Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Navigational Issues and Preliminary Risk Assessment

Doc Ref: **7.20.07**

Chelsea Embankment Foreshore - Annexes: Hazard Logs

APFP Regulations 2009: Regulation **5(2)(q)**

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Annexes

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Annex A: Hazard log introduction

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Annex F: Worst credible hazard log – Phase A: Construction of Cofferdam

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Annex A – Hazard log introduction

A.1 Construction Phases

A.1.1 The assessment has been divided into 4 distinct project phases to allow for assessment of hazards and the proposal of risk reduction measures commensurate with the risk posed by different operations associated with the project. These are:

- Phase A - Construction of cofferdam
- Phase B - Construction of drop shaft/culvert/connections
- Phase C - Removal of cofferdam
- Phase D – Permanent works site.

A.2 Risk assessment criteria

A.2.1 **Risk Matrix** - The following risk matrix has been used to provide a risk score that combines severity of a particular consequence together with the probability of the consequence occurring.

Likelihood						
	1 - Rare	1	2	3	4	5
	2 - Unlikely	2	4	6	8	10
	3 - Possible	3	6	9	12	15
	4 - Likely	4	8	12	16	20
	5 - Almost Certain	5	10	15	20	25
	Severity	Level 1	Level 2	Level 3	Level 4	Level 5

A.2.2 **Risk Classification** – The risk score indicates the magnitude and acceptability of the risk in accordance with the ALARP principle.

Score	Classification	Definition
1 - 2	**Slight**	No Action is required
3 - 4	**Minor**	No additional controls are required, monitoring is required to ensure no changes in circumstances
5 - 9	**Moderate**	Efforts should be made to reduce risk to 'As Low As Reasonably Practicable' (ALARP). Job can be performed under direct supervision of Senior Officer
10 - 14	**High**	Efforts should be made to reduce risk to 'As Low As Reasonably Practicable' (ALARP). Job can only be performed after authorisation from Harbour Master and after further additional controls required under the circumstances
15 - 25	**Extreme**	Intolerable risk. Job is not authorised

A.2.3 **Severity** – The criteria used throughout this assessment has been provided by the Port of London Authority. It identifies four distinct areas of risk with the probable consequences associated with each hazard assessed in terms of harm or loss to:

- People (life);
- Environment;
- Operational Impact, and;
- Media Attention.

People	Level
First aid case / Medical treatment case	1
Restricted work case	2
Lost Time Injury / Moderate permanent partial disability injury	3
Single Fatality / Severe permanent partial disability	4
Multiple fatalities	5

Operational Impact	Level
Insignificant or no damage to vessel / equipment	1
Minor or superficial damage to vessel / equipment	2
Moderate damage to vessel / equipment requiring immediate repairs	3
Major damage to vessel / equipment and detention	4
Very serious damage to vessel or equipment possible criminal proceedings	5

Environment	Level
Low impact with no lasting effect	1
Temporary effect / Minor effect to small area	2
Short to medium term impact	3
Medium to long term effect / large area affected	4
Long term impact / severe impact on sensitive area	5

Media Attention	Level
No Coverage	1
Local coverage	2
Regional coverage	3
National coverage	4
International coverage	5

Annex B – Most likely hazard log: Phase A - Construction of cofferdam

B.1 Most likely summary hazard list: Phase A - Construction of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1A	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**8**	**4**	**6**	**6**
2A	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	8	4	6	6
3A	Planned Arch closure - Arch No 1	During construction, use of and deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**12**	**6**	**12**	**6**
4A	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	9	6	6	9
5A	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
6A	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
7A	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**8**	**4**	**6**	**8**
8A	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
9A	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
10A	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
11A	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12A	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
13A	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	6	4	6	8

14A	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**9**	**6**	**9**	**9**
15A	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	6	9	6	9
16A	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	6	9	6	9
17A	Contact with Chelsea or Victoria Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Bridge, including arches, abutments and any associated bridge superstructure.	6	9	6	9
18A	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
19A	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
20A	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
21A	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
22A	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
23A	Contact with Chelsea or Victoria Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victora Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

B.2 Most likely hazard list – Phase A: Construction of cofferdam

1A - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
1A - LTTCE	Emergency Arch Closure - Arch No 2	During Thames Tideway Tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2A - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
2A - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close Noarch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3A - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3A - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1.
- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

