

Chapter 5 - Appendix G

Risk Factor Mitigations

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Vessel Conditions

Deep Draft Vessel Quality – Refers to the proficiency of the crew, compliance of the vessel with all regulatory requirements, and safety issues relating to maintenance, inspection record, age, casualty history, maneuverability and handling, flag, class society, and owner.

- Port State Control
- Pilotage area extension
- Tug escort
- Notice of Arrival reports
- Safety zone around vessel
- Inspections
- Refuse entry
- Extra bridge watch
- Demonstrated experience or simulator training

Shallow Draft Vessel Quality – Refers to the proficiency of the crew, compliance with any regulatory requirements, and safety issues relating to maintenance, age, casualty history, owner, crew fatigue, and English language communications problems.

- Special VTS attention
- Training
- Extra bridge watch
- Inspections
- Demonstrated experience or simulator training

Commercial Fishing Vessel Quality – Refers to the ability of the crew to operate and maintain their vessel to expected safety standards.

- Licensing
- Mandatory inspections
- Voluntary inspections
- Special VTS attention
- Training
- Extra bridge watch
- Stricter consequences for violations

Small Craft Quality – Refers to the ability of the operator to operate safely and comply with regulatory requirements pertaining to the navigation of the vessel, including local knowledge and rules of the road.

- Voluntary training
- Mandatory education
- Licensing
- Enforcement
- Stricter consequences for violations

Traffic Conditions

Volume of Commercial Traffic – Refers to all commercial vessels including, but not limited to, ocean-going cargo ships, passenger ships, and oil rigs, tugs and barges, inland craft, and commercial fishing vessels.

- Dredging
- High water entry restrictions
- Underkeel clearance
- Artificial islands around bridges and structures
- Tug assistance
- Tide level monitoring
- Extra pilot
- Restrict other movements
- Patrol / escort vessel
- Aids - leading lights / range lights
- Route restrictions
- Laser range lights
- Precise positioning
- Quality hydrography
- Speed restrictions
- VTS
- Mandatory AIS

Volume of Small Craft Traffic – Based upon use of the vessel, not size limited.

- Training
- Education
- Licensing
- Special designated areas
- Propulsion requirements
- Speed limitations
- Restricted routes
- Restrictions for races or regattas
- Navigation / safety equipment

Traffic Mix – Refers to the mix of vessel types that interact in a fairway.

- Ship routing
- Safety Zone around vessel (e.g., LNG / LPG)
- Restrictions based upon cargo route
- Speed limitations
- VTS
- Day / night rules
- Additional aids
- Restrictions based upon route / operating hours / speed
- Prioritizing movements
- Queuing / slotting
- High Speed Craft Code
- Regulated Navigational Areas

Congestion – Refers to the number of vessels relative to the geographical area and/or time.

- Ship routing
- Waiting anchorages
- Dredging and widening
- Movement restrictions / slotting
VTS
- Prioritizing movements
- Restrict access to waterway
- Speed limitations
- Ship domain
- Prohibit certain activities (e.g., fishing, recreational)

Navigational Conditions

Winds – Refers to wind generated conditions that may affect the ability of a vessel to safely maneuver in a predictable manner.

- Restrict movements
- Close port (or section of)
- Tug assistance
- Wind screen
- Special anchorage or mooring rules
- Remote wind sensors
- Length restrictions
- VTS monitoring of anchorages / berths
- Temporary anchorage areas
- Draft restrictions
- Monitor critical aids to navigation
- Port / fairway closure

Water Movement – Refers to conditions generated by tides or river current that may affect the ability of a vessel to safely maneuver in a predictable manner.

- Real time monitoring & predictions
- Tide gauge
- Propulsion requirements
- Underkeel clearance
- Limit meeting / passing / overtaking areas
- Minimum speed requirements
- Movement restrictions based upon tidal window
- Air draft requirements
- Information on charts

Visibility Restrictions – Refers to conditions due to fog, rain, sleet, snow, smoke, etc., that limit a vessel's ability to see aids to navigation, or other vessels or landmarks.

