Pilotage Risk Management Methodology (PRMM)

2008

Second Narrows Vessel Transits

Vancouver Fraser Port Authority

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July 2008

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EXECUTIVE SUMMARY

A. The Project

The Second Narrows Vessel Transit review is a ***modified*** Pilotage Risk Management Methodology project. It represents a continuation of a risk assessment initiative started in 2006. The original project was suspended to permit an in-depth review of assist tug capabilities and protocols. The work took place under the guidance of Captain Gregory Brooks of Towing Solutions.

This report contains an overview of the issues, profiles of the stakeholders, a review of the hazards and defences and the risk mitigation strategies agreed by the Risk Team.

B. The Question

All PRMM projects involve the development of a question that provides focus to the risk assessment activity. In this case the question is:

> *What risk mitigation strategies need to be adopted for vessels transiting the Second Narrows MRA to assure an acceptable level of operational and environmental safety while supporting the economic goals of the Port and its stakeholders?*

C. The Stakeholders

The Primary Stakeholders for this PRMM review are:

- ❑ Vancouver Fraser Port Authority
- ❑ Pacific Pilotage Authority
- ❑ British Columbia Coast Pilots Ltd.
- ❑ The Assist Tug Companies
- ❑ The Terminal Operators East of the Second Narrows Bridges
- ❑ The Shipping Companies
- ❑ The Tug & Barge/Boom Companies
- ❑ Transport Canada
- ❑ Canadian Coast Guard

The Risk Team invited representation from each of the above organizations.

D. Risk Scenarios

There were eight risk scenarios developed and considered by the Risk Team. They were:

- ❑ Rudder Failure of a loaded vessel of 150,000 tons displacement
- ❑ A Night Passage Occurrence
- ❑ A Bad Weather Occurrence
- ❑ A Vintage Vessel With Poor Navigational Equipment
- ❑ Pilot Incapacitated
- ❑ An Assist Tug Failure
- ❑ Tug & Barge Delays due to Poor Visibility
- ❑ Log Boom Limitations in the Second Narrows Movement Restricted Area

The examination of the current hazards and defences impacting each of these scenarios produced a number of risk mitigation strategies designed to enhance safety while providing greater scope for the economic objectives of the stakeholders.

E. Proposed Risk Mitigation Strategies

There were eight risk mitigation strategies as well as two economic optimization strategies for tug and barge/boom operators proposed by the Risk Team.

- ❑ Conduct a formal review of the navigational aids needed to enhance transit safety in the Second Narrows Movement Restricted Area (MRA).

- ❑ Make use of Personal Pilotage Units – particularly for large vessels.

- ❑ Adopt the agreed Assist Tug Protocols for vessels up to 13.5 meters draft and conduct any further simulations and live trials necessary to ensure safe transit for vessels up to 15 meters draft.

- ❑ Dredge the channel to provide a wider passage as well as ensure that the depth is uniform and appropriate.

- ❑ Establish vessel size and type restrictions that will ensure safety while providing a degree of increased flexibility to vessels up to 13.5 meters draft.

- ❑ Establish/clarify the requirements for daylight-only passages

- ❑ Develop additional protocols to document current practices around a pilot being incapacitated or an assist tug failure.

- ❑ Ensure that the training for pilots and tug crews incorporate the lessons learned from the simulations and tanker trials as well as the other protocols developed as part of this risk assessment initiative.

- ❑ Relax some of the current restrictions on tug and barge transits in periods of poor visibility. (Optimization)

- ❑ Increase the size of log booms permitted to transit the MRA (Optimization)

I

Introduction

A. Project Background

The Port of Vancouver is Canada's largest port and Second Narrows is the narrowest point in the harbour. There are two bridges at this location as illustrated on the cover page of this report – the Iron Workers Memorial Bridge for vehicle traffic and a rail bridge with a lifting span to accommodate vessel movement through the area. The Vancouver Fraser Port Authority (VFPA) has strict regulations in place to ensure the safety of this busy area of the harbour. These requirements are set out in the Harbour Operations Manual which is readily available on Authority's website.

The VFPA initiated a review of the Second Narrows Movement Restricted Area (MRA) requirements in 2006. The prevailing regulations were 25 years old and did not reflect changes in vessel size and safety improvements as well as changes in navigational aids and technology. There were also commercial drivers for this project. MRA requirements prevent today's larger tankers from transiting the MRA fully loaded. This has a negative impact on the efficient operations of the terminal east of the Second Narrows bridges.

The project started with a risk assessment generally following the Pilotage Risk Management Methodology (PRMM). A Risk Team including all key stakeholders was formed. In addition, a subcommittee of tug operators including both barge and log tow companies, was established to consider the unique needs of this segment of the industry. Considerable work was done but it was agreed that technical issues around tug assist operations needed further detailed review before the project could proceed.

The VFPA arranged for the services of Captain Gregory Brooks of Towing Solutions, a recognized expert in tug escort procedures, to advise the Risk Team. The broader risk assessment was suspended while the tug escort question was addressed.

Under Captain Brooks' guidance, the VFPA, the tug companies and the British Columbia Coast Pilots (BCCP) conducted a series of worst case scenario simulations involving a tanker with a hard over rudder failure. These simulations allowed the team

to develop assist tug strategies for mitigating the risks. It also facilitated an assessment of the capability of the assist tugs available in the Vancouver harbour. Subsequently a live tanker trial was conducted using a vessel supplied by Kinder Morgan.

The results of the work are documented in a series of reports produced by Captain Brooks. The simulations and live trial revealed weaknesses in the current tug assist procedures which are being addressed by the stakeholders. New assist tug protocols are being developed that will guide the training of both pilots and tug operators. The work will also influence the design and capability of the next generation of tugs. Further trials will likely be required and the results could lead to further changes in the size and load regulations for vessels transiting the Second Narrows MRA.

With the current tug assist work nearing completion, the VFPA decided to return to the broader risk assessment activity. A meeting was held with the Risk Team on May 26 and 27, 2008 to restart the process. Subsequently, there was a meeting on June 16th with the tug operators to review and update their earlier recommendations concerning barge and log towing. Finally, there was a meeting with the Risk Team on June 18th to deal with potential risk mitigation strategies for all traffic moving through the MRA.

B. Methodology Overview

The Pilotage Risk Management Methodology is a formal risk assessment process developed by Transport Canada in cooperation with the four Canadian Pilotage Authorities (Appendix A). It consists of three modules – Project Initiation, Risk Assessment and Action. In 2006 the methodology was adapted by David Batchelor of Batchelor Marine Consulting Services Inc. and applied to the Second Narrows MRA study.

As noted, the project was suspended to allow for the assist tug simulations and trials. In restarting the PRMM process, it was recognized that many aspects of the process had been carried out. Consequently, the methodology was again modified to avoid excessive duplication. Some of the earlier work (Appendix B) was reviewed to insure that the conclusions and recommendations were still valid.

The current PRMM project is intended to finalize and document the hazards, scenarios, risks and mitigation strategies. While it deviates from the formal methodology, the key elements have been covered.

C. PRMM Question

The PRMM methodology (Appendix A) calls for the development of a question that, in effect, summarizes the issue. The question should be acceptable to all key stakeholders. The decisions implied by the question must generally be within the mandate of the VFPA.

The question proposed by the facilitator was as follows.

"Do current Vancouver Fraser Port Authority (VFPA) requirements for the transit of the Second Narrows Movement Restricted Area (MRA) assure an acceptable level of operational and environmental safety while recognizing the economic goals of the Port and its stakeholders?"

In the discussion it was acknowledged that the answer was already known due largely to the tug escort work. The current requirements are not adequate. Further, an objective of this project is not just to maintain current safety levels but to enhance the safety of MRA transits. Consequently, a more appropriate question would be:

What risk mitigation strategies need to be adopted for vessels transiting the Second Narrows MRA to assure an acceptable level of operational and environmental safety while supporting the economic goals of the Port and its stakeholders?

In answering the question, consideration needs to be given not only to the current environment but also the expected changes that will be impacting the marine industry in the future. Some of these changes identified by the group include:

- ❑ Larger vessels
- ❑ Greater pressure to load to maximum capacity
- ❑ Increased priority for environmental Issues
- ❑ Terminals with increased capacity able to accommodate larger vessels
- ❑ Increased traffic as the economy improves
- ❑ Larger barges – double hulls for tank barges
- ❑ Increased pleasure craft traffic in areas of heavy commercial traffic
- ❑ Changing navigational and ship handling technology requiring ongoing training of pilots and escort tug crews

D. Project Objectives

The project objectives for PRMM projects were discussed briefly and agreed. The objectives are to ensure that:

- ❑ Safety is the primary focus of the project.
- ❑ A comprehensive baseline of facts and information is documented to support the decision process.
- ❑ All potential stakeholders have been identified and have an opportunity to provide input.