4A - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4A - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution		• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5A - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
5A - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6A - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
6A - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7A - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
7A - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8A - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8A - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9A - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
9A - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10A - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10A - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11A - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
11A - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Single Major Injury • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12A - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12A - LTTCE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

13A - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13A - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

14A - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
14A LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub-Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

15A - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
15A - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

16A - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16A - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

17A - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17A - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub-Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

18A - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18A - LTTCE	Collision with High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19A - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19A - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20A - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20A LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21A - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
21A - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22A - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
22A - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23A - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
23A - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

Annex C– Most likely hazard log: Phase B - Construction of drop shaft/culvert/connection

C.1 Summary most likely hazard list: Phase B - Construction of drop shaft/culvert/connections

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1B	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**8**	**4**	**6**	**6**
2B	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	8	4	6	6
3B	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**12**	**6**	**12**	**6**
4B	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	9	6	6	9
5B	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
6B	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
7B	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**8**	**4**	**6**	**8**
8B	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
9B	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
10B	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
11B	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12B	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
13B	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
14B	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
15B	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
16B	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A

17B	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18B	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
19B	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	6	4	6	8
20B	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**9**	**6**	**9**	**9**
21B	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	6	9	6	9
22B	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	6	9	6	9
23B	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6

C.2 Most likely hazard list – Phase B: Construction of drop shaft/culvert/connections

1B - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
1B - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2B - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
2B - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3B - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3B - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1.
- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

4B - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4B - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5B - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
5B - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6B - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
6B - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7B - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
7B - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8B - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8B - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9B - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
9B - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10B - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10B - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11B - LTTCE - Contact with Blackfriars Bridge (Road & Rail)

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
11B - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Single Major Injury • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12B - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12B - LTTCE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

13B - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13B - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

14B - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
14B - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

15B - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
15B - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

16B - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16B - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

17B - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17B - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

18B - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18B - LTTCE	Collision with High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Master • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

19B - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19B - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Master • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare
Amenities		
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

20B - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20B - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Master • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

21B - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
21B - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

22B - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
22B - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

23B - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
23B - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

Annex D– Most likely hazard log: Phase C – Removal of of cofferdam

D.1 Most likely summary hazard list: Phase C - Removal of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1C	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**8**	**4**	**6**	**6**
2C	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	8	4	6	6
3C	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**12**	**6**	**12**	**6**
4C	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	9	6	6	9
5C	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
6C	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	4	6	8
7C	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**8**	**4**	**6**	**8**
8C	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
9C	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
10C	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
11C	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	6	4	6	4
12C	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
13C	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	6	4	6	8
14C	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**9**	**6**	**9**	**9**
15C	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	6	9	6	9

16C	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	6	9	6	9
17C	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	6	3	6	6
18C	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	**N/A**	**N/A**	**N/A**
19C	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
20C	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
21C	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
22C	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
23C	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	**N/A**	**N/A**	**N/A**

D.2 Most likely hazard list – Phase C: Removal of cofferdam

1C - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
1C - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2C - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
2C - LTTCE	Planned Arch Closure - Arch No 2	During removal of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3C - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3C - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1.
- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

4C - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4C - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5C - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
5C - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6C - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
6C - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7C - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
7C - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8C - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8C - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9C - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
9C - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
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Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10C - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10C - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11C - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
11C - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Single Major Injury • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12C - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12C - LTTCE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

13C - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13C - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

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Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

14C - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
14C - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

15C - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
15C - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

16C - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16C - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

17C - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17C - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	3	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

18C - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18C - LTTCE	Collision with High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19C - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19C - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20C - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20C - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21C - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
21C - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22C - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
22C - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23C - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
23C - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

Annex E– Most likely hazard log: Phase D – Permanent work site

E.1 Most likely summary hazard list: Phase D –Permanent work site

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1D	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**8**	**4**	**6**	**6**
2D	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	**N/A**	**N/A**	**N/A**	**N/A**
3D	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**N/A**	**N/A**	**N/A**	**N/A**
4D	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	9	6	6	9
5D	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	9	6	9	12
6D	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	9	6	9	12
7D	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**9**	**6**	**9**	**12**
8D	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
9D	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	6	4	6	6
10D	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	6	2	6	6
11D	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	**N/A**	**N/A**	**N/A**
12D	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	**N/A**	**N/A**	**N/A**
13D	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
14D	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
15D	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**

