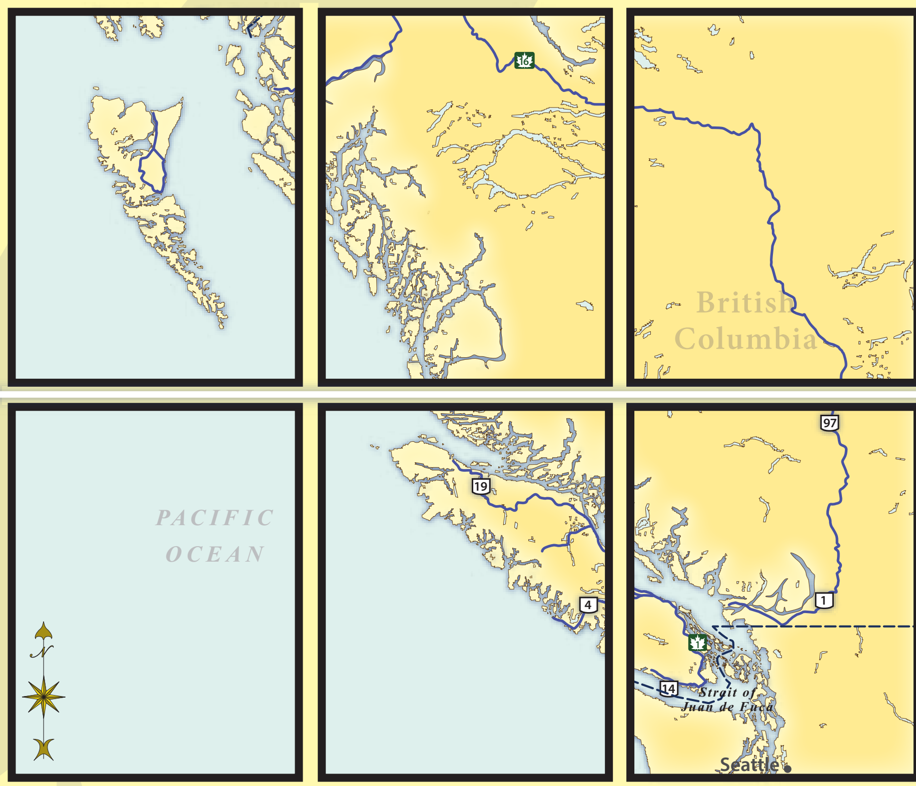
British Columbia Ministry of Environment

WEST COAST
Spill Response Study

VOLUME 3: World-Class Oil Spill Prevention, Preparedness, Response & Recovery System



July 19, 2013

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NOTE: The West Coast Spill Response Study is intended to provide a high level overview of key issues of interest to the BC Ministry of Environment. It was completed on a short timetable, with the first volume finished in March 2013 and Volumes 2 and 3 in July 2013, even as the context continued to evolve. Nuka Research appreciates the input provided by the Ministry and other agencies following a short review period. The incorporation of this input, all analysis, commentary, opinion, omissions, and/or errors, belong to Nuka Research as the author.

EXECUTIVE SUMMARY

The British Columbia Ministry of Environment commissioned Nuka Research and Planning Group, LLC, to prepare this report. The report is the third volume of the three-volume West Coast Spill Response Study. Volume 1 described the current marine spill prevention and response system and Volume 2 characterized vessel traffic on the coast and anticipated future changes. Volume 3 describes one vision of the key features of a world-class system, provides examples where these features are implemented, and suggests opportunities to enhance the system on the west coast of Canada.

This report presents a high-level overview of the features of a world-class system with recommendations and considerations for areas of enhancement. It does not constitute a risk assessment, nor does it seek to define what an acceptable level of risk is, or should be, for the people and resources of BC.

At the same time that all parties should strive for excellence in designing and implementing a marine spill prevention and response system, it is important to acknowledge that: (1) spills can still happen even with the best possible prevention and safety measures in place, and (2) even the best possible spill response system cannot guarantee that resources-at-risk will be protected from negative impacts if a spill occurs.

Defining "world-class"

There will be many visions of what a "world-class" system entails, and almost as many ways to assess them. In presenting a vision of a world-class system, the authors reviewed existing standards and assessment tools, which typically focus on either spill prevention (vessel safety) or spill response (including planning and preparation for a spill response). Based on this review, we identified 11 key features of a world-class prevention and response system. These features are categorized into three groups: prevention (related to safe vessel operations and the availability of rescue and salvage resources), preparedness and response (including both planning and the personnel and resources needed to mount an effective response and recovery), and the overall system (including governance, the pursuit of continuous improvement, and funding). Table 1, below, summarizes the 11 features used in this report.

Table 1. Key features of a world-class marine spill prevention and response system

PREVENTION ELEMENTS
1. Vessel operations surpass international safety and spill prevention standards
2. Vessel traffic is monitored and, in higher-risk areas, actively managed to prevent accidents
3. Rescue and salvage resources can be on-scene quickly enough to be effective after an incident or spill

PREPAREDNESS AND RESPONSE ELEMENTS
4. Geographic areas are prioritized for protection from oil spills
5. Contingency planning is comprehensive, integrated, and well understood by all relevant parties
6. Sufficient equipment can be deployed quickly to respond to a worst-case spill
7. Sufficient personnel are available to respond to a worst-case spill
8. A process is in place to restore damaged resources and to promote ecosystem recovery after a spill
SYSTEM ELEMENTS
9. Government ensures compliance and transparency
10. All parties actively pursue continuous improvement through research and development and the testing of planning assumptions
11. Financial mechanisms and resources meet needs from initiating the response through recovery

For each of the 11 features and their associated sub-items, Nuka Research provides a brief description, one or more examples of where the feature is being implemented currently, and some general recommendations for related areas of improvement on the west coast of Canada. The recommendations are provided in the spirit of identifying opportunities for improvement. Ultimately, a shared vision must be created for what a future system will look like: it may be based on these features, other sets of recommendations developed for the west coast of Canada, or another comprehensive methodology for assessing a spill prevention and response regime. Regardless of the assessment tool, what is most important is to have a mechanism to continually evaluate, compare against either past performance or desired future outcomes, adjust the system, and ultimately progress toward some defined state.