- ❑ Stakeholder Needs, Issues and Concerns (NICs) are fully considered within the context of safety.

- ❑ The PRMM process is managed in an open and transparent manner.

II

Stakeholder Profiles – Needs, Issues and Concerns

A. Stakeholder Profiles

The PRMM process calls for the identification and profiling of stakeholders including a description of their needs, issues and concerns (NICs). A stakeholder is defined as *"any individual, group or organization able to affect, be affected by, or believe it might be affected by, a decision or activity."* The definition is very broad and demands a careful examination of potential stakeholders.

The participants at the May 26, 2008 meeting developed a long list of potential stakeholders. Subsequently, the primary stakeholders were identified. There were others that could be classified as interested parties. There will be communication with these groups, as appropriate, to ensure that they are informed of any changes or decisions that would be of interest to them. The primary stakeholders are outlined below.

1. Vancouver Fraser Port Authority (VFPA)

The Vancouver Fraser Port Authority "…is committed to facilitating and expanding the movement of cargo and passengers through the Port of Vancouver…by providing facilities, services and technologies that are competitive, safe, commercially viable, dependable and customer oriented."

The Second Narrows Movement Restricted Area is particularly important as it presents a number of hazards that must be overcome to successfully move vessels and cargo to and from the east end of Vancouver Harbour.

The VFPA has concluded that the safety in the MRA must be enhanced but in a manner that facilitates the commercial development east of the bridges.

2. Pacific Pilotage Authority (PPA)

The mission of the Pacific Pilotage Authority, as stated in the legislation, is "…to establish, operate, maintain and administer, in the interests of safety, an efficient pilotage service…." The mission, and the supporting objectives, highlights the contribution of pilotage to marine safety.

The PPA works closely with the VFPA and the BCCP in ensuring safe vessel movement in the Vancouver Harbor.

3. British Columbia Coast Pilots Ltd. (BCCP)

The BC Coast Pilots Ltd. operates under contract to the Pacific Pilotage Authority. Marine safety is a primary concern of the pilots. They pilot a range of vessels in and out of the harbour on a daily basis. They bring a high degree of local knowledge and experience to their assignments and contribute to the objective of marine safety.

The BCCP participated in all of the simulations and live tanker trials and have gained a greater understanding of how to use the assist tugs when piloting a vessel under the bridges. They have long seen a need for further risk mitigation actions and view this project as an opportunity to work with the other stakeholders for safety improvements.

4. Assist Tug Companies

Assist tugs performing escort activities are essential to safe vessel operations in the Vancouver Harbour and especially in the Second Narrows MRA.

There are essentially two companies providing ship assist tug services in the Vancouver Harbour. Both companies have participated fully in the meetings, simulations and trials to date.

Seaspan operates seven Tractor Tugs ranging from 1450 HP to 4000 HP and 22 Tons Bollard Pull to 40 Tons Bollard Pull. However, the bollard pull of one of these tugs may be under-rated as one engine was not working properly at the time of the test. This has now been corrected and the tug will be retested. Company officials estimate that the bollard pull of the tug will reach 54 tons. In addition to the Tractor Tugs, Seaspan has four 1800 HP Conventional Tugs with 25 Tons Bollard Pull. The company has also started construction on a 6000HP Tractor Tug with a 75 Tons Bollard Pull.

SMIT has six Tractor Tugs ranging from 3000 HP and 33 Tons Bollard Pull to 5400 HP and 60 Tons Bollard Pull. Three of the tugs operate in Vancouver Harbour, two are based in New Westminster and one is in Prince Rupert.

The simulation and the trials suggest that the tug power and bollard pull of certain tugs is less than required for maximum safety for larger vessels. Consequently, these companies have a vested interest in the escort tug arrangements required by the VFPA and the pilots. Over time, they can ensure that any new escort tugs meet the enhanced standards. However, in the meantime, the assist tug requirements must give full consideration to the current tug availability.

5. Terminal Operators

Two terminal operators are represented on the Risk Team – Kinder Morgan Canada Ltd. and Pacific Coast Terminals Ltd. Both have facilities east of the second Narrows bridges.

The terminal operators place a premium on safety. For example, Kinder Morgan has policies in place to ensure that the vessels transporting their oil meet specific standards and that vessels are vetted and inspected prior to being granted approval for loading at the terminal. They recognize that marine occurrences can have not only an environmental but also an economic impact.

The current limitations on tanker traffic under the Second Narrows Railway Bridge means that Aframax size vessels, the largest that call on the Kinder Morgan terminal, can only load up to 80% of their capacity. This makes the operation of this terminal less economic than it could be if the vessels could leave with a full load.

Kinder Morgan has been part of this project since the outset. The company made a vessel available to the VFPA for the live tanker trials and provided funding for the simulation modeling with the objective of improving the efficiency of the terminal without compromising safety.

6. Shipping Companies

The shipping companies also have a vested interest in safe operations as their vessels represent multi-million dollar investments. Any occurrence leading to vessel loss, damage or delay is expensive. These companies, like the terminal operators, are conscious of the cost of changes to the number and size of tugs.

7. Tug Operations

Tug operations are considered separately from the assist tug activity. This group encompasses companies moving barges and/or log booms through the Second Narrows MRA. They are subject to the VFPA operational and safety requirements like any other vessel.

These companies have participated in this project from the outset and established a separate sub-committee to examine their particular circumstances. These operators want to ensure that the regulations accurately reflect the capability of current tugs and crews. Further, they want to ensure that the requirements respond to commercial as well as safety needs.

8. Transport Canada

The Vancouver Fraser Port Authority reports to the Minister of Transport. Transport Canada has a responsibility "...to regulate, promote and enforce safe

and sustainable marine practices. The department oversees the safety, security and marine infrastructure of small vessels, large commercial vessels and pleasure craft." It is also responsible for regulating "... the safe transport of dangerous goods by water." The department has appropriate representation on this project.

9. Canadian Coast Guard

The Canadian Coast Guard (CCG) has a mandate that includes marine safety and protection of the environment. Consequently, they have an interest in all marine operations on the coast.

The Marine Communication and Traffic Services (MCTS) plays a key role in managing and monitoring vessel activity. It has a vested interest in any changes in the MRA. MCTS is represented on the Risk Team.

The Aids to Navigation program is responsible for a system of "...floating, fixed and electronic aids to navigation." The issue of navigational aids is an important part of this project. Additional navigational aids may be an outcome of this initiative. Hence this organization also has a vested interest and is represented.

Other potential stakeholders were considered such as communities bordering the harbour, the railway, Burrard Clean, other government organizations etc. These were not considered to be primary stakeholders at this time. Some may be consulted as risk mitigation strategies are developed, others will be advised if changes are made that will impact them.

B. Stakeholder Risk Management Team

A Risk Management Team should include representation from all primary stakeholders. The role of the team is to:

- ❑ Provide information/advice on the focus and structure of the PRMM project.
- ❑ Apply marine/pilotage expertise and area knowledge to the development of scenarios, the identification of hazards, the development of scenarios, the assessment of risks and he development of risk control options and strategies
- ❑ Provide a link to the primary stakeholders
- ❑ Provide feedback on project documentation
- ❑ Provide other support and input, as required.

The Risk Team established by the VFPA for this project includes a wide variety of stakeholders as listed in Exhibit II – 1 on the following page.

Vancouver Fraser Port Authority

- ❑ Yoss Leclerc
  Harbour Master
- ❑ Andrea Heba
  Deputy Harbour Master
- ❑ Captain David Hart
  Manager Dredging

British Columbia Coast Pilots Ltd.

- ❑ Captain Michael Roman
  President
- ❑ Captain Al Murray
  Licenced Pilot
- ❑ Captain Allan Ranger
  Licenced Pilot

Seaspan

- ❑ Captain John Armstrong
  Vice President, Marine Operations
- ❑ Captain Don Westmoreland
  Port Captain

SMIT Harbour Towage

- ❑ Jim Wilson
  Manager Vancouver Operations

SMIT Marine Canada

- ❑ Chris Wellstood
  General Manager Operations
- ❑ Mitch Hughes
  Operations Manager

Pacific Pilotage Authority

- ❑ Kevin Obermeyer*
  President & Chief Executive Officer

Sultran Ltd

Kinder Morgan Canada Ltd.