16D	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
17D	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	**N/A**	**N/A**	**N/A**
18D	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	**N/A**	**N/A**	**N/A**
19D	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
20D	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
21D	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
22D	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	**N/A**	**N/A**	**N/A**
23D	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	**N/A**	**N/A**	**N/A**

E.2 Most likely hazard list – Phase D: Permanent work site

1D - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
1D - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See Assessment Notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2D - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
2D - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

3D - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
3D - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

4D - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
4D - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - Tug • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Moderate Damage - Private Leisure Vessel • Moderate Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5D - LTTCE - Contact - High Speed Passenger Vessel with Permanent Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
5D - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel permanent work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Code of Practice Passenger Vessel Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

6D - LTTCE - Contact - Class V Passenger Vessel with Permanent Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
6D - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel permanent work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Passenger Vessel • Moderate Damage - High Speed Craft • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Code of Practice Passenger Vessel Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

7D - LTTCE - Contact - Private Leisure Vessel with Permanent Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
7D - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel permanent work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Moderate Damage - Private Leisure Vessel • Capsized Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	4	8	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Mariners Guide to Bridges on the Tidal Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

8D - LTTCE - Contact - Commercial freight with Permanent Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
8D - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel permanent work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

9D - LTTCE - Contact - Tug and Tow with Permanent Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
9D - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel permanent work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Moderate Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Pilotage Directions •River Byelaws 1978 (as amended) •Permanent Notice to Mariners •Ship Towage Operations on the Thames •Code of Practice for Craft Towage Operations on the Thames •Port Entry Guide •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

10D - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10D - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Moderate Damage - Passenger Vessel • Moderate Damage - Private Leisure Vessel • Minor Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
1	2	2	**Slight**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11D - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
11D - LTTKS	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Single Major Injury • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

12D - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
12D - LTTCE	Collision with High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

13D - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
13D - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

14D - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
14D - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

15D - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
15D - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

16D - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
16D - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

17D - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
17D - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

18D - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
18D - LTTCE	Collision with High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Minor Damage - High Speed Craft • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19D - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
19D - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Passenger Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20D - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
20D - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Major Injuries • Minor Damage - Barge • Moderate Damage - Private Leisure Vessel • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21D - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
21D - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22D - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
22D - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Major Injury • Minor Damage - Barge • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23D - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Mitigation*
23D - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Major Injury • Minor Structural Damage - Bridge • Minor Damage - Barge • Minor Damage - Tug • Bridge Arch Closure - Temporary • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

Annex F– Worst credible hazard log: Phase A - Construction of cofferdam

F.1 Worst credible summary hazard list: Phase A - Construction of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1E	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**5**	**3**	**4**	**4**
2E	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	5	3	4	4
3E	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**10**	**6**	**10**	**6**
4E	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	12	9	9	12
5E	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
6E	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
7E	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**10**	**6**	**8**	**8**
8E	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
9E	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
10E	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	4	8	8
11E	Mooring Breakout	A vessel involved in Thames Tunnel activites breaks free from moorings	8	6	8	6
12E	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
13E	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	6	4	6	8
14E	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**8**	**6**	**8**	**8**
15E	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	9	12	9	9

16E	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	9	12	9	9
17E	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
18E	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
19E	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
20E	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
21E	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
22E	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
23E	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

F.2 Wost credible hazard list – Phase A: Construction of cofferdam

1E - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
1E - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2E - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2E - LTTCELTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3E - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3E - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1.
- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

4E - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4E - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution		• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5E - LTTCE- Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
5E - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6E - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
6E - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7E - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
7E - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8E - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8E - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9E - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
9E - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10E - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10E - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11E - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
11E - LTTKS	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12E - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12E - LTTCE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

13E - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
13E - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

14E - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
14E - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

15E - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
15E - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

16E - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16E - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

17E - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17E - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub-Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

18E - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8E - LTTCE	Collision - High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19E - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
19E - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20E - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20E - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21E - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
21E - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22E - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
22E - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23E - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
23E - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

Annex G– Worst credible hazard log: Phase B - Construction of drop shaft/culvert/connection