A summary of the authors' assessment of each of these features in BC is presented in Section 6.

Opportunities to enhance the current system

Driven primarily through federal mandates and port-specific planning, the west coast of Canada currently benefits from several marine oil spill prevention, preparedness, and response-related initiatives. In addition to holding this system up against the 11 elements listed above, the authors offer several overarching recommendations and considerations informed by the research conducted to develop this three-volume study:

- **A world-class system cannot be created overnight, but there are tangible improvements on the current system that can be started today.** Achieving world-class distinction is not the result of a one-time success, but rather of a continuous effort. Even though improving the system will take time, this is not a reason to delay action on the items that can be implemented with relatively few resources such as improving transparency, developing geographic response plans, and starting to build a shared vision for the future.

- **A shared vision and plan of action will rely on better transparency and information sharing, integration of efforts, and a layered approach that depends on local efforts as part of a larger whole.** At the most basic level, a shared vision and goals cannot be achieved unless there is a shared understanding of the current system and how it should be enhanced. The authors benefitted from the willingness of many agency officials to provide information about their efforts and programs, but many key documents and pieces of information were not accessible to us, or to the Ministry of Environment. There are opportunities to leverage the work of existing collaborative organizations like the Pacific States/British Columbia Oil Spill Task Force, and there may be benefits to creating new forums for coordination and communication.

- **Self-awareness is key to creating a world-class system.** While oil spills happen infrequently, the response phase often leaves the public with frustration and concern that "more could have been done" to prevent, prepare for, or respond to a spill. It is the shared responsibility of all key players to honestly examine both the strengths and weaknesses of existing systems, and to ensure that the public understands what can and cannot be done in the context of marine oil spills.

In developing this study, we have reviewed and synthesized a great deal of information, and mined our collective experience as oil spill professionals, contingency planners, and data analysts. We were struck by the observation that most of the major progress that has been made in oil spill prevention, preparedness and response, in North America and worldwide, has been catalyzed by a major oil spill. The initiative of the BC government and the complementary initiatives of federal agencies to achieve improvements to western Canada's marine oil spill regime ahead of a major incident is the critical first step along the path to a world-class system.

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WEST COAST OIL SPILL RESPONSE STUDY, VOLUME 3:

World-class Oil Spill Prevention, Preparedness, Response & Recovery System

REPORT TO *British Columbia Ministry of Environment*

July 19, 2013

1. INTRODUCTION

This report was developed by Nuka Research and Planning Group, LLC, (Nuka Research) for the British Columbia (BC) Ministry of Environment (Ministry). It presents one approach to considering what “world-class” prevention, preparedness, response, and recovery could look like for marine oil spills on the west coast of Canada.

1.1 Purpose

As the volume of shipping on Canada’s west coast has increased, and with several major marine transportation projects proposed for British Columbia (BC) ports, the BC government has a strong interest in understanding the risks associated with increased shipping and ensuring a world class marine oil spill prevention, preparedness, and response regime is in place. The Ministry commissioned Nuka Research to conduct three complementary reports to inform their efforts:

- **Volume 1:** An assessment of the existing spill prevention and response regime in place for the west coast of Canada;
- **Volume 2:** A vessel traffic analysis that assesses the current and projected levels of shipping on the west coast of Canada; and
- **Volume 3:** A recommendation regarding the elements of a world-class oil spill prevention, preparedness, and response system commensurate with present and future oil spill risks from marine vessels.

The three volumes together form the West Coast Oil Spill Response Study. The purpose of Volume 3 is to describe one vision of the key features of a world-class oil spill prevention, preparedness, and response system, provide examples where these features are implemented, and suggest opportunities for enhancements on the west coast of Canada.

At the same time that all parties should strive for excellence in designing and implementing a world-class system, it is important to acknowledge that:

- Spills can still happen **even with the best possible prevention and safety measures** in place, and
- Even the best possible spill response system **cannot guarantee that environmental and other resources will be protected** from negative impacts if a spill occurs.

1.2 Scope

This report focuses on world-class capacity to prevent, respond to, and clean up vessel spills in marine waters on Canada's west coast. Spills may be of any substance onboard a vessel, whether it be fuel or cargo. We refer broadly to oil spills in the text, noting that one of the characteristics of a world-class system would be that the equipment is the best available to respond to a spill of any substance. (See Volume 2 for a characterization of vessel traffic in the area, including the types and quantities of fuel onboard.)

This report presents a high level overview of the features of a world-class system with recommendations and considerations for areas of enhancement. It does not constitute a risk assessment, nor does it seek to define what an acceptable level of risk is, or should be, for the people and resources of BC.

The analysis and recommendations are presented in the context of the west coast of Canada, including the applicable policies; agencies, organizations, and companies; equipment resources; geography; and environmental conditions. We do not presume to provide recommendations for other parts of Canada or for other nations.

1.3 Report organization and contents

Following the introduction in Section 1, Section 2 describes some of the ways to evaluate oil spill response preparedness and outlines the approach we chose for this study. Sections 3-5 recommend steps to fill gaps between the current regime and a world-class system by considering the current context in BC as compared to the vision we have described of a "world-class" system. It also highlights areas where new or expanded measures may be needed in light of the anticipated increases in vessel traffic described in Volume 2. Section 6 provides a summary of the opportunities we identify in a series of three tables. Section 7 concludes with summary observations and considerations.

2. APPROACH

There are many visions of what a world-class system entails, and almost as many ways of assessing them. This section references some existing models and describes the approach taken for the purpose of this study.