- ❑ Michael Davies
  Director, Engineering

Pacific Coast Terminals Co. Ltd.

- ❑ Wade Leslie
  Manager, Operations

Westward Shipping Ltd.

- ❑ Marc Fellis
  Manager, Marine Operations

Transport Canada

- ❑ Captain John T. F. Yeung
  Manager, Compliance & Enforcement

Chamber of Shipping

- ❑ Rick Bryant
  President

Canadian Coast Guard

- ❑ Martin Jenner
  Officer In Charge
  Vancouver MCTS Centre
- ❑ Kevin Carrigan*
  Superintendent
  Aids to Navigation
- ❑ Gary Hamilton*
  LOS Officer
  Aids to Navigation

Council of Marine Carriers

- ❑ Philip Nelson*
  President

Consultant

- ❑ Captain Gregory Brooks
  President
  Towing Solutions

❑ John Meyers Mgr. Vancouver & Environmental Affairs	

Exhibit II – 1: Second Narrows Marine Restricted Area – PPRMM Risk Team

III

Hazards and Risk Scenarios

A. Hazard Identification

The PRMM Manual defines hazard as *"a source of potential harm, or a situation with the potential for causing harm, in terms of human injury, damage to health, property, the environment and other things of value, or some combination of these."*

The Risk Team identified a number of potential hazards.

Physical Hazards – Natural

- ❑ Tides – often leaving a short window of opportunity for safe transits
- ❑ Water depth – this can be a problem for under keel clearance
- ❑ Channel width
- ❑ Fog – fall and winter
- ❑ Freshette
- ❑ Weather – wind, rain squalls etc.

Physical Hazards – Man-made

- ❑ Bridges (2)
- ❑ Power Lines
- ❑ Submerged crossings
- ❑ Marine traffic – both commercial and pleasure

Technical Hazards

- ❑ Inadequate bollard pull capability of tugs
- ❑ Inadequate bollard strength on vessels
- ❑ Inadequate bollard positioning on the vessel
- ❑ Lift bridge opening – if power fails before bridge is locked into position, it will come down
- ❑ Lights on railway bridge may not be working
- ❑ Flashing light east of bridge can be obscure
- ❑ Inadequate navigational aids
- ❑ Power/equipment failure on vessel or tug

Human Hazards

- ❑ Lack of training leading to errors
- ❑ Minimum manning on the vessel's bridge
- ❑ Language problems
- ❑ Illness – Pilot incapacitated

Economic Hazards

- ❑ Lack of funds for additional navigational aids
- ❑ Lack of funds for simulations, trials and training
- ❑ Lack of investment in new technology such as Portable Piloting Units
- ❑ Financing challenges for tugs with greater bollard pull capability – The transition will take time and will depend on the potential return on investment

The physical hazards present risks but there are mitigation options available. The same is true for some of the technical hazards and the human hazards from a pilot or tug crew perspective. However, other hazards or risks related directly to the design or condition of the vessel and the capability of its crew are difficult to deal with from a risk mitigation perspective. Issues such as language, crew fatigue, pressure on the crew to cut corners and other similar risks are beyond the control of the Port Authority or the pilots. In extreme cases, the pilots could refuse to take the vessel through the MRA. However, in most instances, these challenges are part of the pilot's working environment.

Another hazard that is beyond the control of local authorities is the result of the rapid rise in fuel costs. Some vessels search for cheap fuel in an attempt to manage costs. This can increase the probability of engine/power failure on some vessels. Such a scenario reinforces the importance of the proposed tug assist protocols.

B. Reportable Occurrences in the Second Narrows MRA

All marine occurrences must be reported to the Transportation Safety Board (TSB). These occurrences should include both accidents and "near accident." However, the latter may not always be reported. The TSB maintains a database of these incidents which can be sourced by interested parties. This information is reviewed as part of any PRMM project as it can, at times, illustrate trends or specific risks.

The TSB identified 17 occurrences in the vicinity of the Second Narrows Bridge in the ten year period 1998 to date (Appendix C). Some of these are just outside the MRA but remain relevant as they illustrate the kind of accident that can happen in the area. Of the total, five occurred while the vessel was docked and therefore are not relevant to this review. A further three incidents involved pleasure craft or rental boats. The remaining nine occurrences involving commercial vessels included:

- ❑ Grounding – Barge
- ❑ Striking – Tanker
- ❑ Flooding – Tug
- ❑ Engine Trouble – Charter Vessel
- ❑ Machinery Failure – Tug
- ❑ Near Collision – Bulk Carrier
- ❑ Near Contact – Bulk Carrier
- ❑ Struck by another vessel – Barge
- ❑ Broken Tow & Striking – Tug & Research Vessel

None of the above nine incidents involved any significant personal injury and only two presented any direct risk to the Second narrows Bridge.

In summary, there will always be risks that result in accidents. However, the occurrence record in and around the MRA over the past ten years is quite positive. This is attributable to the policies of the VFPA and the skill of the pilots and tug operators.

While the past track record is positive, it does not suggest that there is no need for further risk mitigation. As noted in Chapter I – Section C the marine environment continues to evolve and safety measures must keep pace with the changes and anticipate future needs. This PRMM is looking not only at strategies to mitigate current risks but also at changes needed to respond to the future.

C. Risk Scenarios

Risk scenarios are developed to test the hazards and defences in different sets of circumstances. Often, they present the worst case scenario. For example, the tug assist simulations called for a “hard over” rudder failure as the vessel was approaching the Second Narrows bridges. The chances of this happening may be minimal but, if it does, the outcome could be extreme without the proper tug escort and procedures in place.

Some scenarios were developed early in the process in 2006 but, as noted, the work was suspended so that the tug escort issue could be examined. The Risk Team revisited the issue of scenarios and proposed the following for further consideration. Subsequently, the Tug Committee added two more scenarios that were representative of their activities.

1. Rudder Failure

One of the drivers behind this risk assessment was a desire to accommodate fully loaded Aframax vessels through the Second Narrows MRA. These tankers

can only take about an 80% load in order to conform to the current vessel draft requirements. This results in an economic loss to the companies.

A rudder failure or power blackout while transiting the MRA was developed as a "worse case" scenario for these vessels. It was the subject of simulations and live tanker trials under the guidance of Captain Gregory Brooks of Towing Solutions. The original mandate of the work was "to provide the pilot conning a ship entering the Port of Vancouver with the tools, training, procedures and ability to save a ship of up to 150,000 tons displacement that suffers a hard over rudder failure (or black out) when approaching the Second Narrows Bridge." It was recognized that the key to averting disaster would be the role and ability of the escort tugs to respond to the pilot in an appropriate manner.

A risk mitigation strategy was developed based on the lessons learned – and the training proposed – as a result of the simulations and live trials undertaken over the past year.

The current PRMM is not intended to revisit the work that has been done with Towing Solutions nor define the work yet to be done. This is taking place as a parallel initiative.

2. Night Passage Occurrence

This scenario involves taking a Panamax size vessel through the MRA at night with poor visibility. While it is not a "worse case" scenario it is one that occurs with some frequency and needs to be considered. For the purpose of this scenario it has been assumed that there is appropriate tug escort.

The issues involve poor visibility, a longer response time to potential crises due to the lighting and concerns about the adequacy of current navigational aids. Of course, the channel limitations in terms of both natural and man-made hazards are also a factor.

3. Bad Weather Occurrence

This scenario also involves taking a large vessel through the MRA in bad weather with poor visibility. While the arrangement may include an appropriate tug escort, in heavy wind conditions the escort tugs are likely to be busier and it may be more difficult to get the ideal tug combination due to the limited number of tugs that actually meet the requirements arising out of the Towing Solutions study. If an appropriate tug escort is not available, the pilot faces a greater challenge as the vessel is more difficult to control in heavy wind conditions.

In addition, the concerns about the adequacy of navigational aids and the limitations of the channel are also important factors.

4. Vintage Vessel With Poor Navigational Equipment Occurrence

This scenario includes a poorly equipped, older vessel with an inexperienced crew and serious language problems. The vessel is not well equipped for tug escort (Bollard availability and location) and is at the maximum draft currently allowed. These vessels present a challenge in the best of conditions. However, if visibility is poor and the weather is bad the risk increases significantly.

5. Pilot Incapacitated

There have been times when a pilot has suffered a medical emergency. If this happens during an MRA transit these is a danger that control of the situation could be lost leading to a marine occurrence.

