

### Existing Risk Controls and Proposed Future Mitigations

Rank No.	Hazard Ref	Group	Accident Category	Hazard Detail	Existing Risk Levels							Future Risk Levels							Remarks							
					Existing Risk Controls	M L			W C			Risk Overall	Future/Possible Mitigations	Expected Reduction in Risk Level	M L			W C			Risk Overall					
						People	Property	Environment Stakeholders	People	Property	Environment Stakeholders				People	Property	Environment Stakeholders	People		Property		Environment Stakeholders				
1	3	Commercial	Collision	LNG Carrier in collision with another vessel in port approaches	Compulsory pilotage seaward of Ballybunnion Bar for vessels great than 13.0m draft	3	6	0	6	5	5	5	4.98	VTS Information and Traffic Organisation Services Develop compulsory pilotage for all vessels west of Ballybunnion Bar irrespective of draught Develop revised pilot boarding areas to reflect compulsory pilotage areas.	ML & WC frequency reduced by 1	3	5	0	5	5	5	5	4.63			
2	29	Commercial	Fire/Explosion	Fire on LNG Carrier whilst alongside	IMO Gas Codes - SIGTTO procedures, construction fire fighting equipment Ship staff procedures and training Shannon Foynes Emergency Procedures Existing shore fire services Shipping Vetting for charter vessels	4	4	0	2	7	7	2	7	5.03	Jetty fire fighting equipment Proximity FiFi 1 Tug on station. Develop joint emergency plan (inc. evacuation plan) Ship/Shore InterfaceShore services fire fighting training	WC frequency reduced by 1. WC People reduced by 1	4	4	0	2	5	6	2	6	4.45	Joint emergency plan will take into account available services and equipment and procedures.
3	31	Commercial	Fire/Explosion	Fire on LNG Carrier while underway in harbour areas	IMO Gas Codes - SIGTTO procedures, construction fire fighting equipment Ship staff procedures and training Shannon Foynes Emergency Procedures Shore fire services Shipping Vetting for charter vessels	4	4	0	2	7	7	2	7	5.03	Escort FiFi 1 escort tug, second FiFi 1 tug in attendance in transit Develop joint emergency plan (inc. evacuation plan)	WC frequency reduced by 1. WC People reduced by 1	4	4	0	2	5	6	2	6	4.45	Joint emergency plan will take into account available services and equipment and procedures.
4	36	Commercial	Grounding	LNG Carrier grounds in the port approach prior to boarding pilot	Bridge Team Competence Environmental Operating Limits for pilot embarkation	2	6	0	6	4	7	0	7	5.27	VTS surveillance and Navigational Assistance Service Limits to be reviewed in light of LNG Carriers Mismatch in GPS Datum - ships navigation system not set to correct datum source	ML & WC frequency reduced by 1	2	5	0	5	3	6	0	6	4.38	
5	42	Commercial	Grounding	LNG Carrier leaves channel between Doonaha Buoy and North Carrig and grounds	Bridge Team Competence Compulsory Pilot for large vessels Experienced pilots Pilots portable laptop available Existing Navigation Buoyage	2	6	0	6	4	7	0	7	5.27	VTS Navigational surveillance, Navigational Assistance and Traffic Organisation Services. Absense of passing/overtaking traffic (mobile Control Zone). Use of optimum track Improved navigational marks. Consider Starboard Lateral or improving vis of North Carrig Escort towage Develop generic LNG Carrier Passage Plan	ML & WC frequency reduced by 1	2	5	0	5	3	6	0	6	4.38	Starboard Mark may be useful but unlikely to be cost effective as North Carrig available could cause small vessels to navigate closer to shallows
6	40	Commercial	Grounding	LNG Carrier leaves fairway and grounds between Tail of Beal and Beal Bar Buoys	Bridge Team Competence Compulsory Pilot for large vessels Experienced pilots Pilots portable laptop available Existing Underkeel Clearance Software Existing Navigation Buoyage	2	6	0	6	4	7	0	7	5.27	Embark Pilot to seaward of Ballybunnion Buoy or Vessel to remain at sea until conditions improve VTS Navigational Surveillance and Navigational Assistance Organisation Escort towage Environmental Operating Limits Develop generic LNG Carrier Passage Plan Consider repositioning Beal Bar buoy Consider removing Carrigaholt buoy or moving to new position on 14.9m patch on leads. Consider updating hydrographic survey of Estuary	ML & WC frequency reduced by 1	2	5	0	5	3	6	0	6	4.38	The option "Consider replacing 3 x Cardinal marks with Starboard Lateral marks" deemed to be inappropriate as Starboard marks difficult to see at day. The Carrigaholt buoy is in 30m. Moving this buoy to the 14.9m patch would 'force' vessels to turn into Estuary and avoid them delaying the turn. This would be very appropriate if Doonaha could be swept to a greater depth and he Doonaha bouy removed.