G.1 Summary worst credible hazard list: Phase B - Construction of drop shaft/culvert/connections

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1F	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**5**	**3**	**4**	**4**
2F	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	5	3	4	4
3F	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**10**	**6**	**10**	**6**
4F	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	12	9	9	12
5F	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
6F	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
7F	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**10**	**6**	**8**	**8**
8F	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
9F	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
10F	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	4	8	8
11F	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	8	6	8	6
12F	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
13F	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
14F	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
15F	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A

16F	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
17F	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18F	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
19F	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	6	4	6	8
20F	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**8**	**6**	**8**	**8**
21F	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	9	12	9	9
22F	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	9	12	9	9
23F	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9

G.2 Worst credible hazard list – Phase B: Construction of drop shaft/culvert/connections

1F - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
1F - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2F - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2F - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3F - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3F - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1.
- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

4F - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4F - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5F - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
5F - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6F - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
6F - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7F - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
7F - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8F - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8F - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9F - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
9F - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10F - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10F - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London
•Schedule to the General Directions for Navigation in the Port of London
•Pilotage Directions
•River Byelaws 1978 (as amended)
•Permanent Notice to Mariners
•Ship Towage Operations on the Thames
•Code of Practice for Craft Towage Operations on the Thames
•Port Entry Guide
•Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11F - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
11F - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12F - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12F - LTTCE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

13F - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
13F - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

14F - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
14F - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

15F - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
15F - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

16F - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16F - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

17F - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17F - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

18F - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8F - LTTCE	Collision - High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Master • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

19F - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
19F - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Master • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

20F - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20F - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Master • Berth Master to monitor VHF • CCTV to provide additional information to Berth Master

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

21F - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
21F - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

22F - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
22F - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Master • Berth Master to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Master • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

23F - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
23F - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

Annex H– Worst credible hazard log: Phase C – Removal of of cofferdam

H.1 Worst credible summary hazard list: Phase C - Removal of cofferdam

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1G	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**5**	**3**	**4**	**4**
2G	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	5	3	4	4
3G	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	**10**	**6**	**10**	**6**
4G	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	12	9	9	12
5G	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
6G	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
7G	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**10**	**6**	**8**	**8**
8G	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
9G	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
10G	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	4	8	8
11G	Mooring Breakout	A vessel involved in Thames Tunnel activites breaks free from moorings	8	6	8	6
12G	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	6	4	6	8
13G	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	8	4	6	8
14G	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	**8**	**6**	**8**	**8**
15G	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	9	12	6	6

16G	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	9	12	9	9
17G	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	9	6	9	9
18G	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
19G	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
20G	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
21G	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
22G	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
23G	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

H.2 Worst credible hazard list – Phase C: Removal of cofferdam

1G - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
1G - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2G - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2G - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Inspection Routines
  - General Inspection - every 2 years
  - Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result.
- Principal Inspection to be conducted immediately prior to work commencing

3G - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3G - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Bridge Special Signal Lights • VTS Qualification	• Scheduling of arch closures in order to facilitate minimum disruption to river users • Inspection routine (see assessment notes) • Arch No 1 typically not used due to corresponding Arch on Victoria Rail Bridge being blocked by moored barges. • A Notice to Mariners to be issued, informing river users of the planned closures and the lights/markings to expect

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is proposed that Arch No 1 is closed to all navigation for the duration of Phase 1. • Inspection Routines o General Inspection - every 2 years o Principal Inspection - every 6th year - requires full inspection within touching distance of all elements and therefore inspection from below is required - Arch Closure as a result. • Principal Inspection to be conducted immediately prior to work commencing

4G - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4G - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- Port Entry Guide
- Mariners Guide to Bridges on the Tidal Thames

Assessment Notes

- Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011.
  - For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s.
  - The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s.