6. Assist Tug Failure

There have been situations where the assist tug has experienced some form of mechanical problem or has lost a line to the vessel. There is also the possibility that the tug master could suffer a medical emergency. Again, if this occurs during a transit of the MRA, the risk of an occurrence increases. One of the TSB incidents falls into this category.

7. Tug & Barge Delays Due to Poor Visibility

Currently tugs with tows are not allowed to transit the bridges during periods of poor visibility. At times, there is a significant backlog of these vessels waiting for a window of improved visibility. When this occurs, there is pressure on the tug masters to take advantage of the opening. The resulting congestion presents a potential risk.

The tug and barge sub-committee recommended that “tugs towing or pushing a barge of up to 6500 tonnes displacement carrying dangerous goods and/or a pollutant cargo” be allowed to transit through the second narrows providing specific conditions are met.

8. Log Boom Limitations in the MRA

Log booms that “contain 10 sections or more” can only transit the second narrows with an assist tug. The tug companies made the case that a log boom is more rigid and easier to control if it is two wide. They are recommending that tows of up to ten sections long and two wide – a maximum of twenty sections – be allowed to transit the MRA without an assist tug.

The eight scenarios listed above are a mix of traditional risk scenarios and proposals for regulatory change. Again, this approach was deemed to be appropriate given the work that has been done over the past two years.

The link between the scenarios and the identified hazards is illustrated in Exhibit III-1. Many of the hazards can be applied to most of the scenarios. This is particularly true of the Physical Hazards – both natural and man-made – as well as the technical hazards involving navigational aids in the MRA and at the bridges.

Exhibit III - 1: Scenario – Hazards Linkage

Hazards \ Scenarios	Rudder Failure	Night Passage	Bad Weather	Vintage Vessel	Tug Delay (Visibility)	Log Boom Limitations	Pilot Down	Assist Tug Failure
Physical Hazards – Natural								
❑ Tides	X	X	X	X	X	X		
❑ Water Depth	X	X	X	X				
❑ Channel Width	X	X	X	X	X	X		
❑ Fog	X	X	X	X	X	X		
❑ Freshette	X	X	X	X	X	X		
❑ Weather – wind, rain squalls etc	X	X	X	X	X	X		
Physical Hazards – Man Made								
❑ Bridges (2) – Vehicle and Railway	X	X	X	X	X	X		
❑ Power Lines	X	X	X	X				
❑ Submerged Crossings	X	X	X	X				
❑ Marine Traffic	X	X	X	X	X	X		

Technical Hazards ❑ Inadequate bollard pull capacity of tugs ❑ Inadequate bollard positioning on vessels ❑ Inadequate bollard strength on vessel ❑ Lift bridge failure ❑ Railway bridge lights failure ❑ Flashing light obscured ❑ Inadequate navigational aids ❑ Power/equip failure (vessel or tug)	X X X X	 X X X X X	 X X X X X	 X X X X X X X	 X X X	 X X X	 	 X
Human Hazards ❑ Lack of training – Vessel ❑ Lack of qualifications of vessel crew ❑ Minimum manning on bridge ❑ Language problems ❑ Illness-Pilot incapacitated	X X X X	X X X X	 X X X	X X X X			 X 	
Economic Hazards ❑ Lack of funds for navigational aids ❑ Lack of funds for simulation & training ❑ Lack of investment in new tech. (PPU's) ❑ Financing new tugs (ROI)	X X X X	X X	X X	X X X	X	X	 	

IV

Defences

A. Introduction

The PRMM Manual defines defence as "*a physical or administrative measure to limit, reduce or prevent an adverse consequence."* The current defences are outlined in Section B below. The description is not intended to be all inclusive. It simply illustrates the kinds of physical and administrative defences that are in place.

These defences have been deemed to be inadequate by the Risk Team. They have suggested other risk mitigation strategies – some of which will require further review. Others have already been agreed by key players.

B. Significant Current Defences

There are a number of existing administrative defences in place including the policies and practices set out in the Vancouver Fraser Port Authority Operations Manual. Some of these are presently under discussion as part of the Tug Assist Review. The Manual will be updated to reflect the agreed vessel and assist tug protocols. Current defences include restrictions on the movement of vessels in specific tide, wind, visibility and traffic conditions. The Manual also sets out transit speeds, vessel size limitations, communication protocols and a range of other requirements.

Physical defences include the current navigational aids around the bridges. While these are viewed as insufficient, they do provide a basic level of defence as evidenced by the limited number of occurrences in this area. The use of pilots constitutes a major defence for the MRA. In the case of tankers, two pilots are used.

David Batchelor noted in 2007 that there was a concern that the Coast Guard would like to privatize the ongoing maintenance of the pipe lights on the rail bridge. He stated that the Risk Team felt strongly that there should be no downgrading or removal of navigational aids within the MRA. This view also reflects the current mood of the Team.

In terms of mitigating the severity of incidents such as oil spills, there are government standards that dictate the nature of response required. In B.C. Burrard Clean has a contract to provide this service in the harbour.

C. Additional Defences – Potential Risk Mitigation Strategies Proposed by the Risk Team

A risk mitigation strategy is "*an action intended to reduce the frequency and/or severity of injury or loss, including a decision not to pursue the activity.*"

The Risk Team identified a number of Risk Mitigation Strategies that are currently agreed or needed to enhance safety in a manner that supports the economic objectives of the Port Authority and the commercial objectives of the private sector stakeholders. Two of the proposals involving the movement of tug & barges and tug & log booms through the MRA are less about reducing current risk levels and more about changing current practices in a safe manner to facilitate the economic optimization of these activities.

1. Navigational Aids

There is general acceptance that the current navigational aids are not adequate. However, they should be maintained until such time as there is agreement on a more comprehensive package of aids. There was some agreement that the VFPA should contract with an "expert" to review the current and future navigational aids requirements. The review should give consideration to factors such as:

- ❑ Improving the markings and/or painting of the bridges to enhance visibility
- ❑ Improving the channel marking with buoys
- ❑ Enhancing the MCTS AIS system to provide real time information on currents, tides, wind and other key factors
- ❑ Installing visibility sensors that link to the AIS system

These and other navigational aids recommendations from an expert analysis of needs would go a long way to mitigate the current and future risks. Implementation of this recommendation will require the input and cooperation of the VFPA, the pilots and the Coast Guard.

2. Pilotage Technology

The development of Personal Pilotage Units (PPU) provides a tool that would enhance the pilot`s ability to navigate safely in difficult conditions by providing more and better information. These units would be linked to the AIS system.

The PPUs would have the greatest benefit when piloting larger vessels through the MRA.

3. Assist Tug Protocols

Captain Gregory Brooks of Towing Solutions has been working with the VFPA, the pilots and the tug companies to develop new assist tug protocols. These have been set out in his reports on the subject.

One of the major challenges with the new protocols is the limited number of tugs in the harbour that can meet the required standards for current vessels transiting the MRA. Responding to the assist tug requirements in the future for larger vessels – up to 15 meter draft – presents an even greater challenge. It has been agreed that further simulations and live trials will be required to ensure that the protocols are appropriate for these vessels.

Assist tug companies will need to factor these new requirements in their plans for modifying current, or building new, assist tugs. This will depend, in part, on the demand for these services and the potential return on investment for these major expenditures.

Captain Brooks has proposed a Tractor Tug Performance Certification Protocol (Appendix D). There was some agreement that the protocol would serve as a useful starting point. However, the tug companies have concerns about the practicality of the proposal. The document will subject to further discussion between the VFPA, the pilots and the tug companies. Any agreed Performance Protocol should be reviewed after one year and adjustments made, as required.

This report is not attempting to present the results of Captain Brooks work. His reports should be read in conjunction with this document to obtain a full appreciation for all of the hazards and risk mitigation strategies.

4. Dredging the Channel

Dredging has the potential to widen the channel as well as ensuring that the depth is appropriate. This action would enhance safety by providing more room to manoeuvre vessels and to accommodate the traffic.

There are some challenges to this strategy. Underwater cables – crossings cannot be disturbed. Also, the nature of the bottom – hence the degree of difficulty – is not known. Finally, the cost will be one of the determining factors.

It has been agreed that the VFPA will take the necessary action to determine the feasibility of dredging the channel.

5. Vessel Size Restrictions

Discussions between the pilots and the VFPA have resulted in a proposal to deal with vessel size requirements. This will be discussed further and finalized.

