Prepare and issue simulation report

The critical requirement for the marine simulation modelling is that it dovetails with the navigation risk assessment to ensure maximum utility.

In order to undertake the simulations Marico Marine will sub-contract HR Wallingford – UK centre of excellence for marine simulation modelling for infrastructure development. Marico Marine has experience of interfacing marine simulation modelling into infrastructure development with HR Wallingford, and has two personnel (Dr [redacted] who are former employees of HR Wallingford with extensive experience of undertaking actual marine simulation modelling.

Existing marine simulator models have been established for the Thames at HR Wallingford and thus represent the most up to date simulator of the study area with regulator and industry adopted representation of the river layout, visual scene, hydrodynamics and operating vessels. This will enable effective integration of any hydrodynamic model outputs (as being developed separately by the Environmental Consultant) to the benefit of the marine simulation model.

1.2.2 HR Wallingford – Full Bridge Simulators

HR Wallingford operates four real time simulators from its UK Ship Simulation Centre. These comprise two ship simulators and two dedicated tug simulators. All four simulators are full bridge, real time manoeuvring simulators specifically designed for port design and ship operations applications, but are also used for training and pilot familiarisation purposes. They have been used successfully in over 300 studies world-wide and have proved to be reliable, flexible and cost-effective design and evaluation tools that can be used for optimising harbour layouts, establishing operational strategy, and training in safe manoeuvring procedures.

The four simulators are fully integrated such that they can be used to represent one or more piloted ships, or two ships and two independently manned tugs, all within the same simulated environment. Either of the two ship simulators can be adapted to represent a further tug with suitable consoles and controls.

Alternatively, the simulators can be used as four independent simulators, which during training or familiarisation sessions, enables more "hands-on" time for pilots and tug masters. When operating in this mode, an independent ship can also be controlled from within each of the tug simulators to maximise the training opportunities for tug masters.

The system is capable of real time simulation of vessel behaviour in a range of environmental conditions making the simulators suitable for a wide range of design, assessment and training tasks including:

- Pre-feasibility studies, in the form of desk studies or simulation aided desk studies
- Investigation and development of site specific terminal/port/harbour and approach channel designs

- Assessment of safety standards and procedures for shipping and port management operations
- Feasibility studies for new vessels using existing harbours / ports
- Effective training in manoeuvring procedures for pilots, tug masters and ships' officers
- A mobile version of the real-time simulator can be used for on-site pilot training and port design.

Immediately adjacent to each bridge are Briefing/Observation Rooms, with a suite of monitors that relay the instrument and situation displays from the bridge control console, along with simulation visuals, as seen from the bridge.

These enable project team members to observe, monitor and integrate the simulation runs without disturbing the simulation participants. There are also meeting rooms nearby, which can act as a base for the project team, and where all members of the Simulation Team can gather to discuss each simulation in structured detail and to consider any issues raised by the runs.

Mathematical manoeuvring models are tailored to particular studies based on the design ship(s)/tug(s) dimensions, drawings and, whenever possible, ship trials data. HR Wallingford also has an extensive library of Thames ship and tug models for vessels of different sizes and hull forms.

All ship manoeuvring models are verified by professional mariners/pilots and navigation experts.

1.2.3 Real Time Navigation Simulation Runs

During the simulation runs, it will be necessary for marine pilots and masters (independent and PLA) to be in attendance to simulate pilotage of design vessels passing the proposed bridge location. It should be noted that the PLA Harbour Master Upper may also wish to attend to ensure the simulations are accurate and reflect a wide range of operating conditions.

At the start of each run, the desired scenario (vessel, bridge layout, tidal state, wind and wave conditions, lighting level and visibility) are configured within the simulator and the ship is initialised with a suitable position, heading, and forward and transverse speeds. During the run, the wind, waves, light levels and visibility can be altered as required. The pilot can call upon the assistance of tugs, which are controlled in response to verbal commands from the pilot.

As each simulation run proceeds, the pilot and tug masters are presented with the visual and other information that allow representative ship handling decisions to be made, based on accepted navigation practice, skill and experience. In particular, the use of experienced mariners ensures that realistic limits of ship controllability are reproduced and accounted for within the simulation.

Simulation data is recorded at an appropriate frequency (typically every 1 second) for later analysis and reporting (see **Annex B**). The list of data parameters recorded can vary, but typically includes:

- Elapsed time
- Ship position and heading
- Speed and rate of turn
- Rudder and engine settings
- Underkeel clearance
- Tug and thruster activity
- Current and wave conditions at the ship
- Position and heading of any target ships.

1.3 REQUIREMENT 3: NAVIGATION RISK ASSESSMENTS

c. Describe your proposed understanding, approach and methodology in delivering the requirements detailed in Volume 2, The Scope, Section 3.1, Requirement 3.

1.3.1 NRA Requirements

Transport for London have requested Navigation Risk Assessments (NRA) to cover:

- I) Preliminary NRA – complete
- II) NRA to support single preferred bridge option
- III) Full NRA & any other work to support protective provisions
- III) Support through TWAO

Marico Marine have undertaken numerous navigation risk assessments on the river Thames and have assisted the PLA in developing a standard risk assessment framework based on the International Maritime Organisation Formal Safety Assessment. The methodology outlined below is therefore fully compliant with PLA requirements. The NRA process involves the collection of information enabling hazard identification, followed by the assessment of risk and then the identification/review of risk control and mitigation measures. For items II) & III) the following methodology will be employed.

1.3.1.1 NRA Methodology

The identification of hazards will be achieved using a variety of different techniques. The proposed hazard identification process is semi-quantitative in that the following data/information is analysed:

- **Navigation Assessment** - Quantitative Assessment:
  - Risk exposure analysed using Automatic Identification System data
  - Incident analysis undertaken on PLA incident database, (2010-2018).
- **Navigation Risk Assessment** – Formal Safety Assessment approach based on:
  - Results of Navigation Assessment – Qualitative Analysis;
  - Stakeholder consultation – liaison with local users to illicit detailed local knowledge:
  - Navigation Authority – PLA;
  - Key river users – Thames Clippers / Cory Riverside Energy; and
  - River users in the vicinity of the proposed bridge.
- Expert judgement from Marico Marine personnel.

The NRA tasks are as follows:

- **Task 1**: Data collection, vessel traffic analysis and incident analysis
- **Task 2**: Stakeholder consultation
- **Task 3**: Hazard ID definition, assessment of risk, risk control identification and definition
- **Task 4**: Reporting

1.3.1.2 Task 1: Data collection, vessel traffic analysis and incident analysis

At study commencement Marico Marine will undertake a review of the bridge designs with the relevant project descriptions, method statements, drawings and any marine activity/movements (as known and provided to Marico Marine).

In order to make an appropriate assessment of vessel traffic in the vicinity of the proposed bridge, it will be necessary to collect appropriate vessel traffic data to analyse the navigation by vessel type, spatial distribution and temporally over time. This data has already been collected as part of the vessel traffic survey conducted by Marico Marine. This analysis directly informs the exposure to risk and hence the overall navigation risk assessment process. The better the data quality is, the lower the uncertainty becomes, resulting in a greater accuracy of the risk assessment.

Vessel track analysis is derived from vessel traffic survey. A GIS database is constructed based on this data, which enables a multitude of queries to be undertaken. Tracks are created by sequentially joining up AIS transmissions, which then enables further analysis.

A quantitative and geometric descriptive of baseline vessel traffic in the vicinity of the proposed bridge will be undertaken. The analysis will include Track analysis, Gate analysis, Density analysis, and Analysis of historical incidents the (see **Annex C**):

1.3.1.3 Task 2: Stakeholder Consultation:

Stakeholder consultation is fundamental to ensuring all interested parties are included in the assessment and also to elicit detailed local knowledge. Marico Marine has conducted such consultation for projects on the River Thames and through our experience we commonly opt to split consultation into two groups - primary consultees necessitating face-to-face meetings due to either their statutory role, or potential localised impact, and other consultees where due to time/resource limitations consultation may be undertaken via telephone or email.

Key stakeholders include:

- PLA
- Owners and operators of large/tall vessels transiting the area
- Owners and operators of relevant marine facilities in the area

1.3.1.4 Task 3: Hazard ID definition, assessment of risk, risk control identification and definition

Marico Marine will utilise the new PLA risk assessment format, including the risk matrix given in **Annex C**, both before and after mitigation. The risk assessment process, which has recently been further refined by Marico Marine for the PLA follows the International Maritime Organisation approach to marine risk assessment. It combines the likelihood of a hazard occurrence with an estimation of consequence to determine risk.

A structured process, will be undertaken to determine hazards and produce a matrix based on an appropriate hazard log and risk register that incorporates vessel types and hazard categories. The defined hazards will draw upon updated analysis of vessel traffic data and incident rates and also integrate with the PLA definitions, where appropriate, to ensure that a thorough basis for analysis is established.