5G - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
5G - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

6G - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
6G - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Code of Practice Passenger Vessel Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

7G - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
7G - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Permanent Notice to Mariners
- Mariners Guide to Bridges on the Tidal Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

8G - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8G - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

9G - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
9G - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Temporary Notice to Mariners - providing notice that construction activities are being conducted in the area

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10G - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10G - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • River Byelaws 1978 (as amended) • Permanent Notice to Mariners • Ship Towage Operations on the Thames • Code of Practice for Craft Towage Operations on the Thames • Port Entry Guide • Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11G - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
11G - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Tug Operator Procedures • Emergency Plans & Procedures • Mooring Inspections • Inspection Routine • Qualified Crew	• Use of reputable marine contractors

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
• Code of Practice for the Safe Mooring of Vessels on the Thames 2010

Assessment Notes

12G - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12G - LTTCE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • Tug Operator Procedures • Passage Planning • VTS Navigational Broadcast • Qualified Crew • Vessel Master Experience • Thames AIS • HSC Code • VHF Communications • COLREGs	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

13G - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
13G - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • Qualified Crew • BML Local Knowledge Endorsement • Thames AIS • Passage Planning • VHF Communications • Tug Operator Procedures • General Directions • Vessel Master Experience • VTS Navigational Broadcast • COLREGs • Emergency Plans & Procedures	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Use of reputable and experienced marine contractor • Berth Co-ordinator • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Co-ordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide
- Code of Practice Passenger Vessel Operations on the Thames

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

14G - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
14G - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Vessel Master Experience • Qualified Crew • VHF Communications • VTS Navigational Broadcast • Ship Towage Code of Practice • Tug Operator Procedures • COLREGs • General Directions • Admiralty Charts • Perm / Temp Notice to Mariners • Emergency Plans & Procedures • Aids to Navigation	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Closure of Arch No 1 to all traffic • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • CCTV to provide additional information to Berth Coordinator

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- River Thames Recreational Users Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

15G - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
15G - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Tug Operator Procedures • Perm / Temp Notice to Mariners • COLREGS • General Directions	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	6	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

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Working at height	Loading / Unloading operations	Welfare Amenities
Lifting operations	Movement of materials	Fire safety
Slips and trips	Mooring	

16G - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16G - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • Qualified Crew • Bridge Special Signal Lights • Emergency Plans & Procedures • VTS Navigational Broadcast • Thames AIS • Passage Planning • Ship Towage Code of Practice • BML Local Knowledge Endorsement • Perm / Temp Notice to Mariners • Tug Operator Procedures • General Directions • COLREGS	• Light Warnings - providing visual warning that barge is about to depart berth • Sound Warnings - providing audio warning that barge is about to depart berth • Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment • Berth Co-ordinator • Berth Co-ordinator to monitor VHF • Provision of Thames AIS receiver at berth location - providing greater visibility of vessels in near vicinity • CCTV to provide additional information to Berth Co-ordinator • Closure of Arch No 1 to all traffic

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	4	16	**Extreme**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	4	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

17G - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17G - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • General Directions • PLA Bridge Guide • Passage Planning • Accurate Tidal Information • Qualified Crew • Vessel Master Experience • Tug Operator Procedures • COLREGs • Ship Towage Code of Practice • Emergency Plans & Procedures	• Use of reputable and experienced marine contractor • Sub-Contractors Risk Assessment

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	3	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Ship Towage Operations on the Thames
- Code of Practice for the Safe Mooring of Vessels on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners
- Port Entry Guide

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

18G - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8G - LTTCE	Collision - High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19G - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
19G - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20G - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20G - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21G - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
21G - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22G - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
22G - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23G - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
23G - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

Annex I– Worst credible hazard log: Phase D – Permanent work site

I.1 Worst credible summary hazard list: Phase D –Permanent work site

Hazard Id	Hazard Title	Hazard Description	People	Environment	Operational	Media
1H	Emergency Arch closure - Arch No 2	There may be an emergency requirement to close No 2 arch.	**5**	**3**	**4**	**4**
2H	Planned arch closure - Arch No 2	There may be a requirement to close No 2 arch for maintenance.	N/A	N/A	N/A	N/A
3H	Planned Arch closure - Arch No 1	During construction/use/Deconstruction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	N/A	N/A	N/A	N/A
4H	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	12	9	9	12
5H	Contact - High Speed Passenger Vessel with work site	A High Speed Passenger Vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
6H	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	10	6	8	10
7H	Contact - private leisure vessel with work site	A private leisure vessel comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	**10**	**6**	**8**	**8**
8H	Contact - commercial freight operator with work site	A commercial freight operator comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
9H	Contact - tug and tow with work site	A tug and tow comes into contact with Thames Tunnel temporary or permanent work site at Chelsea Embankment.	8	6	8	6
10H	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	8	4	8	8
11H	Mooring Breakout	A vessel involved in Thames Tunnel activities breaks free from moorings	N/A	N/A	N/A	N/A
12H	Collision - High Speed Passenger Vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
13H	Collision - Class V passenger vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
14H	Collision - private leisure vessel (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
15H	Collision - commercial freight operator (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A