2.1 Assessing a spill prevention and response system

Several assessment tools, guidance documents, and standards have been developed for oil spill prevention or response preparedness. While most of these are not comprehensive (they tend to focus on either prevention or response preparedness), they are useful tools that have informed our own analysis and could be used to further inform system improvements on the west coast. They can be considered in the following general categories:

2.1.1 Standards for vessel safety and safe navigation

Industry and government have developed best practices for vessel safety with varying levels of rigor and oversight. Some were developed specifically to prevent or mitigate oil spills, while others could reduce spills by avoiding accidents. These include such things as the Ship Inspection Report Programme (SIRE) of the Oil Companies International Marine Forum[1] and the American Waterways Operators' Responsible Carrier Program.[2] They typically do not address spill preparedness or response.

2.1.2 Best practices and checklists for preparedness and response

Several tools and checklists have been developed to share best practices for spill preparedness. For example, I-TAC, the Industry Technical Advisory Committee for Oil Spill Response, has created a Pollution Response Equipment Checklist.[3] The Helsinki Commission, a collaborative effort of the countries around the Baltic Sea, has developed recommendations for many aspects of spill preparedness and response (as well as other environmental protection measures).[4] Alaska Clean Seas, the response organization serving Alaska's North Slope, has a Response Readiness Scorecard within its organization to assess its own effectiveness and efficiency of operations, reliability of reporting, and compliance with applicable laws and regulations (Linderman, 2008). The United States Coast Guard uses a Preparedness Standard and Measurement System (PSAMS) to assess its internal readiness, both across the agency and within specific divisions according to a set of key success factors (Weber et al., 2001).[5]

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[1] See: http://www.ocimf.com/SIRE/introduction

[2] See: http://www.americanwaterways.com/commitment_safety/

[3] See: http://www.industry-tac.org/technical_documents/documents/techdoc-equipment_readiness_checklist.pdf

[4] The Helsinki Commission also has guidance on navigation in ice; recommendations can be found at: http://www.helcom.fi/Recommendations/en_GB/valid/

[5] The Pacific States/BC Oil Spill Task Force also prepared a recommended checklist of contingency planning items in 2003. It is available at: http://www.oilspilltaskforce.org/docs/cplanelements.pdf

2.1.3 Evaluation of overall preparedness and response systems

A few tools have been developed to guide efforts to build oil spill response preparedness in developing countries following the International Convention on Oil Spill Preparedness, Response and Co-operation.

The Regional Association of Oil, Gas, and Biofuels Sector Companies in Latin America and the Caribbean (ARPEL) Oil Spill Response Planning and Readiness Assessment tool was created through a cooperative process (Taylor et al., 2008). Specific assessment tools were developed for different scopes of activity – from government at three different levels (local, area, national) to industry operations or facilities. The tool allows a single entity to track its status and progress in spill preparedness, and to compare jurisdictions or operators. The ARPEL assessment tool applies a checklist of 28 elements considered fundamental for comprehensive spill response planning and preparedness across three phases: planning (compliance, risk assessment, and strategy), implementation (resource acquisition, training, and testing competency), and sustained readiness (maintenance, monitoring, and improvement). Three overarching aspects of the system are also identified: management, operations, and evaluation (Taylor et al., 2008).

Additionally, a researcher in the United Kingdom developed a methodology to assess countries' preparedness in North America and Europe across three broad categories: legislation, contingency planning, and response performance. Scores are awarded for efficacy, efficiency, and ethics. Veiga (2004) concludes that the three most important ways to ensure a meaningful national preparedness scheme are the implementation of risk management strategies, sustainable financing, and industry participation.

2.2 Features of a world-class system for this study

Envisioning a world-class marine oil spill prevention, preparedness, and response system requires identifying the features of such a system and tailoring their implementation to a specific area. We identified 11 features (see Figure 2.1) that we believe to be critical to a world-class prevention and response system, based on our experience, literature review (including but not limited to the approaches described above), and select interviews. The elements related to prevention focus on the vessel and its operations; other factors, such as navigational aids and charts, are also important to safe operations but not addressed here.

Sections 3-5 of this report discuss these 11 features in greater detail, providing examples from other jurisdictions and identifying opportunities for enhancements to the system in BC. While this approach does not prescribe a specific course of action, it is intended to inform the development of a shared vision for the BC coast. This shared vision should also consider the recommendations that have come before this report and the views of different agencies, municipalities, First Nations, and organizations. Implementation will ultimately require work plans with specific milestones, timelines, and tasking.

The examples are not exhaustive. We also highlight examples from the United States, especially the US states on the west coast of North America, to emphasize opportunities to harmonize approaches where deemed appropriate.

In a 2004 study, Veiga proposes US contingency planning as a model for other countries, though she notes that, at the time, several weaknesses remained: a slow process for the approval of non-traditional response methods, postponing an oil spill-risk assessment, and dwindling funding for research and development. The latter two points were attributed to a shift in government focus after the September 11, 2001, attacks, but both are now areas of ongoing effort in the US following the Deepwater Horizon well blowout. Veiga ranks Canada's approach second in her assessment, ahead of the UK, France, Spain, and Portugal, though acknowledges that the spill response standard could arguably be increased. She adds her perspective that, at the time, the Canadian Coast Guard had "not been able to establish a strong leadership," authorities had not assessed the effectiveness of regulations, and the national contingency plan relied heavily on private response plans. The US and Canada held the first and second positions in her assessment of oil pollution legislation. Canada's performance in oil spill response was not ranked because there has not been a major marine oil spill in Canada. (Veiga, 2004)

A formal risk assessment that combines the views and experiences of key stakeholders with engineering and statistical analysis would be useful to inform the prioritization of these features for implementation in BC. (See, for example, TRB, 2008.)