Quantitative techniques will be used to derive appropriate assessment of hazard likelihood and consequence to minimise uncertainty and subjectivity brought about by qualitative assessments. The risk assessments will develop coherent and pertinent risk registers able to meet the needs of the project. A summary risk register table from the Preliminary NRA is shown below in **Annex C**.

The identification and determination of risk control measures is likely to be determined and structured by:

- Risk controls already in place manged by the PLA;
- Risk controls which are mandated and will be adopted and embedded in the proposed operations; and
- Specific risk controls to deal with identified high risk hazards.

PLA as the navigation authority have a number of risk controls designed at maintaining navigation safety on the tidal Thames. This assessment assumes that such risk controls are in place and are fit for purpose. During, and following the risk assessment, risk control measures will be identified, specifically for dealing with any localised high-risk hazards associated with levels of safety and levels of service.

1.3.1.5 Task 4: Reporting

A detailed navigation risk assessment report will be drafted for each NRA requirement based on the findings of tasks outlined above. Marico Marine takes great pride in the quality of its reports, which are subject to a searching Quality Assurance process. A technical report, suitable for inclusion as a Transport Work Acts Order Annex, will be drafted according to a prescribed process.

1.4 REQUIREMENT 4: EXPERT WITNESS

d. Describe your proposed understanding, approach and methodology in delivering the requirements detailed in Volume 2, The Scope, Section 3.1, Requirement 4.

1.4.1 Expert Witness

If required by the TWAO, Expert witnesses from the project team will be made available. The following expert witnesses are proposed:

- Dr [redacted] – Navigation Risk
- Cmdr [redacted] – Harbour Master & Thames Navigational Practices
- Cmdr. [redacted] – Marine Pilotage
- [redacted] – Navigation Risk Modelling
- Dr [redacted] – Ship motion and Marine Simulation modelling

Expert Support can be provided throughout the TWAO process. All personnel identified above are experienced at providing expert witness services and can provide advice on a case by case basis to support Transport for London.

Where requested the following outline approach will be used to provide the expert witness provision in response to requirements:

- Aims/Objectives
  - Are the aims and objectives clear and consistent with the terms of reference for the project?
  - Were the objectives achievable given any limitations?
  - Is the scope of work clearly described and documented?
- Methodology
  - Is the data presented valid / fit for purpose?
  - Are the underlying assumptions and limitations clearly stated, transparent and related to the accuracy of ascertains / results / outputs?
  - Are the methods clearly described?
- Results
  - Does the text clearly state the key findings of the risk assessment?
  - Are high risk areas shown up and if so how are they related to tolerability?
  - Are mitigation measure effectiveness ratings quantitatively determined?
  - Do the results give an unbiased overall assessment of risk, or are they limited in their applicability due to underlying assumptions and omissions (whether known or unknown)?
  - Do any figures or tables clearly demonstrate the results?
- Conclusions/Recommendations
  - Do the conclusions reflect any supporting information?
  - Is there any comparison between other assessments made either in the same geographic area or in similar environments elsewhere?
  - Are Conclusions/Recommendations coherent, valid, need addressing?
  - Are conclusion related to navigations safety matter?

Where necessary expert witness reports and analysis will be provided to justify findings. This may draw on other aspects of the project, both from the Marine Engineering Support contract, but also from other areas – e.g. Engineering and Architectural Services Consultant Award.

2 OBSTACLES AND CHALLENGES

a. Detail what potential obstacles and challenges may occur with the numerous stakeholder interfaces (including Port of London Authority issues), their likelihood and how they would be managed.

2.1.1 Obstacles and Challenges

The PLA is the regulator responsible for maintaining navigation safety on the Tidal Thames which includes the site of the proposed Rotherhithe to Canary Wharf Bridge and therefore their approval/rejection of the scheme presents a significant project consent risk. The PLA have historically been instrumental in ultimate approval/rejection of infrastructure development on the grounds of unacceptable increases in navigation risk and safety across the river. Frequently, developers who are not well versed with the requirements and responsibilities of the PLA, underestimate the power that the PLA yields to prevent developments progressing. This has been evidenced in a number of high profile projects such as the London River Park project.

As such, gaining consent for the bridge from the PLA is a significant project risk. To mitigate this Marico Marine have developed an excellent relationship with the PLA which commenced when Marico Marine first worked for them in the early 2000's.

Over the years Marico Marine has been committed to engendering trust with the PLA through:

- Employment of experienced Thames marine personnel and ex – PLA Harbour Masters who are versed with the specific geographic and legislative climate.
- Entering into a continued dialogue of communication with the PLA Harbour Masters, when engaged on project assessments within their jurisdictions for navigation safety.
- Early identification of key issues and themes, which are methodically investigated and addressed in a structured manner to the satisfaction of PLA personnel.
- Assisting with the development of key PLA navigational risk methodologies to ensure standardisation and understanding of project hazards are clearly and accurately presented.

Whilst the PLA Harbour Masters may be the regulator for navigation safety, there are also a wide diverse set of stakeholders with whom a project such at this may affect – either at a construction or operation phase. Some of these stakeholders will be other PLA personnel such as marine pilots, marine service personnel, Vessel Traffic Services operatives, etc. However, in addition to the PLA, the wider navigational stakeholders, who could be affected by the proposed bridge also impart a great deal of sway, these include:

- Large vessel owners / operators (e.g. cruise ships).
- Ship Towage operators (Svitzer, Kotug).
- River freight operators (e.g. Cory Environmental, GPS Livetts, Walsh's).
- Commercial Passenger operators (e.g. Thames Clippers, City Cruises, Thames Barges).
- Recreational sailors (e.g. sailing yachts, motor launches, kayaks / rowers).
- Other service and workboat operators.

All of these stakeholders will be impacted to a greater or lesser extent by the proposed bridge, both in terms of physical interference such as increased risk of colliding with the bridge infrastructure, but also the operational constraints that the bridge creates – e.g. waiting of vessels for bridge openings. We have found it important to clearly separate navigation safety issues from financial impacts to stakeholders, to ensure the NRA process accurately reflects safety and risk, and not operational encumbrance.

Through the consultation process, which Marico Marine has undertaken on many central London projects, we are commonly able to identify issues and at times even collaboratively investigate alternative approaches or mitigation / risk control options (with stakeholder involvement). We frequently find that communication is the key and presenting an open and honest approach yields rewards with stakeholders. The applied nature of the analysis and consultation we do with stakeholders, has engendered a relationship based on trust and respect that Transport for London can harness on the Rotherhithe to Canary Wharf Bridge project, by contracting with Marico Marine.

3 TEAM STRUCTURE AND RESOURCE SCHEDULE

Demonstrate how you will ensure sufficient and suitably qualified resource is employed for the duration of the commission.

a. Provide CVs (up to a maximum of 5) for the team, including the expert witness who will be dedicated to the project including their resource grade (e.g. senior consultant).
All CVs shall include individual's qualifications and relevant experience.

Members of staff selected for the project are listed below, CVs can be found in Annex D for key personnel marked with*.

Name	Company Role
[redacted]	Operations Director
	Associate Director
	Principal Consultant
	Principal Consultant
	Principal Consultant
	Principal Consultant
	Principal Consultant
	Principal Consultant
	Senior Consultant
	Consultant
	Consultant
	Junior Consultant
	Simulator Manager

b. Provide a team structure (with brief synopsis) including positions and resource grades. Outline key personnel and staff roles, accountabilities, responsibilities and points of liaison with *the Employer*

c. Provide details for continuity of outputs and robust succession planning in the event of staffing changes.

3.1.2 Continuity

Risk Management is a fundamental component of project management at Marico Marine and hazards are identified, assessed and mitigated throughout the project management process, from deciding whether to bid through to project closure. These hazards are managed through a risk register which is reviewed regularly with the Project Director, Project Team and the client to ensure risks are identified, managed and mitigated as far as possible throughout the project.

3.1.2.1 Personnel

Marico Marine are able to deliver a team of experienced consultants and support staff to the project. All resource is confirmed at tender stage and held open in readiness for contract award. Therefore no personnel changes will occur, unless by exceptional circumstances. If through exceptional circumstances personnel changes are required (e.g. illness, etc), then Marico Marine, with a core business of navigation risk consultancy, has a team of personnel able to fill in any of the specialist roles. This is evidenced by the personnel identified in the project team table (see above).

If necessary new staff CVs would be submitted to *the Employer* for prior approval.
Staff resources and holidays are reviewed as part of this proposal preparation. Project managers actively manage resources and support staff have been identified in case an issue arises, this includes mitigation for project manager illness and the role would be taken by other qualified directors.

The senior project team of Project Director and Project Manager are experienced in project management of projects of this size, and have direct experience of working on the project to date through managing the vessel traffic survey, navigation support and the preliminary Navigation Risk Assessment tasks. This brings a significant cost saving to Transport for London as the key personnel are fully up to speed on the navigational aspects of the project.