Vessel Size/Type	Transit Conditions
Less than 8 meters draft	❑ 15% under keel clearance ❑ 2 knot window
Greater than 8 meters draft	❑ 2.17 m tidal height ❑ 2 knot window
Length plus Breadth greater than 265 m	❑ Restricted to 13.5 m draft with the agreed assist tug arrangements. ❑ Daylight passage only Will review restrictions when risk mitigation strategies are adopted including: ❑ Assist tug matrix ❑ Enhanced Navigational aids ❑ Channel Dredging ❑ Improved bridge marking ❑ Improved bridge lighting ❑ Adoption of Personal Pilotage Units
Tanker Escorts	Tankers (in product) greater than 40,000 DWT will have tug assists through 1st and 2nd narrows – both inbound and outbound

The 13.5 meter vessel draft represents an increase of one meter over current requirements. This change was agreed as a result of the simulation activity and the live tanker trials. There is a consensus that the draft limitations could be increased in the future – perhaps as high as 15 meters – subject to the implementation of the risk mitigation strategies as well as further trials and the availability of more powerful tugs.

6. Daylight Transits

Daylight transits provide considerably more visibility and there is less reliance on the current navigational aids in the MRA. It was noted that this can be an appropriate option for the scenario involving a vintage vessel with poor navigational equipment or for larger vessels

7. Tugs – Visibility

The tug and Barge Sub-Committee made a recommendation in 2006 for a change in the rules around tug & barge transits.

> "Tugs and barges specifically designed for pushing and ASD tugs towing alongside may transit with a barge 6,500 to 10,000 tonnes in either direction with a current of up to ...2 knots... with the required assist tugs. Barges over 6500 tonnes displacement being towed will be considered a deep sea vessel and restricted accordingly."

The original quote called for transits in currents of up to 3 knots. However, further discussion resulted in an agreement to maintain the existing standard of 2 knots. All other aspects of the recommendation remain the same as the original.

On the specific subject of visibility, the 2006 Tug & Barge Subcommittee recommendation was as follows.

> During periods of reduced or zero visibility, a small craft carrying dangerous goods and/or pollutant cargo, or a tug towing or pushing a barge of up to 6500 tonnes displacement carrying dangerous goods and/or pollutant cargo may:
>
> - ❑ Transit through the Second Narrows MRA and
> - ❑ Berth or unberth within the second narrows MRA
>
> providing the following conditions are met:
>
> - ❑ There is an assist tug in accordance with the stated requirements;
> - ❑ The tugs have on board two forms of electronic navigation (e.g. radar, ECDIS or precision electronic chart plotter)
> - ❑ The movement within the MRA is at or near slack water.
>
> Pusher tug/barge combinations between 6,500 tonnes and 10,000 tonnes may request special clearance from the Harbour Master during periods of reduced or zero visibility. When considering such requests the Harbour Master shall take into account the experience and local knowledge of the tug's crew and the vessel's navigational equipment.

8. Tugs – Log Booms

The Log Towing Sub-Group made a recommendation in 2006 to increase the size of tug & booms transiting the MRA from 10 sections to 20 sections – not to exceed ten sections long or 2 sections wide. This arrangement makes the tow more rigid and would reduce the risk of breakup.

9. Additional Protocols

There are standard practices for occurrences such as a pilot being incapacitated and a tug failure. It was agreed that documenting these protocols would be beneficial and would ensure that everyone was familiar with the procedures.

10. Training

Training was viewed as an important part of any risk mitigation strategy. The assist tug procedures can be documented but must also be included as part of the training for pilots and tug crews. If an event occurs, there is no time to check the handbook. The response must be immediate. This requires comprehensive training – likely using simulators as well as live events.

The other protocols such as pilot down or tug failure should also be part of the ongoing training for all participants.

Exhibit IV – 1 (pages 29 – 30) illustrates the link between the potential Risk Mitigation Strategies and the eight scenarios.

D. Risk Mitigation Recommendations – January 2007

In addition to the risk mitigation strategies set out in Section C above, there were two sets of recommendations prepared by David Batchelor, in consultation with the committee, and circulated in February 2007. The first set of recommendations was to be adopted immediately while the second set was to be deferred until the escort tug study was completed. These recommendations have yet to be implemented.

The earlier recommendations were reviewed to determine if they remain valid. Most are unchanged but there were a few minor refinements. Some of the recommendations are incorporated in the strategies proposed in Section C of this chapter. The recommendations are outlined below and incorporate any agreed changes.

The numbering in the following section corresponds with that used in the David Batchelor document. However, the cross references to the version of the Operations Manual used by David Batchelor has been dropped. They are no longer valid as the Manual has been revised since the earlier work. In the following section, any references to the Manual reflect the current version, wherever possible. The focus is on the substance of the recommendations rather than the required revisions to the Manual.

Appendix B does include the cross references. Even though they are no longer valid, participants in the earlier sessions may wish to make reference to the original recommendations – unaltered.

Recommendations A

1. **Definitions**

Amend the definition for a Deep Sea Vessel to read “Deep-sea vessel means any vessel requiring or requesting a pilot in accordance with Section 9 of the Pacific Pilotage Regulations - Ships Subject to Compulsory Pilotage.”

2. **Transit Priority**

The priorities for different types of vessels should be changed as follows:

(a) deep sea vessels carrying dangerous goods
(b) all other deep sea vessels
(c) vessels with tows and small craft carrying dangerous goods
(d) all other small craft

3. **Clear Narrows**

Light tugs should be permitted to transit through the bridges during a clear narrows condition providing a ship to ship agreement has been reached with the vessel(s) for which the clear narrows has been announced.

4. **Visibility**

Deep Sea Vessels: Amend to read: “Any exclusion to the current visibility restrictions will require the approval of the Harbour Master.”

5. **Vessel Size Limitations**

This recommendation has essentially been covered by the outcome of the tug escort recommendations and the agreement between the VFPA and the pilots outlined in Section C – 5.

6. **Tugs and Tows without attendant tugs**

Eliminate the paragraph in section 3.2.10 of the current Manual that dictates the use of the first fixed span south of the CN Bridge main lift span.

7. **Priority**

This recommendation is no longer relevant due to the changes in the current manual.

8. **Separation**

Remove the 600 meter separation requirement for log tows.

9. **Additional tug requirements – Log Tows**

Additional tug(s) are required for log tows when transiting the MRA where the raft contains more than 20 sections or is longer than 10 sections.

10. **Transit windows**

Insert a new paragraph covering tugs and barges specifically designed for pushing and ASD tugs towing alongside.

"Tugs and barges specifically designed for pushing and ASD tugs towing alongside, may transit with a barge 6500 to 10,000 tonnes in either direction with current up to 2 knots with the required assist tugs. Barges over 6500 tonnes displacement being towed will be restricted in the same manner as a deep-sea vessel."

11. **Visibility**

The visibility recommendations are covered by those contained in Section C – 6.

The recommendations contained in Part B of David Batchelor's document have largely been pre-empted by the outcomes of the tug assist activity.

Exhibit IV – 1: Risk Mitigation Strategies Applied to Each Scenario

Proposed Mitigation Strategies / Scenario	Rudder Failure	Night Passage	Bad Weather	Vintage Vessel	Tug Delay Visibility	Log Boom Limitations	Pilot Down	Assist Tug Failure
❑ Expert Assessment of current navigational aids and upgrades where appropriate.		X	X	X	X			
❑ Pilotage Technology		X	X	X				
❑ Assist Tug Protocols		X	X	X				X
❑ Dredging/Widening the Channel	X	X	X	X	X	X		
❑ Vessel Size Restrictions	X	X	X	X				
❑ Daylight Passages				X				
❑ Tugs – Visibility					X			

Exhibit IV – 1: Risk Mitigation Strategies (Continued)

Scenario / Mitigation Strategies	Rudder Failure	Night Passage	Bad Weather	Vintage Vessel	Tug Delay Visibility	Log Boom Limitations	Pilot Down	Assist Tug Failure
❑ Tugs – Log Boom						X		
❑ Additional Protocols	X	X	X	X			X	X
❑ Training	X	X	X	X			X	X

V

Risk Assessments

A. Risk Overview

Risk is defined as "*the chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment or other things of value."*

Residual risk is "*the risk remaining after all risk mitigation strategies have been applied."*

Limited time was spent actually discussing the risk ratings as a commitment has been made to take action to mitigate what is viewed as a higher than acceptable risk as well as out-of-date practices.

Risk is the combination of the probability of an event occurring along with the potential severity of the event. The following definitions apply to the evaluation of the risk inherent in the agreed scenarios.

Probability of Adverse Consequences

- **Highly Probable** – Almost certain that the event will occur with some frequency.
- **Probable** – Event likely to occur at least once.
- **Unlikely** – Event might occur.
- **Improbable** – Event not likely to occur.