Features of a World-Class Marine Spill Prevention and Response System

PREVENTION ELEMENTS

1. **Vessel operations surpass international safety and spill prevention standards**
   - Vessels meet or surpass international requirements
   - Vessels operate within a corporate safety culture that goes beyond compliance
2. **Vessel traffic is monitored and, in higher risk areas, actively managed to prevent accidents**
   - Vessel movement data is compiled and archived for analysis
   - Vessel traffic is actively managed in high-risk areas
   - Marine pilots are required for large vessels transiting certain waterways
   - Escort vessels accompany certain vessels in high-risk operating areas
3. **Rescue and salvage resources are able to be on-scene quickly enough to be effective in the event of an incident or spill**
   - Emergency towing resources are available for rapid deployment
   - Marine firefighting resources are available for rapid deployment
   - Salvage resources are available for deployment as needed to be effective
   - Potential places of refuge are identified in advance

PREPAREDNESS & RESPONSE ELEMENTS

4. **Geographic areas are prioritized for protection from oil spills**
   - Marine and coastal resources are inventoried
   - A process is in place to prioritize areas for spill protection
   - Areas to be avoided are established as appropriate
   - Geographic response plans are developed as appropriate
5. **Contingency planning is comprehensive, integrated, and well understood by all relevant parties**
   - Planning is integrated across jurisdictions and sectors
   - Contingency plans address all major spill response functions
   - Response planning standards ensure sufficient response capacity to respond to a worst-case spill
   - Response operating limits are identified and mitigation measures established
   - Operational tactics are defined
6. **Sufficient equipment can be deployed quickly to respond to a worst-case spill**
   - Response inventories are up-to-date, accessible, and accurate; resources are tracked during a response
   - Response caches are strategically located, stocked, and maintained
   - Equipment is the best available for the operating environments, environmental conditions, and potential spilled substances
   - Logistical support is in place to support the response
   - Spills can be detected, tracked, and modeled as needed to perform the response
7. **Sufficient personnel are available to respond to a worst-case spill**
   - Trained responders are available to staff a significant, prolonged response
   - All responders and response managers use the same incident management system
   - Responders are well-trained and regularly exercised
   - Volunteers are managed to maximize their effectiveness
8. **A process is in place to restore damaged resources and promote ecosystem recovery after a spill**

SYSTEM ELEMENTS

9. **Government ensures compliance and transparency**
   - Government authorities review and audit industry contingency plans
   - Other stakeholders are actively engaged
   - Effective enforcement mechanisms are in place
10. **All parties actively pursue continuous improvement through research and development and the testing of planning assumptions**
    - A research and development program is in place
    - Planning assumptions are verified through drills and exercises, and plans are updated to reflect lessons learned
    - Incident reviews support continuous improvement
    - Data on spill causality and "near misses" are compiled, analyzed, and used to inform changes to systems
11. **Financial mechanisms and resources meet needs from initiating the response through recovery**
    - Sufficient funds are available from industry and/or government to fully implement planning, response, and recovery
    - Fair compensation is awarded for environmental, fiscal, and/or social impacts

Figure 2.1 Features of a world-class system used for this report

3. WORLD-CLASS PREVENTION ELEMENTS

3.1 Vessel operations surpass international safety and spill prevention standards

The International Maritime Organization (IMO) has established a wide range of baseline vessel safety standards to protect human life and the environment. These wide-ranging standards address factors like vessel design and construction (including double hulls for tankers), operating and emergency procedures, training, and human resource management. Whether implemented with the intent to protect human life or to reduce the incidence of spills to the environment, all maritime safety standards serve as the basis of spill prevention since an accident that does not happen is an oil spill that does not happen.

3.1.1 Vessels meet or surpass international requirements

IMO standards seek to establish a baseline level of vessel safety, which, in turn, supports spill prevention by reducing the incidence (through, for example, redundant steering) or severity (through, for example, double hulls for tankers) of marine accidents. Despite the establishment of international standards, there are still a significant number of vessels found to be substandard in Port State Control inspections.[6] Weak enforcement can therefore create an uneven playing field, if some "bad actors" avoid implementing prevention measures or paying their fair share into response systems (Ornitz and Champ, 2002).

EXAMPLES. The European Union (EU) has implemented several measures to ensure that the organizations certifying vessel construction, Port State Control Officers, and maritime education and training are adequate to EU standards[7] if vessels will be operating in the waters of EU member states. These include inspection trips to member states and non-EU countries to ensure that high standards are being upheld there as well. Under the European Maritime Safety Agency (EMSA), enforcement is tied closely to vessel monitoring through the SafeSeaNet program (EMSA, 2013).

OPPORTUNITY. As shown in Volume 2, foreign vessels visiting BC's ports are likely to be flagged to countries that are ranked fairly well by the Paris Memorandum of Understanding, one of the international bodies that tracks vessel inspections (to which Canada is a party). By participating fully in this international organization's efforts and ensuring that both foreign and Canadian-flagged vessels are rigorously and regularly inspected, Canada will do its part to ensure the safety of vessel traffic at least as far as vessel construction, maintenance, and on-board operations are concerned. The Port State Control program may need to be scaled up as vessel traffic increases.

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[6] In 2010, deficiencies were found in 40% of foreign vessels inspected in Canada (TC, 2011).

[7] Some EU standards related to air pollution and other environmental impacts of shipping are more stringent than international standards.

3.1.2 Vessels operate within a corporate safety culture that goes beyond compliance

Although there may be costs to implementing prevention measures, accidents avoided ultimately cost less than accidents that happen. Some operators recognize this and work to instill a "safety culture" in which continuous improvement is sought and prevention or safety measures implemented above and beyond mandated standards (Ornitz and Champ, 2002).

EXAMPLES. Government can incentivize companies to use standards that surpass compliance by offering recognition, as is done in the Washington Department of Ecology's voluntary standards for tank ships and barges,[8] or reduced port fees as Vancouver offers vessels that follow the Green Award program started in Rotterdam.[9]

The Pacific States/British Columbia Task Force established a project entitled "Best Industry Management and Operating Practices for Operators of Large Commercial Vessels and Tank Barges," which focused on developing management and operating standards "that are highly protective of the environment and achievable, to be voluntarily incorporated into tank vessel chartering policies" (Task Force, 2003).