3.1.2.2 Business Continuity

Marico Marine realises the need to minimise disruption to its main business functions and aims to follow the principles defined in BS 25999. Consideration of the recommendations in the Business Continuity Management Report by the Chartered Management Institute, March 2009 have been included in preparing this statement.

Hazards to the continuity of the company's business along with the likely impact, what mitigation strategies are already in place and what else may be done to minimise disruption are highlighted given below:

- Loss of IT and telecommunication
- Loss or corruption of data on portable devices
- Staff absences (illness or accident)
- Adverse weather (snow, fog, ice)
- Theft and / or malicious damage
- Transport disruptions
- Loss of electricity
- Fire
- Flooding to the site

Marico Marine Corporate risk register logs manages and identifies appropriate and fit for purpose risk controls for corporate hazards in line with ISO 9001: 2015 and ISO 3100:2018 (Marico Marine Corporate Risk Map – Right , Corporate Risk Ranked Hazard List – **Annex D**).

4 CONFLICT OF INTEREST

a. Please detail any conflict of interest and whether you may be tendering for or be a sub-consultant for any other package of work connected to the Rotherhithe to Canary Wharf River Crossing.

We believe that we have no conflicts of interest.

For information only, Marine and Risk Consultants Ltd are working on the following projects on the River Thames:

Transport for London	Marine Navigation Support for the Rotherhithe to Canary Wharf Bridge Project
Tideway East, Central and West	Cumulative Navigation Risk Assessments and Worksite Specific Navigation Risk Assessments for the 11 marine sites on the River Thames
Cory Riverside Energy	Marine Navigation Risk Assessment
DHL	Feasibility Study – Thames Marine Logistics
Port of London Authority	Port Marine Safety Code – Designated Person – Named Marine and Risk Consultants Ltd employee – Ray Blair (not proposed as part of the project team).

Annex A Requirements 1: Figures & Supporting Evidence

Example Thames Projects

Client	Title	Date
Tideway East, Central and West	Cumulative Navigation Risk Assessments and Worksite Specific Navigation Risk Assessments for the 11 marine sites on the River Thames (see table below for full list of deliverables)	2015-present
Beckett Rankine / Oxley Wharf Property 3 Ltd	Royal Wharf: Navigation Risk Assessment	2017
Buckingham Group Contracting Ltd	Fulham Football Club – Riverside Stand Expansion Project – Construction Works – Navigation Risk Assessment	2016
Garden Bridge Trust	Construction and Cumulative Navigation Risk Assessment for the Garden Bridge	2016
Sustrans	Rotherhithe Bridge - Navigation Feasibility Assessment	2015
Thames Tideway Tunnel / ARUP	Navigation risk assessments for: • Relocation of Blackfriars Pier; • Relocation of Tattershall Castle; and • Relocation of HMS President on the River Thames.	2014-2015
Transport for London	• London River Services - Pier extensions NRAs: o Bankside Pier extension; o Embankment Pier extension; o Westminster Pier extension; and o Tower Pier re-development. • Preliminary NRA for the Garden Bridge; • Preliminary Local NRA for River Transport at Battersea for the Northern Line Extension; • Cumulative NRA for River Transport at Battersea for the Northern Line Extension; • Woolwich Ferry Replacement Project: NRA for different types of Ferry Systems at Gallions Reach; and • Rotherhithe-Canary Wharf Bridge.	2012-present
St James Group	Nine Elms Pier Marina Extension Marine Impact Assessment – River Thames	2011

Scott Wilson	• Cory Environmental - Navigation Impact Assessment for Charlton Bargeworks Redevelopment – River Thames; and • Marine Impact Assessment for Orchard Wharf – River Thames.	2010-2011
Mace/Gifford	• London River Park Navigation Feasibility Study – River Thames; and • London River Park NRA – River Thames.	2010-2011
Port of London Authority	• Thames Capacity Study; • Port Wide Marine Safety Audit; • Provision of Hazard Management System (Hazman I & II); • Central London Traffic Study; and • Port Wide Navigation Risk Assessment.	2001-present
Balfour Beatty / Network Rail	Blackfriars Bridge Development – Thames Link – Marine Impact Assessment - River Thames	2009
Halcrow PLC	Thames Gateway Bridge Hazard Identification – River Thames	2003

Tideway Tunnel NRA Projects / Reports	
NRA	**Report**
Cumulative NRA	Inception report
	River Works Programme
	CNRA - Winter 2016/2017 and Summer 2018
	CNRA - Phase 2 - Review of Seasonality and Off Peak Barge Threshold
WEST	
PUTEF - Putney Embankment	WSNRA Putney Embankment Foreshore - Phase 1
	WSNRA Putney Embankment Foreshore - Temporary Slipway
CARRR - Carnwath Road	Critical Navigation Hazards Assessment - Carnwath Road Riverside
	WSNRA Carnwath Road Riverside - Phase 1
CENTRAL	
CHEEF - Chelsea Embankment	Chelsea Embankment Foreshore Phase 1 – Construction of the Cofferdam
	Chelsea Embankment Foreshore : Technical Note: Intertidal Terraces
KRTST - Kirtling Street	WSNRA Kirtling Street - Construction of the Bailey Bridge and the reinstatement of the CEMEX jetty service
	WSNRA Kirtling Street - Construction of the Main Jetty and operation of the CEMEX Jetty

	WSNRA Kirtling Street - Operation of the Main Jetty and the CEMEX Jetty
	Technical Note: Construction of the CEMEX Bridge and the reinstatement of the CEMEX Jetty service
	WSNRA: Operational Phase of KRTST and HEAPS
HEAPS - Heathwall Pumping Station	WSNRA Heathwall Pumping Station Phase 1 - Construction of the Cofferdam
	WSNRA: Operational Phase of KRTST and HEAPS
ALBEF - Albert Embankment	WSNRA Albert Embankment Foreshore - Construction of the Upstream and Downstream Cofferdams
	Technical Note - Inter-Tidal Terraces
VCTEF - Victoria Embankment	WSNRA Victoria Embankment - Construction of Cofferdam
	WSNRA Victoria Embankment - Operation of the Worksite
BLABF - Blackfriars Bridge Foreshore	WSNRA Blackfriars Bridge Foreshore - Construction of Western Cofferdam
Site Investigation NRA	NRA EAST - Site Investigation NRA Inception Report
	Ground Investigation Marine Works
EAST	
Chambers Wharf	WSNRA Chambers Wharf - Marine Operation associated with construction of Diagphram Wall and vertical shaft
	WSNRA Chambers Wharf - Marine Operation associated with main tunnel drive (spoil out, segments in and tunnel lining aggregates in)
King Edward Memorial	WSNRA King Edward Memorial Park - Marine Operation associated with construction of Diagphram Wall and vertical shaft
	WSNRA King Edward Memorial Park - Marine Operation associated with construction of Diagphram Wall and vertical shaft
Deptford Creek	Deptford Creek Navigation Feasibility Assessment
	Deptford Creek Navigation Feasibility Assessment Plus exec summary

Examples of Recent non-Thames Assessments Undertaken by Marico Marine.