7	20	Commercial	Contact - Navigation	Large vessel such as a Capesize BC contacts jetty or vessel berthed alongside whilst swinging off Money Point	Bridge Team Competence Compulsory Pilot for large vessels Experienced pilots Pilots portable laptop available Width of estuary 1'	0	4	0	4	5	5	5	4.07	Standby tug is to be stationed off LNGC when alongside	ML & WC frequency reduced by 2	1	4	3	3	3	5	4	5	4.07	Width of estuary 1'. Laden vessels turning onto berth swings away from LNG berth Understood to bew virtually impossible due to width and tidal currents	
8	14	Commercial	Contact - Navigation	Other vessel comes into contact with unoccupied LNG Terminal jetty		2	4	0	2	3	6	3	5	4.28	Remove/Reposition Small Ship Anchorage at Glencloosagh Bay	WC frequency reduced by 1	2	4	0	2	3	5	3	4	3.89	
9	30	Service Craft	Fire/Explosion	Fire on Service Craft in attendance at LNG terminal	Onboard fire fighting systems. Crew training	4	0	0	2	5	5	3	5	3.88			4	0	0	2	5	5	3	5	3.88	
10	12	Commercial Leisure	Collision	Dolphin Watch collides with LNG Carrier in Port Approaches	Experienced coxswains Licenced/inspected Vessels	5	2	0	5	6	6	5	6	4.83	VTS Information and Traffic Organisation Services Impose Control Zone around LNGC whilst in transit Develop SFPA procedures to ensure Dolphin Watch does not hamper LNGC	ML & WC frequency reduced by 2	3	1	0	3	5	5	4	5	3.87	
11	15	Commercial	Collision	LNG Carrier unable to manoeuvre onto berth and drifts down onto ferry	Port Byelaw 85	3	3	0	4	4	5	0	5	3.80	VTS Information Service Tugs available and fast		3	3	0	4	4	5	0	5	3.80	
12	10	Service Craft	Collision	LNG Carrier damaged by contact with tug	Experienced tugmasters	2	6	0	2	2	6	0	6	4.49	New construction tugs with dual redundancy in systems Tugmasters undergo joint bridge simulation and brige team management training Connecting up procedures and training	ML & WC frequency reduced by 1	2	5	0	2	1	5	0	5	3.75	



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25	55	Service Craft	Personal Injury	Mooring gang sustain injuries during mooring (or unmooring) operations on dolphins	Crew Experience PPE	4	0	0	0	6	2	0	4	3.67	Berthing Master or Mooring Supervisor Design of Mooring systems (Optimoor) Trained Personnel Training and HSE Effective Communications Environmental Operating Parameters Use of correct, properly maintained mooring ropes	WC frequency reduced by 1	4	0	0	0	5	2	0	3	3.24	
26	54	Commercial	Personal Injury	Personal injury to LNG carrier crew during towage and/or connecting up	Trained officers and crews ISM Code Safe Working Procedures	4	0	0	0	6	2	0	4	3.67	Experienced tugmaster and tug crews Environmental operating parameters Towline configuration Tug winch freewheel capabilities	WC frequency reduced by 1	4	0	0	0	5	2	0	3	3.24	