OPPORTUNITY. The Port of Vancouver grants a 21% savings on harbor dues to vessels with Green Award certification calling at Burrard Inlet, Roberts Bank, and the Fraser River. This could be further explored to understand the results that the Port has achieved with this effort, and whether similar incentives should be offered at other west coast ports such as Prince Rupert, Kitimat, or Nanaimo. Additionally, Canada or BC could establish a recognition program that is harmonized with the one in Washington State or the standards developed by the Pacific States/BC Oil Spill Task Force.

[8] A set of 30 standards includes operating procedures, personnel policies, technology, and spill preparedness. Some standards are generic, such as those related to bridge management, while others are Washington-specific, such as the checklist for voyage planning that mentions high risk areas along the Washington coast (Washington Department of Ecology, 2009).

[9] The Green Award certification requires certain practices to be followed both onboard the vessel and in the ship management office. Practices relate both to the safety and navigation of the vessel as well as to other environmental impacts from shipping such as air emissions. For more information, see www.greenaward.org.

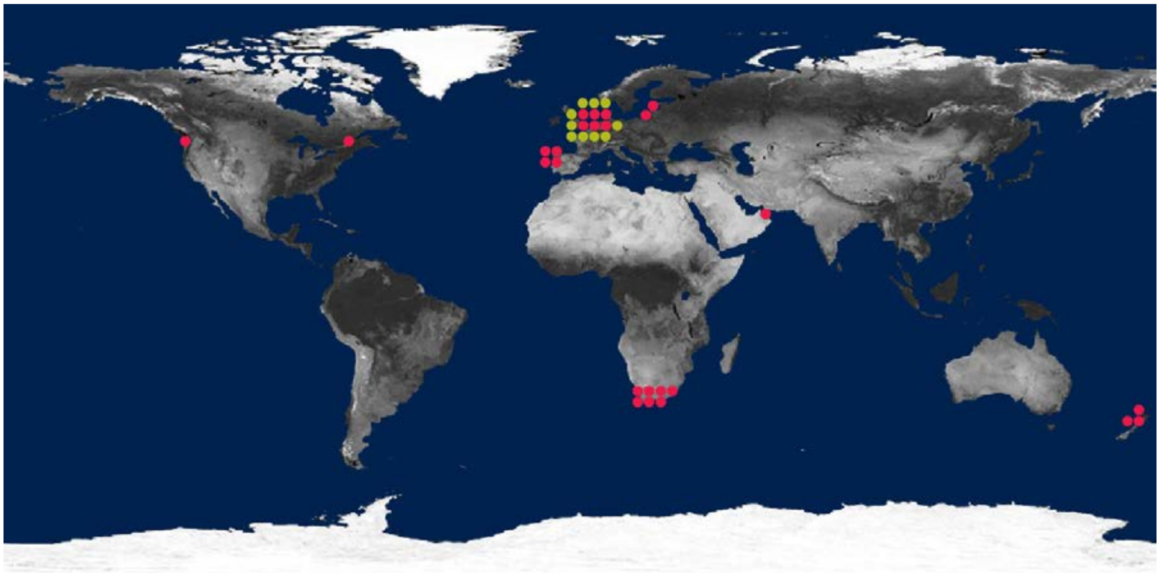

Figure 3.1 Map showing location of ports that provide incentives to vessels with Green Award Certificates based on voluntary ship safety and environmental standards (Retrieved from: http://www.greenaward.org/23-all-incentive-providers-(map).html)

3.2 Vessel traffic is monitored and, in higher risk areas, actively managed to prevent accidents

Analysis of real-time, historic, and forecasted vessel traffic patterns can highlight areas where additional safety precautions are warranted to offset increased risks. These precautions may include actively managing vessel traffic through mandated or voluntary routing or a traffic separation scheme. Knowing where vessels are and monitoring for any that may be traveling unsafely supports enforcement of mandatory vessel routing and can be used to alert a vessel if it is in danger of a collision, allision,[10] or grounding.

3.2.1 Vessel movement data is compiled and archived for analysis

Most large vessels are required to have Automated Identification System (AIS) transponders (IMO, 2002b), allowing their route, speed, and other information to be monitored real-time and recorded for subsequent analysis. While studies have shown general operator compliance with the international requirement for AIS tracking to be high (DNV & ERM-West, Inc., 2010), the reliability of AIS data is uneven in some respects, as discussed in Volume 2 of this study. For example, vessel characteristics such as the type and size of the vessel and the cargo carried are operator-entered and data quality varies.

Collection and analysis of vessel traffic data should be used to inform the continued evolution of risk mitigation measures and contingency planning that changes in vessel traffic patterns necessitate. The more accurate and reliable vessel movement databases are, the more valuable their analyses will be. In order for such analyses to be comprehensive, data on vessel type, direction, port, and, if available, cargo must be collected by a central source and compiled in a manner that is conducive to subsequent analyses. It is also important that

[10] An allision occurs when a vessel underway collides with a fixed object such as a bridge piling or dock.

all vessels with the potential to spill significant amounts of cargo or fuel are included in the tracking system; for example, barges are not required by international mandate to have AIS but this could be implemented voluntarily to improve the understanding and mitigation of spill risks from oil barges.

EXAMPLES. The Marine Exchange of Alaska[11] and Puget Sound Marine Exchange[12] both compile and archive AIS data for their respective areas. The data may be queried according to different parameters, such as tracklines, vessel types, or cumulative vessel visits to an area over a period of time, depending on the purpose of the analysis. This data can be combined with other information about vessels from global databases, and often needs to be to provide meaningful information about the type of vessels and their salient characteristics such as fuel or cargo capacity. This is discussed in Volume 2. (See also Subramanian, n.d.)