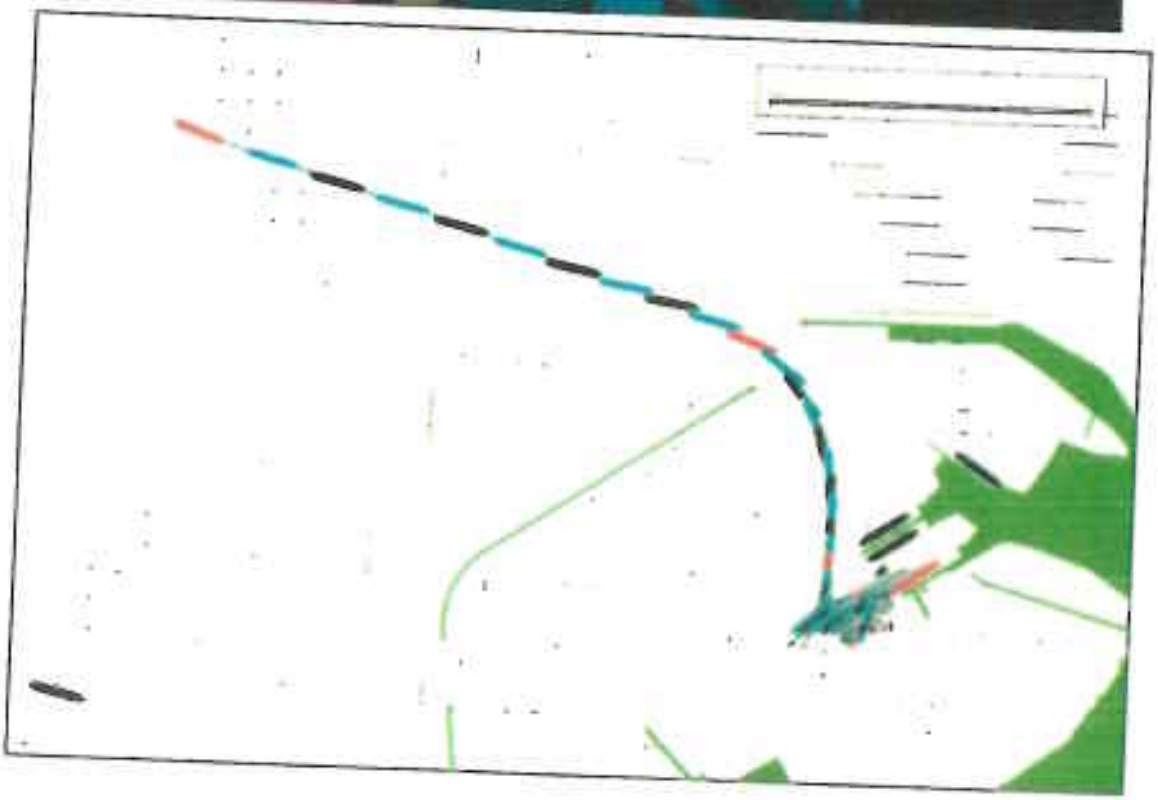
Date	Client	Job Summary	Category
22-Apr-13	Port of London Authority	11UK827 - Central London Traffic Study	Other - Traffic Survey
15-Apr-15	Maersk Oil UK Ltd	15UK1097 - Maersk Culzean Field Development Vessel Traffic Survey	Other - Traffic Survey
29-Jun-15	Sustrans	15UK1126 - Thames VTS for New Bridge Canary Wharf	Other - Traffic Survey
22-Jan-16	Maersk Oil UK Ltd	16UK1184 - Maersk Culzean VTS	Other - Traffic Survey
27-Jul-16	Maersk Oil UK Ltd	16UK1241 - Maersk Vessel Traffic Survey - Maclure	Other - Traffic Survey
26-Sep-16	MCA	16UK1253 - Traffic Reporting & Routeing measures in UK Coastal Waters	Other - Traffic Survey
01-Dec-16	Maersk Oil UK Ltd	16UK1275 - Finzean Vessel Traffic Survey	Other - Traffic Survey
22-Apr-13	Balfour Beatty	08UK689 - Blackfriars Bridge redevelopment	Ports - Navigation Risk Assessment
22-Apr-13	Riverside Resource Recovery Ltd	10UK748 - Charlton Barge Works Risk Assessment	Ports - Navigation Risk Assessment
22-Apr-13	Gifford	11UK791 - London River Park Navigation Risk Assessment	Ports - Navigation Risk Assessment
22-Apr-13	St Marys Harbour Authority	11UK794 - Scilly Islands - NRA	Ports - Navigation Risk Assessment
22-Apr-13	St James Group Ltd	11UK816 - Nine Elms Pier Development NRIA	Ports - Navigation Risk Assessment
22-Apr-13	ABPmer	11UK822 - Poole Harbour Master Plan: Nav Risk Assessment	Ports - Navigation Risk Assessment
22-Apr-13	Belfast Harbour Comissioners	12UK842 - Belfast NRA	Ports - Navigation Risk Assessment
12-Jul-13	Transport for London	13UK939 - Northern Line Extension NRA	Ports - Navigation Risk Assessment
12-Sep-13	Oil and Pipelines Agency	13UK950 - Campbeltown OFD RA	Ports - Navigation Risk Assessment
30-Sep-13	Transport for London	13UK955 - NLE Cumulative NRA - Nine Elms Reach	Ports - Navigation Risk Assessment
08-Jan-14	Arup	14UK971 - Navigation Risk Assessment Garden Bridge	Ports - Navigation Risk Assessment

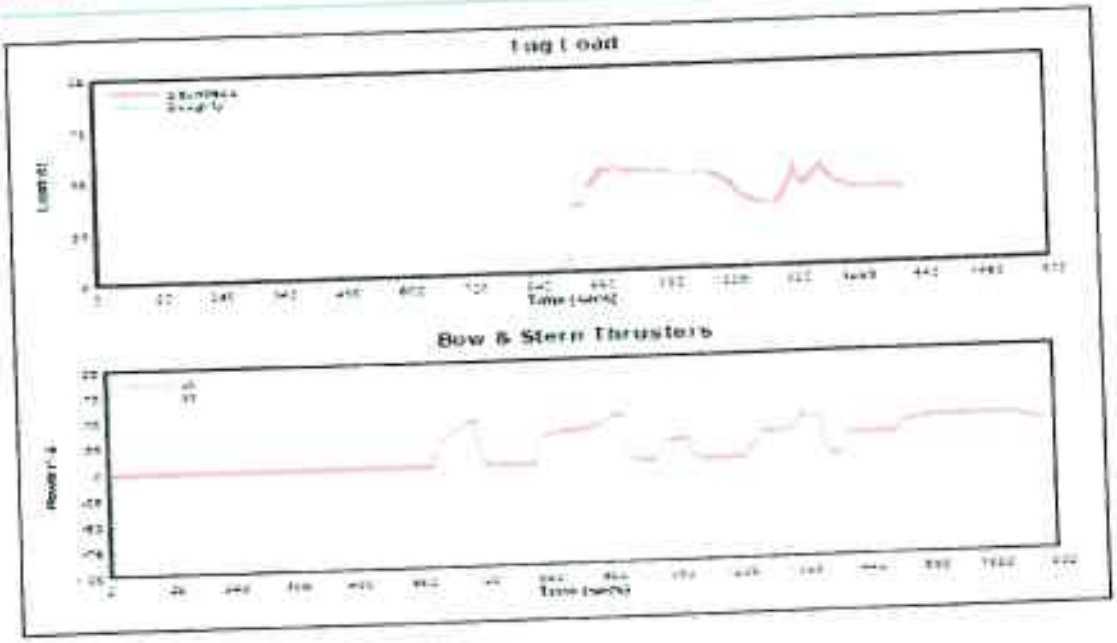
Date	Client	Job Summary	Category
29-Jul-14	Beckett Rankine	14UK1027 - LRS NRA	Ports - Navigation Risk Assessment
27-Aug-14	BMB Thames Tideway Bid Office	14UK1037 - Thames Tideway NRA	Ports - Navigation Risk Assessment
22-Oct-14	Arup	14UK1052 - ARUP TTT Blackfriars Pier, Tattersdhall Castle & President NRA	Ports - Navigation Risk Assessment
22-Oct-14	Port of London Authority	14UK1053 - PLA Capacity Study	Ports - Navigation Risk Assessment
18-Apr-16	Mallaig Harbour Authority	16UK1204 - Mallaig NRA	Ports - Navigation Risk Assessment
16-May-16	Cornwall Council	16UK1213 - Penzance NRA	Ports - Navigation Risk Assessment
01-Jul-16	Dumfries and Galloway Council	16UK1235 - Dumfries and Galloway Council NRA	Ports - Navigation Risk Assessment
02-Nov-16	Thames Tideway Tunnel JV Contractor - Central	16UK1265TTT - Site Investigation NRA	Ports - Navigation Risk Assessment
30-Mar-17	MCA	17UK1322 - MCA Whitstable Oyster NRA	Ports - Navigation Risk Assessment
09-May-17	Newhaven Port Authority	17UK1338 - Newhaven NRA	Ports - Navigation Risk Assessment
25-May-17	Thames River Services	17UK1345 - Thames River Services Vessel RA	Ports - Navigation Risk Assessment
22-Apr-13	SeaGreen Wind Energy Ltd	10UK756 - Forth Estuary R3 AIS Provision	Renewables - Consultancy
22-Apr-13	Other	11UK782 - Argyll Array Shipping Consultancy	Renewables - Consultancy
22-Apr-13	Natural Power Consultants	11UK807 - Navigational Constraints Analysis Wave Device	Renewables - Consultancy
22-Apr-13	Harwich Haven Authority	12UK844 - HHA Tidal Access Analysis- Further Study	Renewables - Consultancy
04-Jan-13	Ailes Marines - Iberdrola	12UK862 - St Brieuc Offshore Windfarm - NRA	Renewables - Navigation Risk Assessment
18-Mar-13	Marine Current Turbines	13UK910 - Skerries Export Cable Route	Renewables - Navigation Risk Assessment