Severity of Adverse Consequences

- **Catastrophic** – Multiple deaths, extreme property damage, loss of vessel.
- **Major** – Death, multiple major injuries, significant damage.
- **Intermediate** – Damage and/or injuries that prevent the vessel from proceeding on its voyage.
- **Minor** – Some damage to the vessel and/or minor injuries to personnel. Vessel is able to proceed on its voyage.

- **Negligible** – Little or no property damage. No injuries to personnel.

The probability and severity estimates are plotted on a Risk Matrix. The intersection of the two factors is the overall scenario risk.

Severity of Adverse Consequences	Probability of Adverse Consequences			
	Highly Probable	**Probable**	**Unlikely**	**Improbable**
Catastrophic	Extreme	High	Medium	Medium
Major	High	High	Medium	Low
Intermediate	Medium	Medium	Medium	Low
Minor	Medium	Medium	Medium	Low
Negligible	Low	Low	Low	Low

B. Risk Assessments – Post Mitigation Strategy Implementation

The risk level is *"an estimate of the probability that a hazard will involve an adverse consequence and of the severity of that adverse consequence."* Each of the scenarios is rated in Exhibit V – 1. The rating assumes that the risk mitigation strategies have all been adopted with the exception of dredging the channel. Dredging to widen the channel and ensure a uniform depth will be a significant risk mitigation action. However, until the feasibility of this action has been determined, it cannot be factored into the risk ratings.

The probability of an occurrence for six of the eight scenarios is "unlikely." By definition, this means that the event might occur but it is unlikely. This is based on the input of the stakeholders as well as the fact that the Transportation Safety Board information on reportable occurrences over the past ten years has been relatively positive. The remaining two scenarios have a probability rating of Probable as both have occurred. The adoption of the proposed risk mitigation strategies should further enhance safety.

The severity of any occurrence varies with each scenario. The worst case would be the rudder failure or a vessel blackout. The proposed assist tug arrangements are a major step forward in mitigation the potential for damage. However, the severity rating in this situation is Major. At the other end of the spectrum is the impact of an incident with a larger log boom transiting the MRA. The boom may break up but the potential for significant damage appears Negligible.

The risk ratings produced by the probability and severity assessments is Medium in all cases except for the log boom scenario which is rated as Low. The PRMM Risk Matrix has a fairly broad "Medium" range. Some of the rankings are higher in the Medium range but do not fall into the High Risk category. Again, this assumes that the mitigation strategies are adopted.

Exhibit V – 1: Scenario Risk Rankings

Scenario	Probability Of Occurrence	Severity Of Occurrence	Risk
Rudder Failure	Unlikely	Major	Medium
Night passage Occurrence	Unlikely	Intermediate	Medium
Bad Weather Occurrence	Unlikely	Intermediate	Medium
Vintage Vessel with Poor Navigational Equipment	Unlikely	Intermediate	Medium
Pilot Incapacitated	Probable	Negligible	Medium
Assist Tug Failure	Probable	Negligible	Medium
Tug/Barge Delays due to Visibility – Occurrence	Unlikely	Minor	Medium
Larger Log Boom	Unlikely	Negligible	Low

Appendix A

Pilotage Risk Management Methodology (PRMM)

Methodology Overview

Methodology Developed by Transport Canada in Cooperation with the Four Canadian Pilotage Authorities

A. Introduction

The Pilotage Risk Management Methodology is divided into three Modules:

- ❑ Project Initiation
- ❑ Risk Assessment
- ❑ Action

The first two modules are dealt with in this report. The Action Module can only be undertaken once the decisions have been made.

B. Module I – Project Initiation

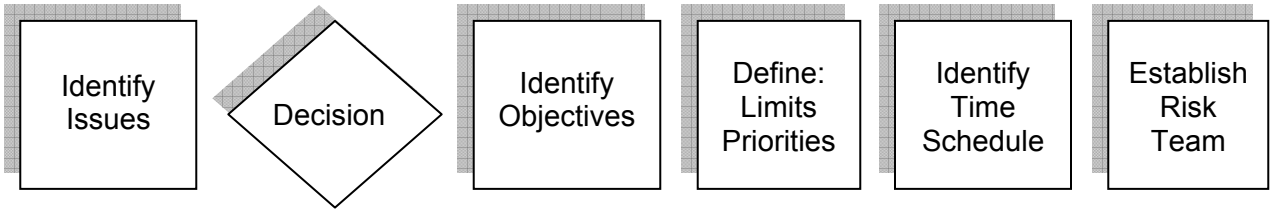
This Module sets the stage for the PRMM risk assessment process. The stated purpose of this module is to:

- ❑ Clearly identify the issues to be addressed and the nature and scope of the decision to be made.

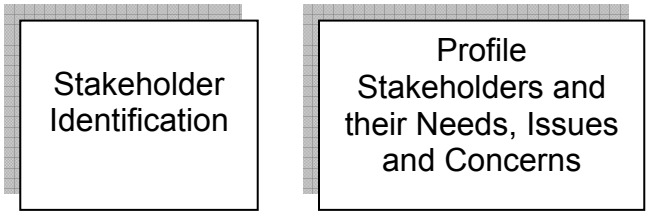
- ❑ Identify stakeholders and their needs, issues and concerns (NICs)

The following Exhibit illustrates the steps that are included in this module.

Nature and Scope of Decision



Stakeholder Analysis



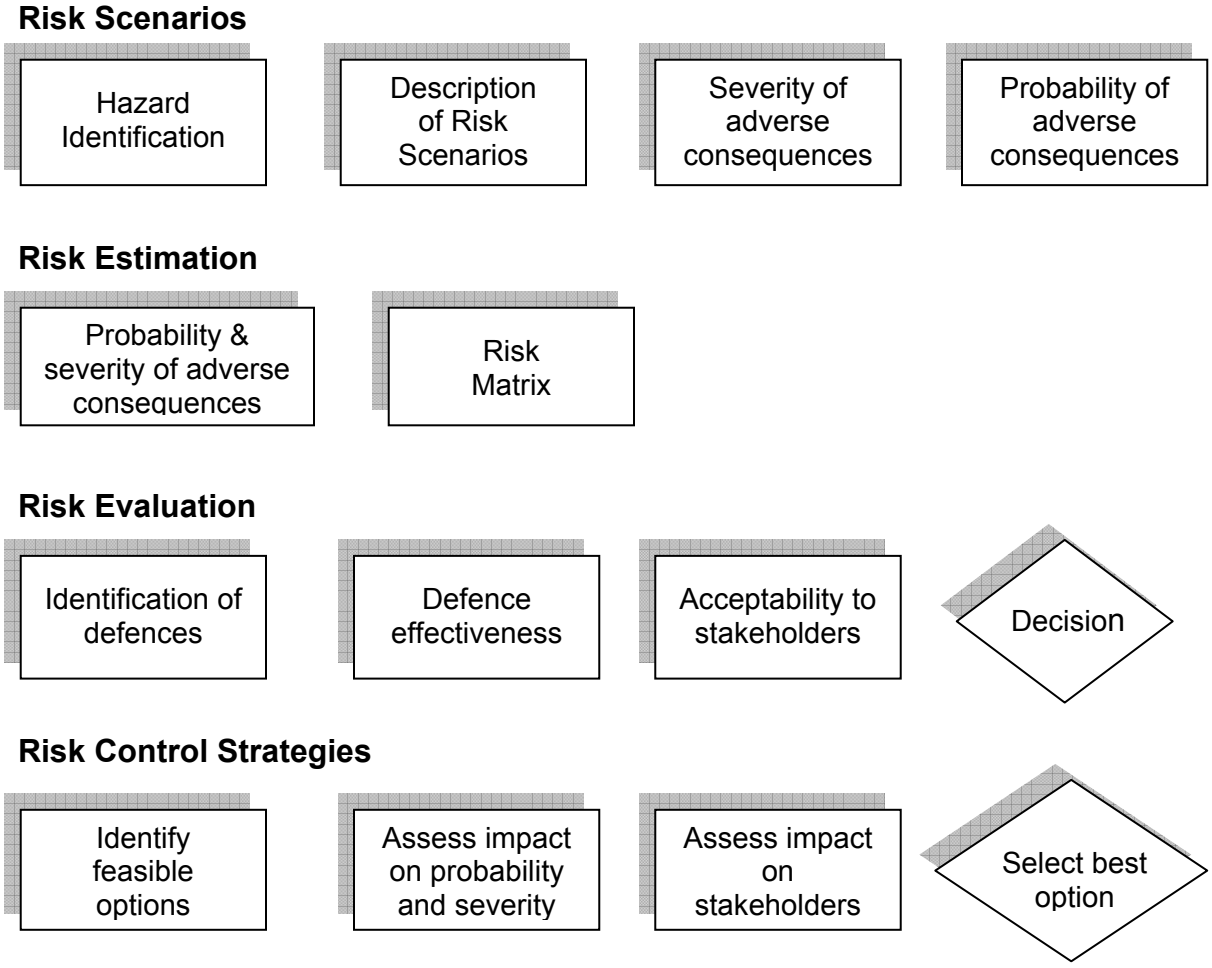
The nature and scope of the decision is determined in consultation with key stakeholders. The stakeholder analysis is based on the research and on information provided by the stakeholders.