27	11	Commercial Leisure	Collision	Fishing vessel in collision with LNG Carrier whilst retrieving pots		3	2	0	3	5	3	2	5	3.58	(VTS Information Service of pending traffic arrival) (Second passive tug in attendance enforcing control zone) Consider defining 'deep water route' as 'narrow channel' as per Colregs		3	2	0	3	4	3	1	4	3.23	
28	33	Service Craft	Foundering	Tug floods or is capsized during ship assist	Experienced tugmasters and crew. Port Byelaw 87(4) Tug QMS	0	2	0	0	6	6	5	6	3.47	Design of tug Towage procedures Freewheel/quick release facilities Joint pilot/tugmaster simulation training	WC frequency reduced by 2	0	2	0	0	5	5	4	5	3.06	
29	32	Service Craft	Foundering	Escort tug floods whilst assisting LNG Carrier	Experienced tugmasters and crew	0	2	0	0	6	6	5	6	3.47	Design of tug - escort notated tugs Towage procedures Freewheel/quick release facilities Joint pilot/tugmaster simulation training Watertight integrity procedures	WC frequency reduced by 2	0	2	0	0	5	5	4	5	3.06	
30	23	Commercial Leisure	Contact - Navigation	Dolphin Watch involved in contact with LNG jetty	Experienced coxswains Licenced/inspected Vessels	2	2	0	2	6	5	2	5	3.63	Maintain safe distance from structure	WC frequency reduced by 1	2	2	0	2	5	4	1	4	3.00	
31	26	Commercial Leisure	Contact - Navigation	Dolphin Watch involved in contact with LNG carrier alongside	Experienced coxswains Licenced/inspected Vessels	2	2	0	2	6	5	2	5	3.63	Impose 150m control zone around berthed vessel Standby tug on patrol.		2	2	0	2	5	4	1	4	3.00	
32	50	Service Craft	Personal Injury	Line boat crew suffer personal injury during berthing operations	Crew Experience PPE ISO SFPA Line boat procedures	6	0	0	0	5	2	0	3	3.70	Line boats built for purpose Trained Personnel Effective Communications Training and HSE Environmental Operating Parameters Use of correct, properly maintained mooring ropes	WC frequency reduced by 1	4	0	0	0	4	1	0	3	2.93	It is always possible of a major injury due to nature of the work. ML risk level of 6 highlights this danger.
33	5	Service Craft	Collision	Pilot launch or harbour craft in collision with LNG Carrier	Experienced Tug and Launchmasters	2	2	0	0	5	5	2	5	2.93			2	2	0	0	5	5	2	5	2.93	
34	19	Commercial	Contact - Navigation	LNG Carrier in contact with channel mark	Pilot embarked at Kilstiffen Buoy Experienced Pilots	0	4	0	0	0	6	0	6	3.61	Embark Pilot to seaward of Ballybunnon Buoy Move Beal Bar Buoy Increase Clearance over Doonaha wreck - remove buoy Escort tug VTS Traffic Organisation Environmental Operating Limits	ML & WC frequency reduced by 1	0	3	0	0	0	5	0	5	2.91	The option "Consider replacing 3 x Cardinal marks with Starboard Lateral marks" deemed to be inappropriate as Starboard marks difficult to see at day. The Carrigaholt buoy is in 30m. Moving this buoy to the 14.9m patch would 'force' vessels to turn into Estuary and avoid them delaying the turn. This would be very appropriate if Doonaha could be swept to a greater depth and the Doonaha bouy removed.