Date	Client	Job Summary	Category
18-Mar-13	East Anglia Offshore Wind Ltd	12UK887 - EAOW Guard Boat	Renewables - Navigation Risk Assessment
22-Apr-13	First Flight Wind Ltd	13UK922 - FFW Shipping and Navigation	Renewables - Navigation Risk Assessment
22-Apr-13	RES Offshore	12UK875 - Mull of Kintyre Demonstrator Tidal Array NRA	Renewables - Navigation Risk Assessment
22-Apr-13	Sea Generation (Kyle Rhea) Ltd	11UK775 - Kyle Rhea - Navigation Feasibility Study	Renewables - Navigation Risk Assessment
22-Apr-13	Thanet Offshore Wind Limited	11UK787 - Thanet OWF: Interturbine Cable Risk Assessement	Renewables - Navigation Risk Assessment
09-Aug-13	Evora Energy	13UK943 - South Hook Subsea NRA	Renewables - Navigation Risk Assessment
11-Aug-14	Ailes Marines - Iberdrola	14UK1031 - St Brieuc Shipping and Navigation Update	Renewables - Navigation Risk Assessment
22-Apr-13	Sustainable Energy Authority of Ireland	10UK761 - Belmullet Marine Traffic Survey	Renewables - Traffic Survey
22-Apr-13	Eneco	11UK833 - Vessel Traffic Radar Survey for Navitus Bay	Renewables - Traffic Survey
22-Apr-13	DP Energy	12UK843 - Islay Energy Park Traffic Survey	Renewables - Traffic Survey
18-Jun-14	ScottishPower Renewables	14UK1016 - VTMS & Personnel Tracking for Wikinger OWF	Renewables - Traffic Survey

Annex B Requirements 2: Figures & Supporting Evidence

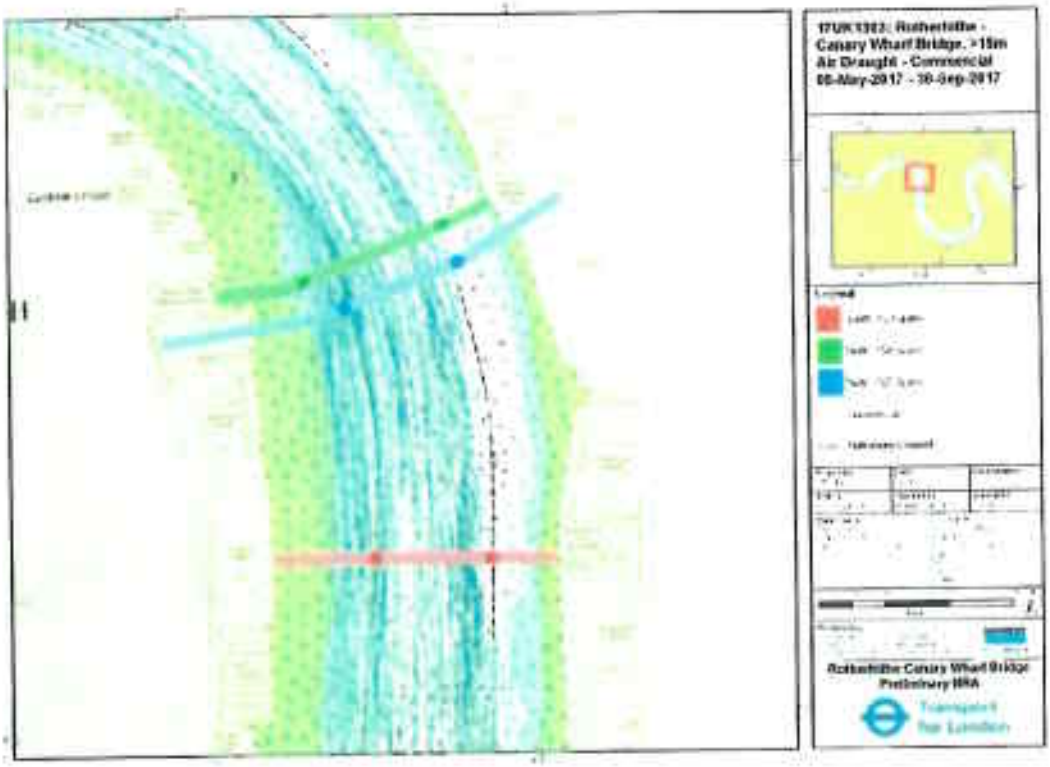
Marine Simulation Modelling – Full Bridge Simulation Photos / Figures.