C. Module II – Risk Assessment

The **Risk Assessment Module** is the heart of the PRMM process. The purpose of this module is to:

- ❑ Develop risk scenarios with respect to identified hazards
- ❑ Assign a level of risk to each adverse consequence
- ❑ Evaluate current defences and their ability to reduce the risk to an acceptable level
- ❑ Identify the best risk control option

The following chart illustrates the steps in the risk assessment process.



Much of the work in Module II is performed by the Risk Management Team.

D. Risk Definitions

Risk is the combination of the probability of an event occurring along with the potential severity of the event. The following definitions have been used to evaluate the risk inherent in the agreed scenarios.

Probability of Adverse Consequences

- **Highly Probable** – Almost certain that the event will occur with some frequency.
- **Probable** – Event likely to occur at least once.
- **Unlikely** – Event might occur.
- **Improbable** – Event not likely to occur.

Severity of Adverse Consequences

- **Catastrophic** – Multiple deaths, extreme property damage, loss of vessel.
- **Major** – Death, multiple major injuries, significant damage.
- **Intermediate** – Damage and/or injuries that prevent the vessel from proceeding on its voyage.
- **Minor** – Some damage to the vessel and/or minor injuries to personnel. Vessel is able to proceed on its voyage.
- **Negligible** – Little or no property damage. No injuries to personnel.

E. Risk Matrix

The probability and severity estimates are plotted on a Risk Matrix. The intersection of the two factors is the overall scenario risk.

Ultimately, the level of acceptable risk is a decision that must be made by the VFPA and the other stakeholders. Risk can never be eliminated but action can often be taken to mitigate the risk levels.

There would need to be exceptional circumstances before accepting extreme or high risk actions. However, medium risk may be acceptable as will low risk activities.

The risk matrix is set out on the following page.

Severity of Adverse Consequences	Probability of Adverse Consequences			
	Highly Probable	**Probable**	**Unlikely**	**Improbable**
Catastrophic	Extreme	High	Medium	Medium
Major	High	High	Medium	Low
Intermediate	Medium	Medium	Medium	Low
Minor	Medium	Medium	Medium	Low
Negligible	Low	Low	Low	Low

Appendix B

Risk Team Recommendations

(Agreed by the Risk Team in January 2007)

Recommendations Summarized by David Batchlor

RECOMMENDATIONS "A"

The recommendations are as follows:

10. **6.3.1 Definitions**

Amend the definition for a Deep Sea Vessel to read *"Deep-sea vessel means any vessel requiring a pilot in accordance with Section 9 of the Pacific Pilotage Regulations - Ships Subject to Compulsory Pilotage."*

11. **6.6.2 Transit Priority**

Suggest that priorities of different types of vessels be changed as follows:

(a) deep sea vessels carrying dangerous goods
(b) all other deep sea vessels
(c) vessels with tows and small craft carrying dangerous goods
(d) all other small craft

12. **6.7.2 Clear Narrows**

Amend by adding the words *"Light tugs are permitted to transit through the bridges during a clear narrows condition providing a ship to ship agreement has been reached with the vessel(s) for which the clear narrows has been announced."*

13. **6.7.5 Visibility**

Deep Sea Vessels Transiting through the MRA. Amend to read: *"Any exclusion to the current visibility restrictions will require the approval of the Harbour Master."*

Deep Sea Vessels moving within the MRA and Under the Bridges. Remove the words "from or" in the last line of this section.

14. **6.7.6 Vessel Size Limitations**

Remove the sentence: "There will be no exceptions to the foregoing."

Remove the sentence: "Vessels loading to the maximum draft of 12.5 metres (41 ft).shall be trimmed at least 15 cm (6 in) by the stern before leaving the berth."

Add new section: *"VESSEL TRIM"*

Add new wording under section on VESSEL TRIM: *"No Vessels passing under 2nd Narrows Bridge shall be trimmed by the head. Any exceptions to this requirement will require the approval of the Harbour Master."*

15. **6.9.2 Tugs and Tows without attendant tugs**

Change the word "shall" to *"may".*

16. **6.9.3 Priority**

Delete. This would be redundant in light of the changes made to 6.6.2.

17. **6.9.5 Separation**

Remove this section in entirety.

18. **6.9.6(1) Additional tug requirements**

Amend to read;

(1) when transiting the MRA where such raft contains more than 20 sections or is longer than 10 sections.

12. **6.6.1 Transit windows**

Insert a new paragraph in this section titled ***"Tugs and barges specifically designed for pushing and ASD tugs towing alongside."***

"Tugs and barges specifically designed for pushing and ASD tugs towing alongside, may transit with a barge 6500 to 10,000 tonnes in either direction with current up to 3 knots with the required assist tugs. Barges over 6500 tonnes displacement being towed will be restricted in the same manner as a deep-sea vessel."

13. **6.7.5. Visibility**

Recommended wording changes:

"(i) During periods of reduced or zero visibility, a small craft carrying dangerous goods and/or a pollutant cargo, or a tug towing or pushing a barge of up to 6500 tonnes displacement carrying dangerous goods and /or a pollutant cargo may

a) transit through the 2nd Narrows MRA and
b) berth or unberth within the 2nd narrows MRA providing the following criteria are met.

i) An escort tug in accordance with Appendix A, and

ii) have on board an operational ECDIS or a precision electronic Chart Plotter, and
iii) two operational Radars, and
iv) the movement within the MRA is at or near slack water (2nd narrows).
v) the Harbour Master may pre-approve a vessel for transit.

(ii) Pusher tug/barge combinations between 6500 tonnes and 10,000 tonnes may request special clearance from the Harbour Master during periods of reduced or zero visibility. When considering such requests the Harbour Master shall take into account experience and local knowledge of the tugs crew, and the vessel's navigational equipment.

(iii) If this is added then 6.7.5 should be amended by adding the words "or proceed to or from a berth within the MRA area." And the "small craft carrying Dangerous goods" wording should be removed from 6.7.5."

14. **Appendix B**

Delete in entirety.

RECOMMENDATIONS "B"

The following recommendations will be affected by the proposed 2nd Narrows Tug Escort Study as referenced earlier. The recommendations remain as important as all others proposed and will form part of the final submission.

1. **6.8.2 Deep Sea Vessels**

   Appendix A to be reviewed and updated utilizing empirical data that is reflective of current standards and tug availability. Remove reference to self-propelled barges.

2. **6.10.1 Draft**

   Recommendation – Amend Table 6.1 to include the following:

   "Vessels with a draft equal to or greater than 12.5m will require a minimum tidal height of 4.27m (14ft) and an under keel clearance of 10% of the maximum draft."

3. **6.10.2 Loaded Crude Oil Tankers of 40,000 mt Summer DWT or greater**

   This section to be removed and included in Appendix A under a separate section on "Tankers".

4. **6.10.3 Tug Escort through Harbour**

   Incorporate this in the tug study.

5. **6.10.4 Night Time Restrictions**

   Amend to read

   "Loaded tanker transits of Second Narrows MRA are restricted to daylight only when the length overall exceeds 185 metres.

   Ballasted inerted tankers proceeding inbound are permitted to transit through the MRA at night provided the tug requirements as specified in Appendix B are satisfied.

   Tankers between 180 m and 185 m arriving in Vancouver for the first time will be required to do one round trip in daylight. If the vessel maneuverability is found to be satisfactory by the pilots it will be allowed night-time transits."