16H	Collision - tug and tow (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
17H	Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)	A vessel conducting Thames Tunnel construction/deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A
18H	Collision - High Speed Passenger Vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment	N/A	N/A	N/A	N/A
19H	Collision - Class V passenger vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
20H	Collision - private leisure vessel (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
21H	Collision - commercial freight operator (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
22H	Collision - tug and tow (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment.	N/A	N/A	N/A	N/A
23H	Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)	A vessel conducting Thames Tunnel delivery/material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure.	N/A	N/A	N/A	N/A

I.2 Worst credible hazard list – Phase D: Permanent work site

1H - LTTCE - Emergency Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
1H - LTTCE	Emergency Arch Closure - Arch No 2	During Thames tunnel works there may be an emergency requirement to close No 2 arch of Chelsea Bridge.	• Emergency Bridge Arch Closure • River Incident	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• VTS Navigational Broadcast • VHF Communications • Aids to Navigation • Thames AIS • COLREGs	• See Assessment Notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	1	5	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	1	3	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	1	4	**Minor**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• It is assessed that Thames Tideway Tunnel activities at the Chelsea Embankment site will not pose additional navigational safety issues in the event of an emergency arch closure. In the event that Arch No 2 is closed then it is expected that all navigation through this bridge will be suspended.

2H - LTTCE - Planned Arch Closure - Arch No 2

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
2H - LTTCE	Planned Arch Closure - Arch No 2	During construction of the temporary cofferdam there may be a scheduled requirement to close No 2 arch.	• Planned Bridge arch closure • Maintenance and Inspection routines	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
Not relevant for this phase of the project

3H - LTTCE - Planned Arch Closure - Arch No 1

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
3H - LTTCE	Planned Arch Closure - Arch No 1	During construction of the temporary cofferdam it is proposed that Arch No 1 is closed to all navigation.	• Planned Bridge arch closure	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	Not relevant for this phase of the project	Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
Not relevant for this phase of the project

4H - LTTCE - Increased Flow

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
4H - LTTCE	Increase in Flow	Changes to the hydrodynamics of the river may affect passing vessels, particularly through the arches of Chelsea or Victoria Rail Bridge.	• Shape and position of temporary cofferdam	• Single Fatality • Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• None identified for this hazard	• 3D and computational modelling • See assessment notes

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • Port Entry Guide • Mariners Guide to Bridges on the Tidal Thames

Assessment Notes
• Changes in flow at Chelsea Embankment is reported in HR Wallingford's 'Combined Sewer Overflow Foreshore Works Fluvial Modelling – Chelsea Embankment', 100-RG-MDL-WALLI-026-AC Release 3.0, November 2011. o For the typical tide/mean freshwater flow simulation the ebb tide results show modest speed increases across the width of the estuary being slightly more than 0.1m/s. o The equivalent results at time of peak flood show a similar distribution of peak currents for the Baseline case although the magnitude of the peak currents is larger for the flood tide with most of the channel having currents greater than 1.5 m/s

5H - LTTCE - Contact - High Speed Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
5H - LTTCE	Contact - High Speed passenger vessel with work site	A High Speed passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Code of Practice Passenger Vessel Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

6H - LTTCE - Contact - Class V Passenger Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
6H - LTTCE	Contact - Class V passenger vessel with work site	A Class V passenger vessel comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Leisure traffic impedes the passage of vessel navigating the channel • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Loss of Hull Integrity - Passenger Vessel • Loss of Hull Integrity - Passenger Vessel • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • VTS Navigational Broadcast • HSC Code • Passage Planning • COLREGs • VHF Communications • Emergency Plans & Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Code of Practice Passenger Vessel Operations on the Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

7H - LTTCE - Contact - Private Leisure Vessel with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
7H - LTTCE	Contact - Private leisure vessel with work site	Private leisure vessels, including narrow boats, comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Bridge Arch Closure - Temporary • Minor Pollution	• Aids to Navigation • VHF Communications • COLREGs • General Directions • Permanent / Temporary Notice to Mariners • VTS Navigational Broadcast	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart • Information provided to local recreational clubs and marinas providing an overview of the works being conducted and expected duration