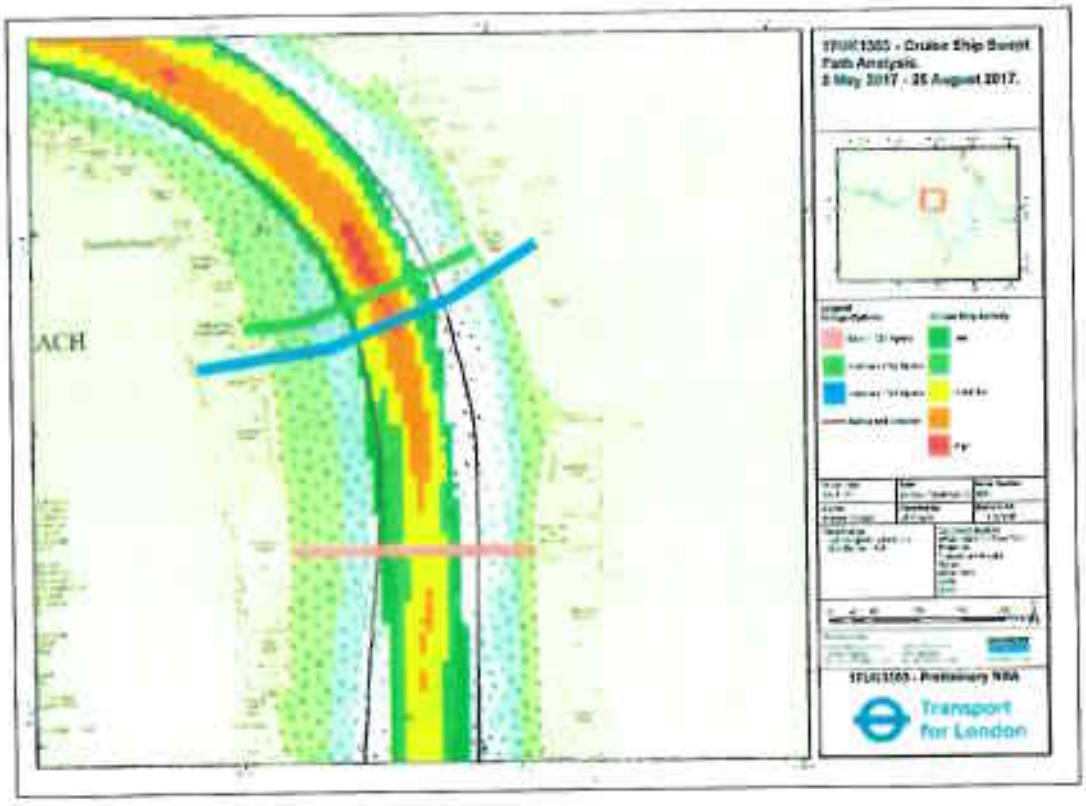


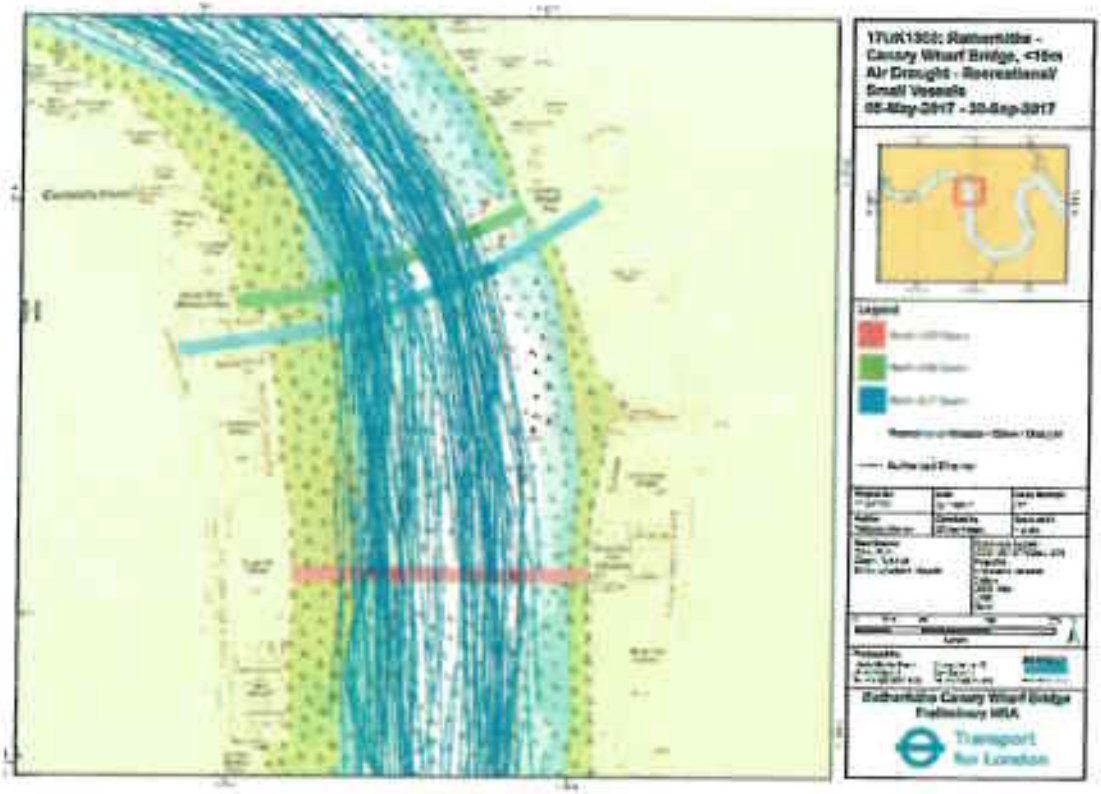

Tug Load
Bow & Stern Thrusters

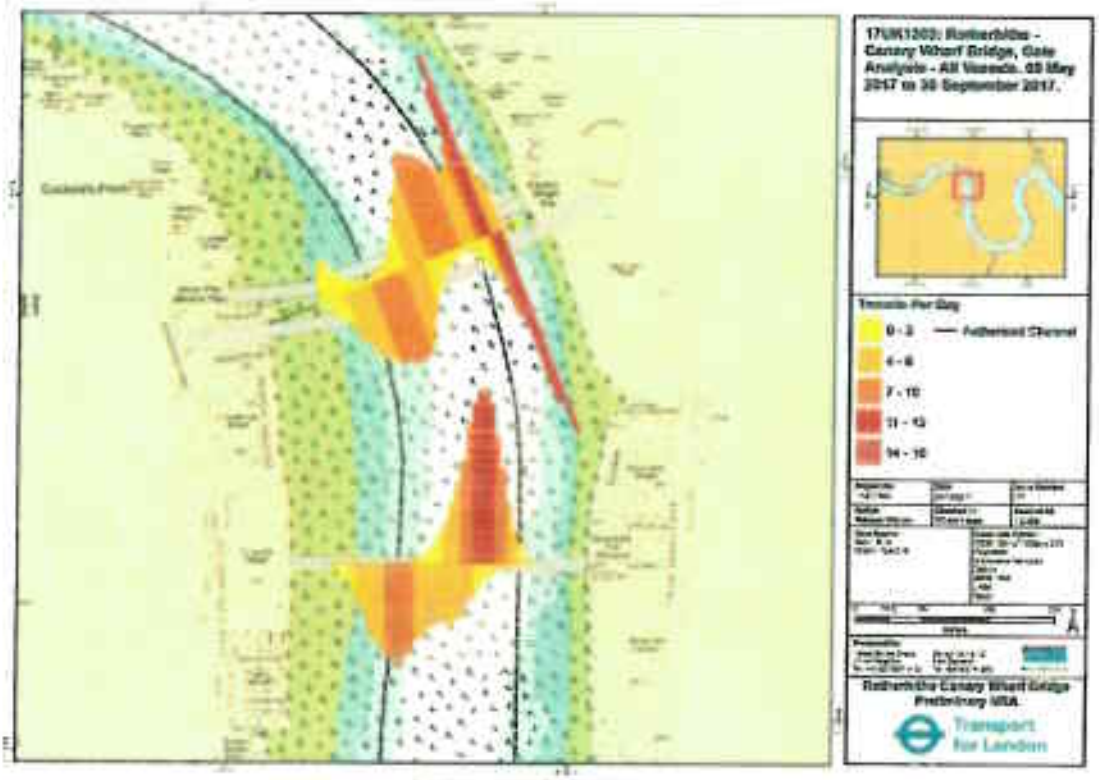
Annex C Requirements 3: Figures & Supporting Evidence

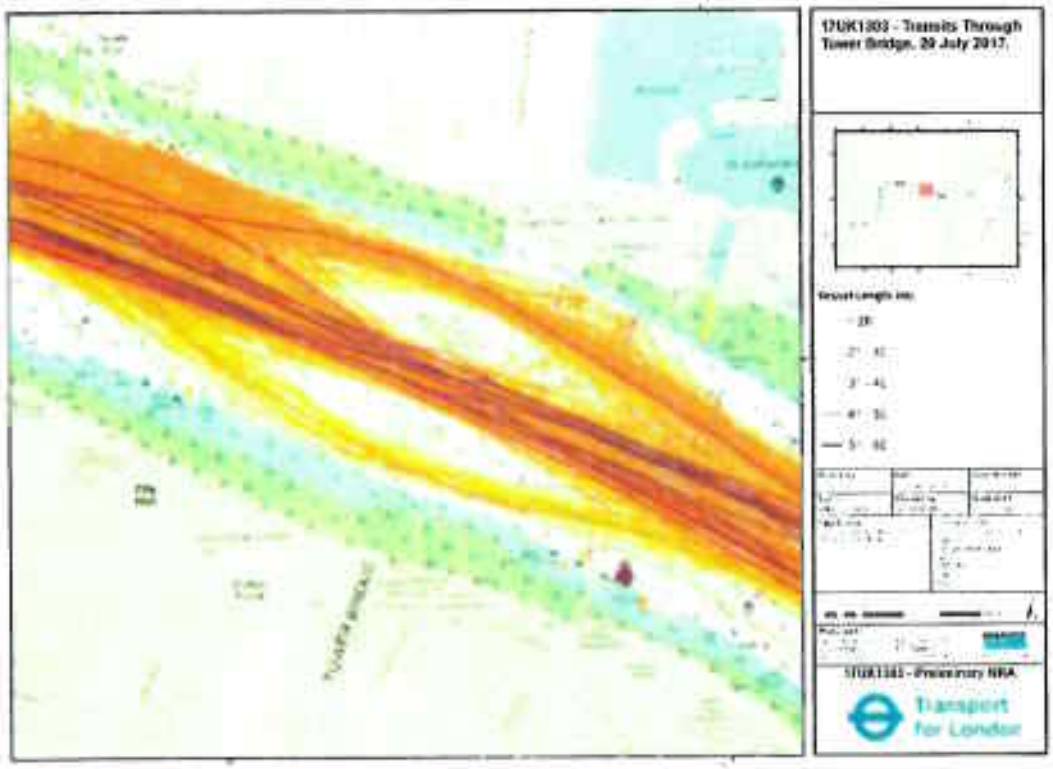
Example Traffic Analysis – Pre.NRA – R2CW Bridge

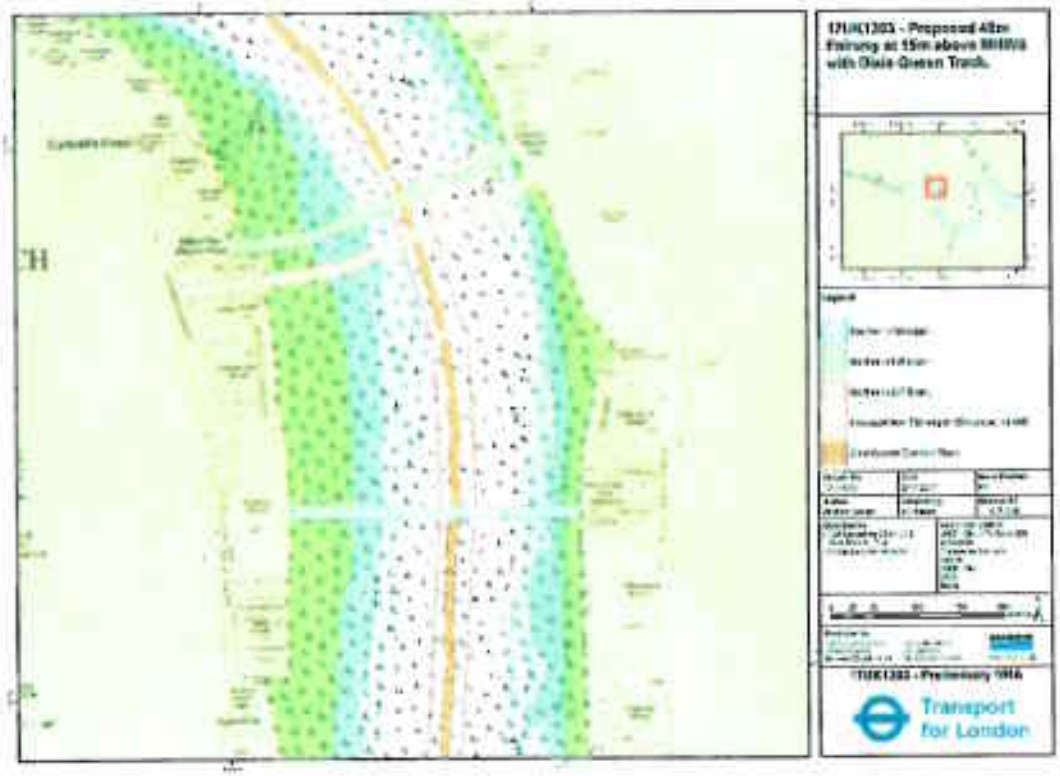





17UK1303: Rotherhithe - Canary Wharf Bridge, <15m Air Draught - Recreational/ Small Vessels
05-May-2017 - 30-Sep-2017
Legend
Rotherhithe Canary Wharf Bridge Preliminary HRA
Transport for London