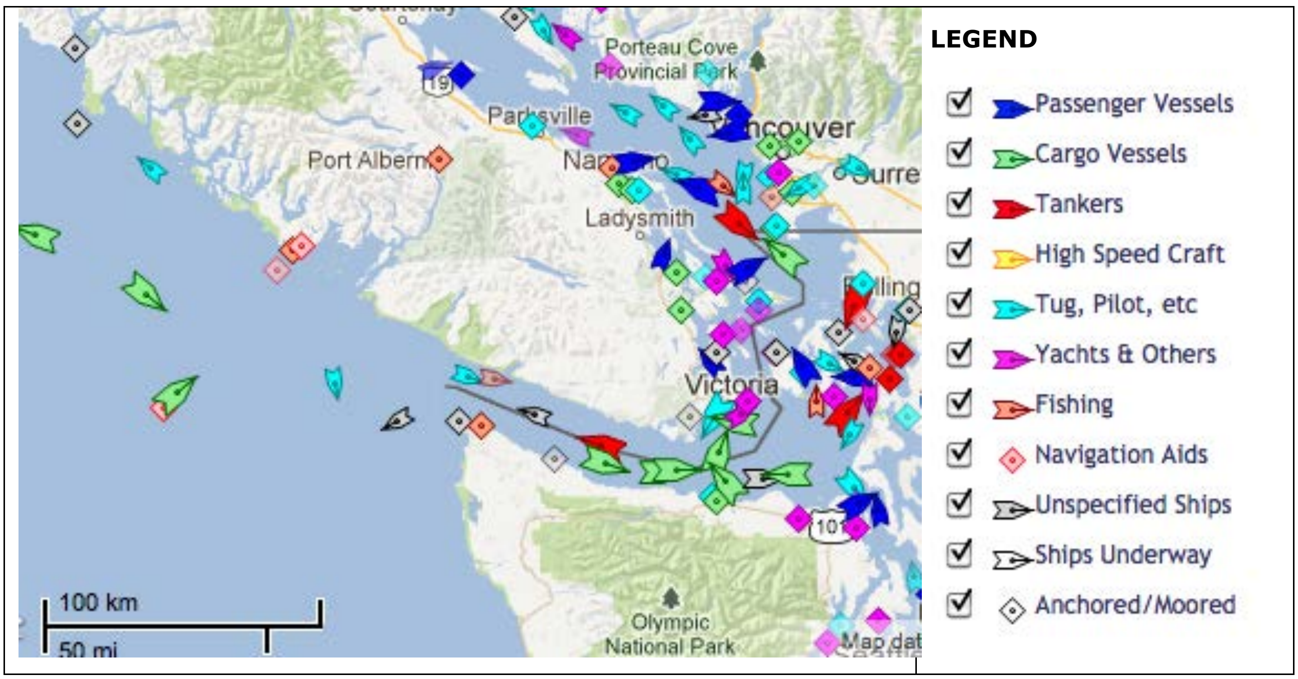

Figure 3.2 Example of AIS screen shot (Port Metro Vancouver region, 9:00am PT May 22, 2013)

OPPORTUNITY. MCTS compiles AIS data on vessel movements as well as data gathered through its own vessel tracking systems, but the data is missing certain vessel-specific information and requires extensive processing to compile and analyze to inform oil spill prevention and response policy. There are also some gaps in coverage areas (DNV, 2012a). MCTS data is aggregated by the CCG, but as AIS data can contain gaps or inaccuracies (see Volume 2), then the resulting analysis is somewhat limited in its accuracy and applicability. It would be useful for the CCG to make raw MCTS vessel movement data more readily available to other government agencies, and to work with others in the maritime industry to explore methods to improve AIS data collection and accuracy.

[11] See www.mxak.org.

[12] See www.marexps.com.

3.2.2 Vessel traffic is actively managed in high-risk areas

There are many measures that can be used to reduce risk in high-traffic areas. A risk assessment should be conducted to identify the combination of these approaches suitable to the particular area. Vessel traffic management measures include:

- *Active traffic management in real-time.* When traffic is monitored as it happens, collisions, groundings, or other accidents can be prevented by directing vessels to change course.
- *Speed limits, depth/height limits, and traffic separation schemes.* These types of restrictions regulate which vessels are allowed where and limit their movement in the allowed space, though oversight and enforcement is required to ensure compliance.
- *Restrictions on vessel operations during certain conditions.* Closure limits reduce the risk of accidents caused by extreme weather, and also limit the potential for spills to occur when no response would be possible. Potential unintended consequences must be considered when imposing closure limits to understand the full implications of re-routing vessels or keeping them in an area that may become congested or experience extreme weather conditions (Harrald et al., 1997). Closures also disrupt commerce. For these reasons, the use of closure limits, and the limits set, must be carefully considered.

EXAMPLES. Active traffic management is common in areas with heavy vessel traffic. For example, the European Union countries collaborate to monitor AIS data on vessel traffic entering member countries' territorial waters. In addition to monitoring vessels coming in and out of the area for potential navigational hazards, the European Maritime Safety Agency (EMSA) checks databases to notify member-state authorities if a vessel has been involved in an incident and may pose a further safety threat, is carrying hazardous cargo, or has a poor safety inspection record (EMSA, 2013).

In Prince William Sound, the US Coast Guard operates a Vessel Traffic Service, mandates routing to separate inbound and outbound traffic, sets speed limits for different operating areas, and will not allow tankers to enter the Sound or depart into the Sound from the Valdez Terminal if conditions reach designated closure limits, which are pre-established maximum wave height and wind speed.[13]

OPPORTUNITY. Many of these potential measures are being implemented in the more heavily traveled south coast, especially around Vancouver, where the Port Metro Vancouver has a number of special navigational requirements. There is also a cooperative vessel traffic management scheme in place for the

[13] These measures are undertaken by designating the Prince William Sound area as a regulated navigation area under US regulations. See 33 CFR 165.1704. Measures can also be implemented voluntarily.