- VTS radar
- Electronic aids (e.g., RACONS)
- DGPS
- AIS
- Controlled movements based upon vessel type
- Special anchorage areas
- Variable pilotage embarkation points
- Remote sensors
- Security broadcasts if no VTS / Calling-in points
- Prioritized movements
- Port / fairway closures

Obstructions – Refers to floating items that could damage a vessel, such as ice, logs, deadheads, containers, etc.

- Notice to Shipping
- Clean-up vessels
- Debris tolerant buoys and beacons
- Ice detection
- Predict / report ice and snow conditions
- Weather routing
- Ice breaker assistance
- Restrictions based upon construction
- Ice pilots
- Convoys
- Ice buoys
- Temporary alteration of routing
- Propulsion requirements

Waterway Conditions

Visibility Impediments – Refers to conditions caused by structures, background lighting, or vegetation that obstruct visibility.

- Reduce background lighting and/or color
- Shielded security lighting on berths
- Retransmit VTS video
- Enhanced aids (e.g., light pipes, laser range lights)
- Mandatory bridge-to-bridge communications
- AIS
- Restrictions on new developments

Dimensions – Refers to the extent to which meeting and overtaking vessels have to make passing arrangements, and includes limits on their ability to maneuver. The extreme case is one-way traffic, and includes bridges and locks.

- One-way traffic
- VTS
- Restrictions on meeting and overtaking areas
- Size restrictions
- Traffic control signals
- Speed restrictions (minimum and maximum)
- Restrictions based upon vessel type (maneuverability)
- Pilots
- Slotting
- Convoy
- Dredging and widening
- Channel design and marking
- Fendering and artificial islands
- Different aids (range lights)
- Tugs
- Queuing
- Monitoring aids

Bottom Type – Refers to what a vessel will hit if the vessel runs aground.

- Underkeel clearance
- Measure / predict tide
- Prohibited anchorage areas (regarding pipes and cables)
- Hull protection and configuration
- Precision positioning
- Up to date surveys
- Protected areas (e.g., coral areas)
- Dredging
- Speed limitations
- Notes on charts / ECDIS
- Dredging for advertised minimum depth

Configuration – Refers to the number of intersections, bends, obstructions, and crossing traffic.

- Ship routing measures
- VTS
- Regulated Navigation Areas
- Prioritize movements
- Special local rules
- Location of artificial structures
- Additional aids
- AIS
- ECDIS
- VHF sectors
- Tug assistance
- Pilotage
- Bridge-to-bridge reporting points
- Enforcement of navigation rules
- Channel realignment
- Improved facility location
- One-way routes

Immediate Consequences

Personnel Injuries – Refers to the maximum number of expected casualties in the most probable worst case scenario.

- More frequent mass casualty drills
- Coordination between agencies
- Waterfront evacuation plans / drills

Petroleum Discharge – Refers to the largest petroleum spill in the most probable worst case scenario.

- Require double hulls
- Tug escort
- Drills
- Response capabilities / equipment
- Response training
- Container requirements

Hazardous Materials Release – Refers to largest hazardous material spill in the most probable worst case scenario.

- Require double hulls
- Tug escort
- Drills
- Response capabilities / equipment
- Response training
- Container requirements

Mobility – Refers to infrastructure that is critical to the Marine Transportation System.

- Tug escort
- Increase inventory / surge stocking levels
- Redundant systems
- Dolphins / fender / structure protection

Subsequent Consequences

Health and Safety – Refers to the potential consequences to the community that lives on or near the waterway.

- Evacuation plans
- Education / awareness
- Predictive models
- Equipment suitable to probable accidents
- Zoning requirements
- Evacuation drills
- Responder training

Environmental – Refers to both the risks to wetlands and endangered species and how sensitive people are to the quality of their environment.

- Predictive models
- Response training
- Response equipment
- Education

Aquatic Resources – Refers to water dwelling life forms harvested for commercial reasons.

- Season limits
- Location limits
- Restocking ability
- Contamination checks

Economic – Refers to the extent of the impact if a particular waterway is closed for some period of time.

- Inventory / surge capacity
- Alternate sources
- Salvage equipment
- Construction equipment