17UK1303: Rotherhithe - Canary Wharf Bridge, Gate Analysis - All Vessels. 05 May 2017 to 30 September 2017.
Transits Per Day
0 - 3
4 - 6
7 - 10
11 - 13
14 - 16
Rotherhithe Canary Wharf Bridge Preliminary HRA
Transport for London


17UK1303 - Transits Through Tower Bridge, 29 July 2017.
Transport for London


Transport for London

PLA Risk Assessment Methodology

RISK ASSESSMENT MATRIX

RISK CRITERIA		FREQUENCY				
		Level 1	Level 2	Level 3	Level 4	Level 5
		Rare	Unlikely	Possible	Likely	Almost Certain
CONSEQUENCE	5 – Loss of vessel or severe damage to vessel / environment. Multiple fatalities international news coverage	Moderate (5)	High (10)	Extreme (15)	Extreme (20)	Extreme (25)
	4 – Major damage to vessel / environment. Single Fatality. National news coverage	Minor (4)	Moderate (8)	High (12)	Extreme (16)	Extreme (20)
	3 – Moderate damage to vessel / environment. Moderate / major injury. Regional news coverage	Minor (3)	Moderate (6)	Moderate (9)	High (12)	Extreme (15)
	2 - Minor or superficial damage to vessel / environment. Minor injuries and local news coverage	Slight (2)	Minor (4)	Moderate (6)	Moderate (8)	High (10)
	1 - Insignificant or no damage to vessel / equipment / environment. No injuries.	Slight (1)	Slight (2)	Minor (3)	Minor (4)	Moderate (5)

ACTION KEY	
Slight (1 – 2)	No Action is required
Minor (3 – 4)	No additional controls are required. monitoring is required to ensure no changes in circumstances
Moderate (5 – 9)	Efforts should be made to reduce risk to 'As low as reasonably practicable' (ALARP), but activity may be undertaken
High (10 – 14)	Efforts should be made to reduce risk to 'As low as reasonably practicable' (ALARP). Activity can only be undertaken with further additional controls
Extreme (15 – 25)	Intolerable risk. Activity not authorised

Example Risk Assessments Results Hazard Table – Pre.NRA – R2CW Bridge

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Title	Baseline Risk	Baseline Level	Residual Risk	Residual Level	Risk Reduction
3	1	1	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Class 5/HSC/RIBs	10.5	High	9.4	Moderate	1.1
15	2	2	Collision as a result of Bridge - < 15m Air Draught - Class 5/HSC/RIBs ICW Other Vessel	8.8	Moderate	7.9	Moderate	1.1
22	3	3	Grounding - < 15m Air Draught - Recreational / Small Vessels	8.3	Moderate	7.2	Moderate	1.2
17	5	4	Collision as a result of Bridge - < 15m Air Draught - Recreational / Small Vessels ICW Other Vessel	7.0	Moderate	6.3	Moderate	0.7
1	3	5	Contact - Bridge Pier - East / Canary Wharf Pier - > 15m Air Draught - Commercial	6.9	Moderate	6.1	Moderate	0.8
10	6	6	Contact - Bridge Pier - West - < 15m Air Draught - Recreational / Small Vessels	6.0	Moderate	5.6	Moderate	0.4
16	6	7	Collision as a result of Bridge - < 15m Air Draught - Intra Port Trade Freight & Workboats ICW Other Vessel	6.0	Moderate	5.4	Moderate	0.6
20	6	8	Grounding - < 15m Air Draught - Class 5/HSC/RIBs	6.0	Moderate	5.4	Moderate	0.6
4	6	9	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Intra Port Trade Freight & Workboats	6.0	Moderate	5.2	Moderate	0.8
5	11	10	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Recreational / Small Vessels	5.5	Moderate	4.9	Minor	0.6
21	11	11	Grounding - < 15m Air Draught - Intra Port Trade Freight & Workboats	5.0	Moderate	4.8	Minor	0.2
14	11	12	Collision as a result of Bridge - > 15m Air Draught - Recreational ICW Other Vessel	5.0	Moderate	4.7	Minor	0.3
11	6	13	Contact - Bridge Span - > 15m Air Draught - Commercial	4.8	Moderate	4.4	Minor	0.4
6	14	14	Contact - Bridge Pier - West - > 15m Air Draught - Commercial	4.2	Minor	3.7	Minor	0.5
8	14	15	Contact - Bridge Pier - West - < 15m Air Draught - Class 5/HSC/RIBs	4.2	Minor	3.6	Minor	0.6
9	14	16	Contact - Bridge Pier - West - < 15m Air Draught - Intra Port Trade Freight & Workboats	4.2	Minor	3.4	Minor	0.8
19	14	17	Grounding - > 15m Air Draught - Recreational	4.0	Minor	3.4	Minor	0.6
2	14	18	Contact - Bridge Pier - East / Canary Wharf Pier - > 15m Air Draught - Recreational	4.0	Minor	3.2	Minor	0.8
18	20	19	Grounding - > 15m Air Draught - Commercial	3.9	Minor	3.1	Minor	0.8
13	20	20	Collision as a result of Bridge - > 15m Air Draught - Commercial ICW Other Vessel	3.9	Minor	3.0	Minor	0.9
12	14	21	Contact - Bridge Span - > 15m Air Draught - Recreational	3.8	Minor	3.0	Minor	0.8
7	22	22	Contact - Bridge Pier - West - > 15m Air Draught - Recreational	3.5	Minor	2.6	Minor	0.9

Example Baseline / Residual Risk Assessment Table – Pre.NRA – R2CW Bridge

Hazard ID	Hazard Title	North 150m		North 127m		South 230m	
		Baseline Risk	Residual Risk	Baseline Risk	Residual Risk	Baseline Risk	Residual Risk
1	Contact - Bridge Pier - East / Canary Wharf Pier - > 15m Air Draught - Commercial	8.0	6.1	8.0	6.1	7.2	5.4
2	Contact - Bridge Pier - East / Canary Wharf Pier - > 15m Air Draught - Recreational	4.0	3.2	4.0	3.1	4.0	3.1
3	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Class 5/HSC/RIBs	10.5	9.4	10.5	9.4	6.0	5.0
4	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Intra Port Trade Freight & Workboats	6.0	5.2	6.0	5.2	6.0	5.2
5	Contact - Bridge Pier - East / Canary Wharf Pier - < 15m Air Draught - Recreational / Small Vessels	5.0	4.5	5.0	4.5	4.0	3.5
6	Contact - Bridge Pier - West - > 15m Air Draught - Commercial	4.0	3.7	8.0	6.1	7.2	5.4
7	Contact - Bridge Pier - West - > 15m Air Draught - Recreational	3.0	2.6	3.0	2.3	4.0	3.3
8	Contact - Bridge Pier - West - < 15m Air Draught - Class 5/HSC/RIBs	4.0	3.5	4.0	3.2	4.0	3.2
9	Contact - Bridge Pier - West - < 15m Air Draught - Intra Port Trade Freight & Workboats	4.0	3.4	6.0	5.1	6.0	5.1
10	Contact - Bridge Pier - West - < 15m Air Draught - Recreational / Small Vessels	6.0	5.6	4.0	3.7	4.0	3.5
11	Contact - Bridge Span - > 15m Air Draught - Commercial	6.0	4.2	6.0	4.0	6.0	4.0
12	Contact - Bridge Span - > 15m Air Draught - Recreational	4.0	3.0	4.0	3.0	4.0	3.0
13	Collision as a result of Bridge - > 15m Air Draught - Commercial ICW Other Vessel	3.9	3.0	3.9	3.0	3.9	3.0
14	Collision as a result of Bridge - > 15m Air Draught - Recreational ICW Other Vessel	5.0	4.2	5.0	4.1	5.0	4.1
15	Collision as a result of Bridge - < 15m Air Draught - Class 5/HSC/RIBs ICW Other Vessel	9.0	7.9	9.0	7.4	9.0	7.3
16	Collision as a result of Bridge - < 15m Air Draught - Intra Port Trade Freight & Workboats ICW Other Vessel	6.0	5.4	6.0	5.1	6.0	5.2
17	Collision as a result of Bridge - < 15m Air Draught - Recreational / Small Vessels ICW Other Vessel	7.0	6.3	7.0	5.8	7.0	5.9
18	Grounding - > 15m Air Draught - Commercial	3.9	3.1	3.8	3.1	3.9	3.1
19	Grounding - > 15m Air Draught - Recreational	4.0	3.4	4.0	3.3	4.0	3.3
20	Grounding - < 15m Air Draught - Class 5/HSC/RIBs	6.0	5.4	6.0	5.0	6.0	5.3
21	Grounding - < 15m Air Draught - Intra Port Trade Freight & Workboats	5.0	4.3	5.0	4.1	5.0	4.2
22	Grounding - < 15m Air Draught - Recreational / Small Vessels	8.0	7.2	8.0	6.7	8.0	7.2
	Total Risk Scores	**122.3**	**104.2**	**126.3**	**103.5**	**120.2**	**98.3**
	Risk Reduction	**18.1**		**22.8**		**21.9**	