Strait of Juan de Fuca to manage the high volume of vessel traffic along the international boundary. Some combination of these measures may be needed farther north as traffic increases and larger vessels begin traveling through the area. A risk analysis could be conducted to determine whether special restrictions such as closure limits, speed limits, draft limits, or vessel traffic separation or services are warranted in additional areas due to expected increases in vessel traffic.

3.2.3 Marine pilots are required for large vessels transiting certain waterways

Marine pilots use their extensive local knowledge and experience to help vessel masters navigate safely through a specific port or waterway. Given the global nature of shipping and the constantly changing tides, currents, and other conditions in coastal ports and waterways, a pilot trained to navigate the local waters increases the likelihood of safe passage. In addition to having knowledge of and direct experience with local waterways, pilots also undergo extensive on-going evaluation and professional development, are held to a high degree of accountability, and must maintain their skills and local knowledge, typically through recertification procedures. (NRC, 1994) Because of the extensive experience required, pilots are typically highly experienced mariners prior to beginning the pilotage training and certification process, which may take several months or years.

> ***Increased vessel traffic may require significantly more pilots, particularly for northern ports where there may be a smaller pool of experienced mariners.***

EXAMPLES. Marine pilots are common in many heavily used ports and waterways, and pilotage is mandatory for the entire coast of British Columbia.

OPPORTUNITY. As discussed in Volume 1, there are pilotage requirements throughout the coast for vessels over 350 GT (excluding pleasure craft) and pleasure craft over 500 GT. Increased vessel traffic (as discussed in Volume 2) may require significantly more pilots, particularly for northern ports where there may be a smaller pool of experienced mariners. This should be determined and a plan put in place to ensure that there are enough qualified pilots available. The Pacific Pilotage Authority and BC Coast Pilots/Fraser River Pilots are aware of the potential implications of proposed port expansions and new projects (PPA, 2011).

3.2.4 Escort vessels accompany certain vessels in high-risk operating areas

Escort vessels improve spill prevention by assigning one or more tugs to accompany certain ships through high-risk areas. The escort vessel may travel alongside or ahead of the larger ship to scout for navigational hazards, and the tugs can provide immediate assistance in the event of a steering or propulsion failure or navigational error, both of which may prevent a spill from occurring. It is also important to balance these benefits with the recognition that escort vessels represent additional vessels in the system, and are not immune to their own safety problems, particularly because they are traveling in close proximity to the tanker (and each other, if more than one escort is used). Standards for watch-standing are also important: even if a pilot, a master, and a mate are on the bridge of a tanker, for example, if an escort has a single watch stander and something happens to that person, problems may result.

Figure 3.3 Laden tanker in Prince William Sound being escorted by two tugs (PWSRCAC photo)

The internationally mandated transition from single to double hulls for large tank vessels led to debate in some places about whether escort tugs were still needed, given the additional level of spill mitigation that the double hulls are intended to provide. Double hulls do not prevent accidents, though, and it has been widely recognized that escorts still provide a measurable prevention benefit, even for double-hulled ships.[14] Escorts may also provide a spill prevention benefit for large cargo vessels, which can carry in excess of 2500t of fuel (DNV and ERM-West, 2010).

EXAMPLES. Escort tugs are used in many places around the world, including the East Johor Strait in Singapore, the Hound Point Marine Terminal in Scotland, Placentia Bay in Newfoundland, and Mongstad and Sture Terminals in Norway (RPG, 2012). The US states of Alaska, Washington, California, Massachusetts, and Delaware, among others, also use escorts in some ports.

OPPORTUNITY. There are escort requirements for laden oil tankers over certain sizes in Haro Strait and Boundary Pass (one escort) and the Vancouver First and Second Narrows (two escorts). It will be important to consider whether changes in vessel traffic in the central and northern areas will warrant escorts, and whether escorts should be used for large vessels in addition to oil tankers.

[14] In 2010, US federal law was amended to specifically extend the escort vessel requirements for double-hull oil tankers in Prince William Sound, Alaska. This provision is found in Section 711 of the Coast Guard Authorization Act of 2010 (Public Law 111-281).

3.3 Rescue and salvage resources can be on-scene quickly enough to be effective after an incident or spill

When a vessel suffers a casualty, preventing that incident from resulting in an oil spill requires quick and informed decision-making and the immediate deployment of personnel and equipment to control the vessel and minimize the damage. Once an accident has occurred, lightering remaining cargo or fuel from the damaged vessel and other types of salvage operations can be critical to mitigating the pollution impact.

3.3.1 Emergency towing resources are available for rapid deployment

Emergency towing services may already be on hand if an escort system is in place. When the vessel is not already being escorted by a tug, then a dedicated rescue tug, tug of opportunity, or other towing-capable vessel of opportunity equipped with emergency towing equipment will need to respond quickly.

- *Dedicated rescue tugs* typically provide a higher prevention benefit than general purpose vessels, in part due to the tug specifications and the training and focus of the crew on emergency operations (Berg et al., 2009).
- *Tugs or other towing-capable vessels of opportunity* may be able to assist if they happen to be in the area. The likelihood of appropriately powered vessels being on hand will vary depending on the nature of the marine activity and vessel traffic patterns. They may also be used with Emergency Towing Systems (ETS). These packages of equipment can be deployed to a ship that loses steering or propulsion to enable it to be towed (ADEC, 2012a). This service may include the use of CCG or Royal Canadian Navy vessels that would provide emergency services to a distressed vessel. Regardless of the vessel used, they must be able to be on-scene quickly in order to be effective (exact speed requires depends on the conditions, location, and size and other characteristics of the distressed vessel).

Any tow vessel must have a high enough towing or pulling capacity to provide effective rescue services for the distressed ship; these requirements will vary according to the size of the distressed ship and the environmental conditions.