35	18	Commercial Leisure	Contact - Navigation	Commercial angling craft involved in contact with LNG Carrier jetty		0	2	0	2	5	5	2	5	3.15	Proposed mitigations for higher ranked risks will apply	WC frequency reduced by 1	0	2	0	2	4	4	1	4	2.79	
36	25	Commercial Leisure	Contact - Navigation	Commercial angling craft involved in contact with LNG Carrier		0	2	0	2	5	5	2	5	3.15	Proposed mitigations for higher ranked risks will apply	WC frequency reduced by 1	0	2	0	2	4	4	1	4	2.79	
37	9	Recreational	Collision	Leisure craft obstructs vessel manoeuvring on/off berth or swinging in the fairway or manoeuvring in an anchorage.		2	2	0	2	5	3	2	3	3.13	Proposed mitigations for higher ranked risks will apply	WC frequency reduced by 1	2	2	0	2	4	3	1	3	2.79	
38	52	Service Craft	Personal Injury	Personal injury to launch crew during pilot transfer or operation in exposed areas of Estuary or outside entrance	Experienced Launchmasters and Crews Environmental Conditions PPE	2	0	0	2	5	0	0	5	2.73			2	0	0	2	5	0	0	5	2.73	
39	51	Service Craft	Personal Injury	Pilot suffers personal injury during transfer to or from an LNG Carrier	Experienced pilots Environmental Conditions PPE	2	0	0	2	5	0	0	5	2.73			2	0	0	2	5	0	0	5	2.73	
40	47	Commercial	Mooring Breakout	LNG Carrier passing other jetties causes vessels alongside to part moorings.	Experienced pilots Width of Estuary	0	1	0	1	1	5	1	5	2.65			0	1	0	1	1	5	1	5	2.65	
41	24	Recreational	Contact - Navigation	Leisure craft involved in contact with LNGCarrier alongside		0	2	0	0	5	5	2	3	2.91	Proposed mitigations for higher ranked risks will apply	WC frequency reduced by 1	0	2	0	0	4	4	1	3	2.56	

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42	17	Recreational	Contact - Navigation	Leisure craft involved in contact with LNG jetty structure		0	2	0	0	5	5	2	3	2.91	Proposed mitigations for higher ranked risks will apply	WC frequency reduced by 1	0	2	0	0	4	4	1	3	2.56		
43	21	Service Craft	Contact - Navigation	Escort tug contacts navigational mark	Experienced tugmasters and crew		0	3	0	0	0	4	0	3	2.55			0	3	0	0	0	4	0	3	2.55	
44	22	Commercial	Contact - Navigation	LNG Carrier comes into contact with berth or another vessel alongside during transit and swing	Compulsory Pilot for large vessels Experienced pilots Pilots portable laptop available		1	4	3	3	3	5	4	5	4.07	Develop generic LNG Carrier Passage Plan Berthing and Escort tugs are fast.		0	2	0	2	3	3	3	3	2.49	
45	34	Service Craft	Foundering	Line boat capsizes during mooring operations.	Experienced Mooring Boat Operators SFPA Operating Porcedures		2	0	0	0	4	4	1	4	2.45			2	0	0	0	4	4	1	4	2.45	
46	1	Commercial	Cargo Release	Uncontrolled LNG gas released from vessel. Failure of cargo containment system on board.	IMO Gas Codes Construction of vessel and equipment Detection Systems Auto-shut down systems		0	0	0	3	3	2	0	2	2.42	IMO Gas Codes Construction of vessel and equipment Detection Systems Auto-shut down systems		0	0	0	3	3	2	0	2	2.42	
47	43	Service Craft	Grounding	Pilot launch grounds whilst attending LNG Carrier	Sufficient Water for majority of Estuary Competent Launchmasters		0	1	0	0	0	4	1	4	2.09			0	1	0	0	0	4	1	4	2.09	
48	38	Commercial	Mooring Breakout	Mooring breakout of LNG Carrier during cargo transfer alongside jetty	Existing mooring plans Procedures regarding of tending lines (Port Byelaw 26)		0	0	0	0	3	6	0	6	2.44	Environmental Operating Parameters Environmental Monitoring Equipment and Display on Jetty Load cells on Mooring Equipment Standby tug on patrol Effective design Proximity of second tug in extreme weather Trained jetty supervisors	WC frequency reduced by 2 and Property by 1	0	0	0	0	3	4	0	5	2.02	Design and available computer simulations assist in the risk reduction