Example Rick Control Effectiveness Table – Pre.NRA – R2CW Bridge

ID	Name	Bridge Location		
		North159m	North127m	South120m
		Cumulative Risk Reduction		
1	Relocate eastern bridge pier further from authorised channel	3.48	4.19	4.36
2	Relocate western bridge pier further from authorised channel	1.42	4.18	4.41
3	Passing disallowed within vicinity of bridge	1.49	1.49	1.50
4	Tugs to be made fast prior to bridge	1.07	1.07	1.08
5	Clear marking and lighting of bridge arch/piers	2.25	2.25	2.27
6	Adherence to bridge procedures	4.08	4.08	4.10
7	Increase span height	2.45	2.45	2.45
8	Increase number of openings	0.81	0.81	0.81
9	Co-ordination with Tower Bridge / abort points while inbound	0.61	0.81	0.81
10	Impact protection	1.96	2.31	2.14
11	Relocate Canary Wharf Jetty further from eastern bridge pier	1.02	1.36	0.00

Annex D Team Structure

Curricula Vitae

Project Risk Register

Corporate Risk Rank Summary

Project Risk Register

Hazard	Nature of Risk	Likelihood/ impact	Mitigation	Recovery Plan	Residual Likelihood/ impact
Delayed project commission / contract	Programme and quality	Medium / high	Liaison between project manager and Client to arrange for acceptance in writing prior to formal contracts. Project team would work 'at risk' until contracts in place (for an agreed period)	Liaise with Client to identify if/where there is flexibility in the deadlines and where consultation/analysis could be streamlined (e.g. combining Client and stakeholder review)	Low/high
Delay to project meetings causing delayed responses to draft documents	Programme and quality	High /high	All project meeting dates to be agreed at the kick off meeting. Project dates are laid down as per this proposal.	Informal liaison with Client/Stakeholders to discuss likely nature of the responses.	Low/high
Delay in stakeholders responses to documents/ consultation	Programme and quality	Medium / high	PM and client to agree dates for submission of documents/stakeholder workshops for review; PM to keep Client fully informed of any slippage. Project team to highlight any periods of absence (holidays/training etc.) and amend programme (or identify alternative organisation representatives) accordingly.	Informal liaison with stakeholders to discuss likely nature of the responses. Submission pending stakeholder feedback may be required.	Low/high

Hazard	Nature of Risk	Likelihood/ impact	Mitigation	Recovery Plan	Residual Likelihood/ impact
Relevant data not supplied by consultees / stakeholder	Programme and quality	Low / high	Use communication and engagement plan to focus information requests; Ensure all communications to client and wider stakeholders are clear and focused	Identification of key stakeholders and target effort to elicit a response. Research staff to gain response from key stakeholders via phone/email.	Low/high
Staff availability to undertake the work	Programme and quality	Medium /high	Individual resources have been reviewed and are presently available to undertake the work. Marico are currently bidding for a number of projects and we have ensured that different teams are working on different projects, therefore ensuring resource availability for all commissions	Marico has a range of staff which have the capability to undertake the work. If necessary, new staff CVs would be submitted to the Client for approval on the project	Low/low

Hazard	Nature of Risk	Likelihood/ impact	Mitigation	Recovery Plan	Residual Likelihood/ impact
More resources required to deliver project deliverables (staff illness, holiday season)	Programme, quality	Low / high	Staff resources and holidays are reviewed as part of this tender preparation. Project manager to actively manage resources and support staff have been identified in case issue arises, this includes mitigation for project manager illness and role would be taken by Project Director.	As above	Low/low
Management of sub-contractors	Programme and quality	High / high	No sub-contractors will be used for this project	No sub-contractors will be used for this project	Low/low
IT Failure	Programme and quality	Medium / Medium	All our data is backed up on off-site storage, providing complete recovery solutions for client information and ensuring continuity of service within 2 working days.	Critical information will be saved locally and via email to allow for reconstruction of project data.	Low/Low

Corporate Risk Rank Summary : Marico Marine Corporate Register (19 March 2018)

Rank	Reference	Title	Hazard Detail	Overall	Most Likely Risk Severity	Worst Credible Risk Severity
1	6	Loss of major customer	Loss of client due to bad publicity, lack of quality of work, higher than expected fees, breakdown in relationship. ML: Loss of single major client. WC: Loss of several major clients, adverse publicity, loss of revenue.	3.97	3.5	4.43
2	7	Increased competitive pressure	Large environmental and maritime consultancies developing in-house marine risk and analysis capabilities. Undercutting quotations. ML: Not awarded contracts. WC: Awarded too few contracts.	3.71	0	7.41
3	41	Travel risks	Staff commuting to work. Travelling on projects. Disruption causing delay. Accident involvement.	2.96	0	5.92
4	38	Gas explosion	Building damaged due to Calor Gas explosion.	2.85	2.43	3.5
5	35	Strategic change management problems	Problems adapting to changes such as mergers, divestitures and internal organisation in order to adapt to rapidly changing market requirements.	2.22	0	4.43
6	33	Cost-reduction pressure	A significant portion of the increase in profits may have to be achieved through cost reduction.	2.22	0	4.43
7	25	Failure to adapt to changing market requirements	Failure to adapt to customer's changing needs.	2.22	0	4.43
8	12	Natural disaster – flood / gales / lightning etc.	Natural disaster prevents normal operations. ML: Operations disrupted for several days. WC: Operations disrupted for several months.	2.22	0	4.43
9	28	Failure to follow QA written procedures	Failure to follow QA procedures (consultancy procedure, survey procedure etc.)	2.22	0	4.43
10	13	Loss of reputation	Loss of reputation in the market place due to error(s), lack of quality, change in client relationship	2.22	0	4.43
11	31	Liquidity risk	Liquidity becomes limited due to late payment or non-payment of client invoices, resulting in company unable to meet its financial obligations.	1.75	0	3.5
12	23	Overdependence on a limited number of customers	Overdependence on a limited number of customers resulting in negative financial impact when one or more are lost. Staff skills would be more limited due to a more restricted market.	1.75	0	3.5
13	26	Significant unexpected staff absence (more than one member of staff)	More than one member of staff is absent for several weeks due to illness / berevement / family commitment.	1.75	0	3.5

Rank	Reference	Title	Hazard Detail	Overall	Most Likely Risk Severity	Worst Credible Risk Severity
14	4	Fraud (employee misconduct)	Employee defrauds the Company. ML: Employee defrauds the Company. WC: Fraud undetected, Company loses money.			
15	24	Failure to meet project requirements	Failure to meet deadlines. Failure to meet client requirements.			
16	40	Loss of data storage back-up hardware or data irretrievably lost	Loss of data storage back-up hardware. Physically lost or data erased possibly due to back-up error.			
17	18	Poor management of contractors	Contractors handled poorly leading to breakdown in relationships and poor quality of work.			
18	32	Political trends	Economic discontent, expanding geopolitical risk universe.			
19	21	Breach of cyber security	Breach of cyber security. Loss of customer confidentiality, breach of bank security, or viruses.			
20	8	Aging workforce and declining competencies in the market place	Work production reduced, increased level of mistakes, flexibility and training ability reduced. ML: Reduction of productivity. WC: Unable to meet customer demand, and loss of client base and reputation. Mistake made resulting in client sueing.			
21	19	Impact of inflation	Cost of inflation increases operational costs such as travel and accommodation and staff wages.			
22	15	Impact of emerging legislation	New legislation which affects operational costs, causing reduced ability to be competitive.			
23	11	Loss of key staff (talented and skilled professionals) due to retirement or changing job.	Loss of key staff resulting in loss of specialist skill and expertise. ML: Affects type of projects taken on. WC: Lose major contract.			
24	14	Failure of Five-Year Business Plan	Failure of strategic plan due to reduced growth, changes in the market, loss of key staff, inability to meet client requirements.			
25	5	Industrial action	Staff threaten to strike or go slow			
26	39	Financial error - accounting	Accounting errors - such as human error when inputting figures, double payments or invoicing error. ML: error spotted and corrected. WC: profits under / overstated affecting bank credit.			
27	22	Financial error - tendering	Under quoting for contract leading to reduced profit margin or even loss.			
28	10	I.T. failure	Network / internet disruption caused by server down or personal PCs down. ML: Operations disrupted for a few hours. WC: Operations disrupted for a couple of weeks.			
29	27	Single member of staff absence (staff illness)	One member of staff is absent for several weeks due to illness / bereavement / family commitment.			

Rank	Reference	Title	Hazard Detail	Overall	Most Likely Risk	Worst Credible Risk
					Severity	Severity
30	20	Electrical power failure	Loss of power.	A	D	D