Appendix C

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (MRA) in Vancouver Harbour (1998 – 2008)

Data Provided by the Federal Transportation Safety Board (TSB)

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	Oct 07/98	June 18/99	Jul. 15/99
Incident Type	Girding & Flooding	Grounding	Striking
Occurrence Location	Off Lynn Terminals	Vancouver Harbour .6 Nautical Miles East of the 2nd Narrows Bridge	Lynnterm #4
Vessel	**Evco Crest**	**Empire 45**	**Cherry Galaxy**
Vessel Type	Tug	Barge	Tanker - Chemical
GRT	56.0	1757.5	12,044
Length	15.1m	67.0m	141.5m
Vessel Phase	Underway - Towing	Underway – Being towed	Unbearthing-Leaving
Weather	Not Known	Clear	Clear
Sea State	Calm/Smooth	Calm/Smooth	Calm/Smooth
Description	While towing a loaded gravel barge off Lynn Terminals, the tug girded and took on water. Tow abort station out of reach. Tug resurfaced when tow line broke. Vessel pumped out. Proceeded under own power to Coal Harbour.	The westbound barge, under tow of the tug Guardian III, struck a channel beacon and grounded. Barge was refloated, inspected and the voyage resumed.	Upon departure from Lynnterm #4, the port quarter of the tanker made contact with the dock. Vessel sustained punctures to shell plating in way of engine room, above the waterline.
Injuries	No injuries		
Damage	Considerable damage	Scratch/Scuff	Holed

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	Jan 19/00	Sept 24/00	Aug 23/01
Incident Type	Fire	Sinking	Accident aboard ship
Occurrence Location	Lynn Creek, Burrard Inlet	Second Narrows, East Harbour	Seaboard #3, Vancouver Harbour
Vessel	**Fraser Warrior**	**Unnamed**	**Leo Forest**
Vessel Type	Tug	Rental Boat	Bulk Carrier
GRT	15.0	N/A	19,731
Length	10.0m	5.0m	176.0m
Vessel Phase	Moored to Piles	Underway – Moving Ahead	Berthed Alongside
Weather	Clear	Clear	Clear
Sea State	Not Known	Calm/Smooth	Calm/Smooth
Description	While moored unattended at the head of Lynn Creek, the tug caught fire. Commercial tugs, fire department and fire boat extinguished the fire.	Unnamed pleasure boat was reported submerged – sinking from intake below the water line. Recovered by passing vessel and towed to Allied Shipyards	A Stevedore was crushed between two logs during loading operations on the Bulk Carrier.
Injuries	No injuries		Serious Injuries
Damage	Considerable damage	Not Known	Holed

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	Dec. 02/03	Apr. 25/04	Sept 22/04
Incident Type	Engine Trouble	Capsize	Machinery Failure
Occurrence Location	Berry Point, Burrard Inlet	Vancouver Harbour near Second Narrows Bridge	Lynnterm #4
Vessel	**Abitibi**	**Unnamed**	**Island Defender**
Vessel Type	Passenger	Rental Boat	Tug
GRT	508.0		119.8
Length	42.4m		21.0m
Vessel Phase	Underway – Moving Ahead	Underway – Moving Ahead	Underway - Towing
Weather	Clear	Clear	Overcast
Sea State	Moderate	Calm/Smooth	Calm/Smooth
Description	The Charter Vessel Abitibi reported engine trouble and was in danger of grounding near Berry Point	A small open rental boat capsized with three persons on board.	The tug, while towing the barge ITB-2, reported a loss of power and was in danger of grounding.
Injuries	No injuries	Not Known	
Damage	Considerable damage	Extensive	Not Known

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	Apr. 23/05	Sept. 15/05	Jan. 13/06
Incident Type	Near Collision	Fire	Near Contact
Occurrence Location	Second Narrows	Vancouver Harbour	Nexen, North Vancouver
Vessel	**Swift Fortune**	**Raven Arrow**	**Isla De Cedros**
Vessel Type	Bulk Carrier	Bulk Carrier	Bulk Carrier
GRT	40,512	25,063	34,433
Length	234.8	182.0	222.1m
Vessel Phase	Underway – Moving Ahead	Anchored	Unberthing - Leaving
Weather	Not Known	Not Known	Overcast
Sea State	Calm/Smooth	Not Known	Rippled
Description	The Bulk Carrier reported a close quarters situation with the S/V Gone Wild in Second Narrows.	The freighter reported a fire in the hatch while carrying out hot work in Vancouver Harbour.	The bulk carrier, while shifting from berth to an anchorage, was at risk of collision with the Second Narrows Rail Bridge in North Vancouver.
Injuries	No injuries		
Damage	No Damage	Minor	

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	May 6/06	Jan. 7/07	June 22/07
Incident Type	Struck by another vessel	Person Falling Overboard	Striking Another Vessel
Occurrence Location	Near Vancouver Wharves	Second Narrows Bridge	Lynnterm West
Vessel	**Evco No. 91**	**Tymac 22**	**Tiger Shark 2**
Vessel Type	Barge	Tug	Tug
GRT	2183.7		9.7
Length	82.9m		15.0m
Vessel Phase	Underway – Being Towed	Underway – Towing	Underway – Moving Ahead
Weather	Clear	Clear	Overcast
Sea State	Calm/Smooth	Moderate to Rough	Calm/Smooth
Description	The tug Evco Crest with Barge Evco No. 91 in tow was struck by barge while shortening its towline near Vancouver Wharves.	The tug Tymac 22, while towing a loaded gravel barge, reported a man fell overboard near Second Narrows Bridge	The Tug struck the cargo carrier Star Hansa which was moored alongside #1 berth Lynnterm West. The Star Hansa suffered propeller damage and delays.
Injuries		Not Known	
Damage	Not Known	None Apparent	Some

Reportable Marine Incidents in the Second Narrows Movement Restricted Area (1998 – 2008)

Date	Dec. 16/07	Mar. 9/08
Incident Type	Grounding	Broken Tow & Struck Quay or other fixed object.
Occurrence Location	Vancouver Harbour	Second Narrows Bridge
Vessel	**Tymac No. 7**	**W.E. Ricker**
Vessel Type	Launch	Research Vessel
GRT	4.0	1,104.5
Length	9.1m	54.4
Vessel Phase	Underway – Moving Ahead	Underway – Being Towed
Weather	Rain	Overcast
Sea State	Not Known	Calm/Smooth
Description	The Water Taxi Tymac No. 7 reported running aground in Vancouver Harbour. The vessel was safely refloated.	The CCGS vessel W.E. Ricker was under tow by tugs Charles H. Cates VI and Charles H. Cates VIII from Allied Shipyards for sea trials when it struck the Northwest Protection pier of the Second Narrows Rail Bridge
Injuries		
Damage	Some	Dent

Appendix D

Proposed Tractor Tug Performance

Certification Protocol

Developed by Captain Gregory Brooks of Towing Solutions Inc.

Proposed Tractor Tug Performance Certification Protocol

All tractor tugs employed in escorting operations in 2nd Narrows must have their escorting performance at six knots proven and documented.

To simplify this process and to minimize the costs involved in estimating each tractor's ability to assist a ship in distress, the tractor's performance will be estimated as a percentage of its rated bollard pull based on its ability to quickly attain the desired working position. Therefore, all tractor tugs employed in escorting operations must have their "Time to the Working Position" recorded and documented by the British Columbia Pilots. This "Time to the Working Position" is defined as the time it takes for the tractor, working with a 30 meter towline, to move from an "Inline, Slack Line" position to the "90º" working position to the side of the ship.

For consistency, the BC Pilots will nominate two pilots each year to perform this certification work. This validation would be accomplished during a normal harbour passage after the tug owner has received permission from the ship master prior to arrival or sailing, and arranged for the designated BC pilot to be on board.

Ideally, using a large ship with good rudder control, and when it is appropriate considering other traffic in the area the pilot will time the tug from the "at rest" position astern of the ship to when it reaches its maximum working angle to the centerline of the ship. To prevent overly affecting the ship during this manoeuvre, the tug should apply the minimum amount of force on the towline necessary to attain the desired position as quickly as possible. During the manoeuvre the pilot should use the ship's rudder to oppose the tug and attempt to maintain his desired course.

Rating System

a Tractors that can perform the "Powered Indirect" manoeuvre at the desired six knot transit speed will be classed as "Tier 1 Escorts" and credited with 105% of their rated ahead bollard pull.

b Tractors that cannot perform the "Powered Indirect" manoeuvre but can obtain a near 90º position to the centerline of the ship within 30 seconds at the six knot transit speed would be classed as "Tier 2 Escorts" and credited with 100% of their rated astern bollard pull for escorting.

c Tractors that can attain an angle greater than 60º angle within the 30 second time allowance would be classed as "Tier 3 Escorts" and credited with 75% of their rated astern bollard pull.

d Tractors that cannot attain a minimum working angle of 60° within this time allowance would be classed as "Tier 4 Escorts" and only credited with only 50% of their rated astern bollard pull.