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
5	3	15	**Extreme**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
5	2	10	**High**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	3	12	**Extreme**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Permanent Notice to Mariners •Mariners Guide to Bridges on the Tidal Thames •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

8H - LTTCE - Contact - Commercial freight with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8H - LTTCE	Contact - commercial freight with work site	Commercial freight comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance
•General Directions for Navigation in the Port of London •Schedule to the General Directions for Navigation in the Port of London •Pilotage Directions •River Byelaws 1978 (as amended) •Permanent Notice to Mariners •Ship Towage Operations on the Thames •Code of Practice for Craft Towage Operations on the Thames •Port Entry Guide •Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

9H - LTTCE - Contact - Tug and Tow with Work Site

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
9H - LTTCE	Contact - Tug and Tow with work site	A Tug and Tow comes into contact with Thames Tunnel work site at Chelsea Embankment.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Damage - Barge • Major Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • Aids to Navigation • Passage Planning • Ship Towage Code of Practice • COLREGs • Oil Spill Contingency Plan • Tug Operator Procedures	• Closure of Arch No 1 to all traffic • All vessels use Arch No 2 of Chelsea Bridge • Update of PLA chart

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	3	12	**High**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	3	9	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
3	2	6	**Moderate**

Relevant PLA Guidance

- General Directions for Navigation in the Port of London
- Schedule to the General Directions for Navigation in the Port of London
- Pilotage Directions
- River Byelaws 1978 (as amended)
- Permanent Notice to Mariners
- Ship Towage Operations on the Thames
- Code of Practice for Craft Towage Operations on the Thames
- Port Entry Guide
- Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Sub Contractors Risk Assessment

An additional control measure 'Sub Contractors Risk Assessment' has been identified during this assessment. The 'Sub Contractors Risk Assessment' is to be produced by the Sub Contractor appointed by the Thames Tunnel Project Team to conduct tug & barge operations and berth / jetty management activities. The assessment is to include (but is not limited to) the following activities:

Working at height	Loading / Unloading operations
Lifting operations	Movement of materials
Slips and trips	Mooring
Fire safety	Welfare Amenities

10H - LTTCE - Vessels subject to increased interaction during periods of low water

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Most Likely*	*Existing Safeguards*	*Proposed Additional Safeguards*
10H - LTTCE	Grounding - All vessels due to 'Squat Effect'	At periods of low water, vessels may be affected by the 'Squat Effect', causing them to be closer to the river bed than expected.	• Reduced effective river width • Misjudgement • Inattention • Lack of communications • Adverse weather conditions • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Major Injuries • Major Damage - Barge • Major Damage - Tug • Major Damage - Passenger Vessel • Major Damage - High Speed Craft • Major Damage - Private Leisure Vessel • Major Damage - Sailing Boat / Small Vessel • Bridge Arch Closure - Temporary • Major Pollution	• Boat Masters Licence • BML Local Knowledge Endorsement • Qualified Crew • Vessel Master Experience • Permanent / Temporary Notice to Mariners • MCA Guidance document	• Proposed temporary cofferdam and working area footprint minimised

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - People			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
2	2	4	**Minor**

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
4	2	8	**Moderate**

Relevant PLA Guidance
• General Directions for Navigation in the Port of London • Schedule to the General Directions for Navigation in the Port of London • Pilotage Directions • River Byelaws 1978 (as amended) • Permanent Notice to Mariners • Ship Towage Operations on the Thames • Code of Practice for Craft Towage Operations on the Thames • Port Entry Guide • Navigational Risk Assessments in the Port of London - Guidance to Operators and Owners

Assessment Notes

11H - LTTCE - Mooring breakout

Hazard ID	*Hazard Title*	*Hazard Description*	*Likely Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
11H - LTTCE	Mooring breakout	A vessel involved in Thames Tunnel activities breaks free temporary/layup moorings.	• Misjudgement • Inattention • Adverse weather conditions • Machinery breakdown • Collision avoidance	• Multiple Major Injuries • Moderate Damage - House Boat • Moderate Structural Damage - Marina • Minor Damage - Barge • Minor Damage - Jetty (Thames Water) • Minor Structural Damage - Bridge • Minor Structural Damage - Jetty (Other) • Minor Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