49	49	Service Craft	Near Miss	Towline parts during approach, transit and/or berthing	Experienced tugmasters and crew		0	2	0	0	0	2	0	2	1.67	Design of tug Towage procedures Freewheel/quick release facilities Joint pilot/tugmaster simulation training		0	2	0	0	0	2	0	2	1.67	
50	48	Commercial	Near Miss	LNG Carrier in close quarters situation with another vessel	Bridge Team Competence Compulsory Pilot for large vessels Experienced pilots		0	0	0	0	0	0	0	4	1.39	VTS Navigational Surveillance and Navigational Assistance Organisation		0	0	0	0	0	0	0	4	1.39	
51	46	Commercial	Mooring Breakout	Mooring breakout at another berth drifting near LNG Terminal	Existing mooring plans Procedures regarding of tending lines (Port Byelaw 26)		0	0	0	0	3	6	0	6	2.44	Safe passing clearance imposed Develop generic LNG Carrier Passage Plan	WC frequency reduced by 2. Highly unlikely	0	0	0	0	2	3	0	3	1.29	There has not been a mooring breakout at Tarbert or Money Point to date.
52	4	Commercial	Collision	LNG Carrier in collision at a navigation pinch point	Compulsory pilotage area for all large vessels Experienced pilots Infrequency of simultaneous large ship movements Simulator Training and Emergency Procedures		4	7	0	7	6	6	6	6	5.86	VTS traffic control and associated procedures Impose Control Zone around LNGC whilst in transit Second passive tug in attendance enforcing control zone Develop generic LNG Carrier Passage Plan	Hazard negated by mitigations	0	0	0	0	0	0	0	0	0.00	Single vessel only at pinch point negates this hazard
53	44	Commercial	Grounding	A Lead-In LNG Carrier leaves fairway and grounds between Tail of Beal and Beal Bar Buoys	Bridge Team Competence Pilotage Advice by VHF Lead-in with pilot cutter Existing navigational buoyage. Existing leading lights Existing Underkeel Clearance Software		2	6	0	7	4	7	0	7	5.61	Embark Pilot to seaward of Ballybunnon Buoy or Vessel to remain at sea until conditions improve Escort tug VTS Traffic Organisation Service Environmental Operating Limits	Hazard negated by mitigations	0	0	0	0	0	0	0	0	0.00	LNGC Carriers will not be lead-in, but this is an accepted practice on some vessels. Not being lead-in negates this hazard. The option "Consider replacing 3 x Cardinal marks with Starboard Lateral marks" deemed to be inappropriate as Starboard marks difficult to see at day
54	6	Commercial	Collision	Cruise vessel in collision with LNG Carrier	Bridge Team Competence Compulsory Pilot for large vessels Experienced pilots Infrequency of visitors		4	5	0	5	5	5	5	5	4.71	VTS Information and Traffic Organisation Services Compulsory pilotage for all vessels west of Ballybunnon Bar irrespective of draught Impose Control Zone around LNGC whilst in transit	Hazard negated by mitigations	0	0	0	0	0	0	0	0	0.00	Very few cruiseships at present. Control Zone removes this hazard
55	28	Commercial	Contact - Navigation	A Lead-In LNG Carrier in contacts channel mark	Pilotage Advice by VHF Lead-in with pilot cutter		0	4	0	6	0	6	0	6	4.35	Embark Pilot to seaward of Ballybunnon Buoy Move Beal Bar Buoy Increase Clearance over Doonaha wreck - remove buoy Escort tug VTS Traffic Organisation Environmental Operating Limits Develop generic LNG Carrier Passage Plan	Hazard negated by mitigations	0	0	0	0	0	0	0	0	0.00	LNGC Carriers will not be lead-in, but this is an accepted practice on some vessels. Not being lead-in negates this hazard. The option "Consider replacing 3 x Cardinal marks with Starboard Lateral marks" deemed to be inappropriate as Starboard marks difficult to see at day