12H - LTTCE - Collision with High Speed Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
12H - LTTCE	Collision - High Speed Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

13H - LTTCE- Collision with Class V Passenger Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
13H - LTTCE	Collision with Class V Passenger Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

14H - LTTCE - Collision with Private Leisure Vessel (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
14H - LTTCE	Collision with Private Leisure Vessel (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

15H - LTTCE - Collision with Commercial Freight Operator (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
15H - LTTCE	Collision with commercial freight operator (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

16H - LTTCE - Collision with Tug and Tow (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
16H - LTTCE	Collision with tug and tow (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

17H - LTTCE - Contact with Chelsea or Victoria Rail Bridge (construction/deconstruction)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
17H - LTTCE	Contact with Chelsea or Victoria Rail Bridge (construction/ Deconstruction)	A vessel conducting Thames Tunnel construction/ deconstruction activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the construction/ deconstruction of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

18H - LTTCE - Collision with High Speed Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
8H - LTTCE	Collision - High Speed Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a High Speed Passenger Vessel (e.g. Thames Clipper) in the vicinity of Chelsea Embankment during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - High Speed Craft • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

19H - LTTCE- Collision with Class V Passenger Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
19H - LTTCE	Collision with Class V Passenger Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a Class V passenger vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Improper lookout • Lack of communications • Adverse weather conditions • Machinery breakdown • High density of leisure traffic • Inadequate training and experience • Tidal set • Collision avoidance • Change in river flow due to new in-river structure	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Passenger Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

20H - LTTCE - Collision with Private Leisure Vessel (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
20H - LTTCE	Collision with Private Leisure Vessel (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a private leisure vessel in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Leisure traffic impedes the passage of vessel navigating the channel • Collision avoidance • High density of leisure traffic • Machinery breakdown • Change in river flow due to new in-river structure • General lack of marine knowledge	• Multiple Fatalities • Moderate Damage - Barge • Major Damage - Private Leisure Vessel • Loss of Hull Integrity - Private Leisure Vessel • Moderate Damage - Tug • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

21H - LTTCE - Collision with Commercial Freight Operator (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
21H - LTTCE	Collision with commercial freight operator (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a commercial freight operator in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

22H - LTTCE - Collision with Tug and Tow (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
22H - LTTCE	Collision with tug and tow (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities collides with a tug and tow in the vicinity of Chelsea Embankment, during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Improper lookout • Lack of communications • Machinery breakdown • Collision avoidance • High density of leisure traffic • Leisure traffic impedes the passage of vessel navigating the channel • Change in river flow due to new in-river structure • Tidal set	• Single Fatality • Moderate Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Major Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

23H - LTTCE - Contact with Chelsea or Victoria Rail Bridge (delivery/material removal)

Hazard ID	*Hazard Title*	*Hazard Description*	*Hazard Causes*	*Consequence(s) Worst Credible*	*Existing Safeguards*	*Proposed Additional Mitigation*
23H - LTTCE	Contact with Chelsea or Victoria Rail Bridge (delivery/ material removal)	A vessel conducting Thames Tunnel delivery/ material removal activities makes contact with Chelsea or Victoria Rail Bridge, including arches, abutments and any associated bridge superstructure during the delivery/ material removal of the temporary cofferdam.	• Reduced effective river width • Misjudgement • Inattention • Non Compliance with procedures • Lack of communications • Adverse weather conditions • Machinery breakdown • Inadequate training and experience • Tug or line failure • Collision avoidance • Tidal set • Change in river flow due to new in-river structure	• Single Fatality • Major Structural Damage - Bridge • Major Damage - Barge • Major Damage - Tug • Loss of Hull Integrity - Tug • Loss of Hull Integrity - Barge • Bridge Arch Closure - Temporary • Moderate Pollution	• Not relevant for this phase of the project	• Not relevant for this phase of the project

Pre Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - People			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Environment			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Operational Impact			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Pre Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Post Control - Media Attention			
Severity	Probability	Risk Score	Risk Band
Not Assessed	Not Assessed	Not Assessed	Not Assessed

Relevant PLA Guidance

Assessment Notes
Not relevant for this phase of the project

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