EXAMPLES. Rescue tugs have been permanently stationed in several waterways, including Neah Bay in Washington, Hinchinbrook Entrance Alaska, and Placentia Bay in Newfoundland (TC, 2010). The State of Alaska places ETS strategically in coastal areas from which they can be deployed and has a training manual and exercise program for their use (ADEC, 2012a).

Figure 3.4 An ETS is delivered via helicopter as part of a drill conducted in the Aleutian Islands in 2012. ETS are pre-positioned around the state as part of an on-going program. (Nuka Research photo)

OPPORTUNITY. There are no designated rescue tugs stationed in BC today, though there are several options for enhancing rescue-towing capabilities. Expanding escort services to other parts of the coast would increase the number of tugs operating in BC waters, which benefits both the vessels being escorted and, potentially, other vessels in the area if the tow can be released in an emergency. If tugs of opportunity are to be relied on, it is important to establish realistic expectations about the type and size of tugs typically in service, which will require further study.

If tugs or vessels of opportunity *are* deemed to be a viable option in some areas, ETS should be positioned and a training program created so that they can be deployed to facilitate an emergency tow. Establishing an agreement regarding the use of the Neah Bay tug for a response in Canadian waters should be explored (this has happened before, but a standing agreement could ensure that it will be available as a resource unless called to another response).

3.3.2 Marine firefighting resources are available for rapid deployment

Controlling shipboard fires and preventing explosions will minimize environmental damages as well as risks to crewmembers and possibly even to public safety. While most vessels have onboard equipment to fight small shipboard fires, a large vessel fire or explosion will require firefighting support from vessels with high-capacity pumps or fire suppression foams. In some cases, this equipment is located on escort or rescue tugs already on scene in high-risk areas; in other cases, non-towing fireboats may be available from ports or harbors.

Consistent and rigorous training in shipboard firefighting is critical, whether by dedicated fire-fighting responders in a busy port or by a volunteer fire department called to a marine response once a year or less.

EXAMPLES. The US recently added requirements that tank vessels plan for marine firefighting as part of their oil spill contingency plans. The regulations promulgated in 2008 set time requirements by which firefighting teams and systems need to be on-scene to aid any actions the crew may take with on-board fire suppression equipment. The external teams may use firefighting tugs, trucks, or aircraft, but the plan-holder must ensure that time requirements can be met in port and both nearshore and offshore (USCG, 2008).

OPPORTUNITY. Incorporate marine firefighting into spill response planning to ensure that resources will be available to respond quickly throughout the coast.

3.3.3 Salvage resources are available for deployment as needed to be effective

The International Convention on Salvage establishes guidelines for agreements among salvors and vessel owners, but does not ensure that resources will be available to promptly implement emergency pumping, lightering, underwater repairs, refloating, and wreck removal. Having salvage contracts already in place between vessels and service providers, as well as resources nearby, can facilitate the prompt deployment and pollution prevention or mitigation facilitated by these important services. Early assessment of the situation and development of plans is important so that the appropriate resources and personnel can be brought from other areas if needed.

EXAMPLES. The United Kingdom and France include salvage in contingency planning, though the services are entirely funded by the government (Veiga, 2004). In the US, new regulations require that tank vessel operators have contracts for marine firefighting, and for certain salvage services depending on the location, within set timelines. These requirements were established to create clarity about what salvage resources are required and to ensure that vessel operators had contracts in place to expedite salvage response (USCG, 2008).

OPPORTUNITY. As Canada does not currently require vessels or spill response organizations to have salvage capabilities, it is not clear whether attempts have been made to inventory salvage resources and service providers available to serve the west coast. The first step to ensuring a sufficient salvage capacity is to develop an understanding of what resources are currently available along the west coast (and, if they come from the US or eastern Canada, how quickly they can be on-scene given border crossings and travel time) and then to identify and fill the gaps.

Figure 3.5 Salvage operations on the M/V Selendang Ayu in the Aleutian Islands included lightering the remaining fuel from the vessel. Holes were drilled in the deck so that fuel oil could be pumped into containers that were then airlifted by a heavy-lift helicopter from the remaining portion of the vessel hull to land. (Unified Command photos)

3.3.4 Potential places of refuge are identified in advance

A vessel in distress may need to be directed to a "place of refuge," where rescue, repair, or recovery operations can take place. Having pre-identified *potential* places of refuge can facilitate decision-making and improve the response's outcome. Involving stakeholders in identifying potential places of refuge (PPOR) early can also help to build trust and manage expectations (Faurot-Daniels and Dietrich, 2008) because waiting to engage stakeholders "in the moment" when a vessel is in distress is much more complicated and likely to generate conflict or frustration.

EXAMPLES. The State of Alaska (ADEC, 2012b) and the San Francisco Bay and Delta Bay Area Committee (in California) (Stout, et al., 011) have both worked with diverse public and private sector stakeholders to identify areas along the coast that are best suited to serve as places of refuge for distressed vessels, depending on the incident and other conditions at the time. This includes consideration of the sensitivity of the area to a potential oil spill, access to the area (including water depth and the vessel size to which it is suited) competing uses in the area (such as commercial fishing), exposure, and available infrastructure for docking, mooring, or salvage (ADEC, 2012b). In some cases, new infrastructure has been established, such as mooring buoys, to enhance a potential place of refuge site.

OPPORTUNITY. Transport Canada's Places of Refuge plan outlines important considerations when selecting a place of refuge for a distressed vessel, but *potential* places of refuge should be identified and information to evaluate their suitability should be compiled ahead of a potential incident. This does not limit the decision-maker's control in the event of an incident, but provides critical guidance to streamline decision-making in an emergency situation. Potential places of refuge should be identified with stakeholder input and detailed information about sensitive resource considerations and logistics. When potential places of refuge are identified in advance, they can also become focal points for the staging of spill response and salvage resources and may warrant additional spill response planning.

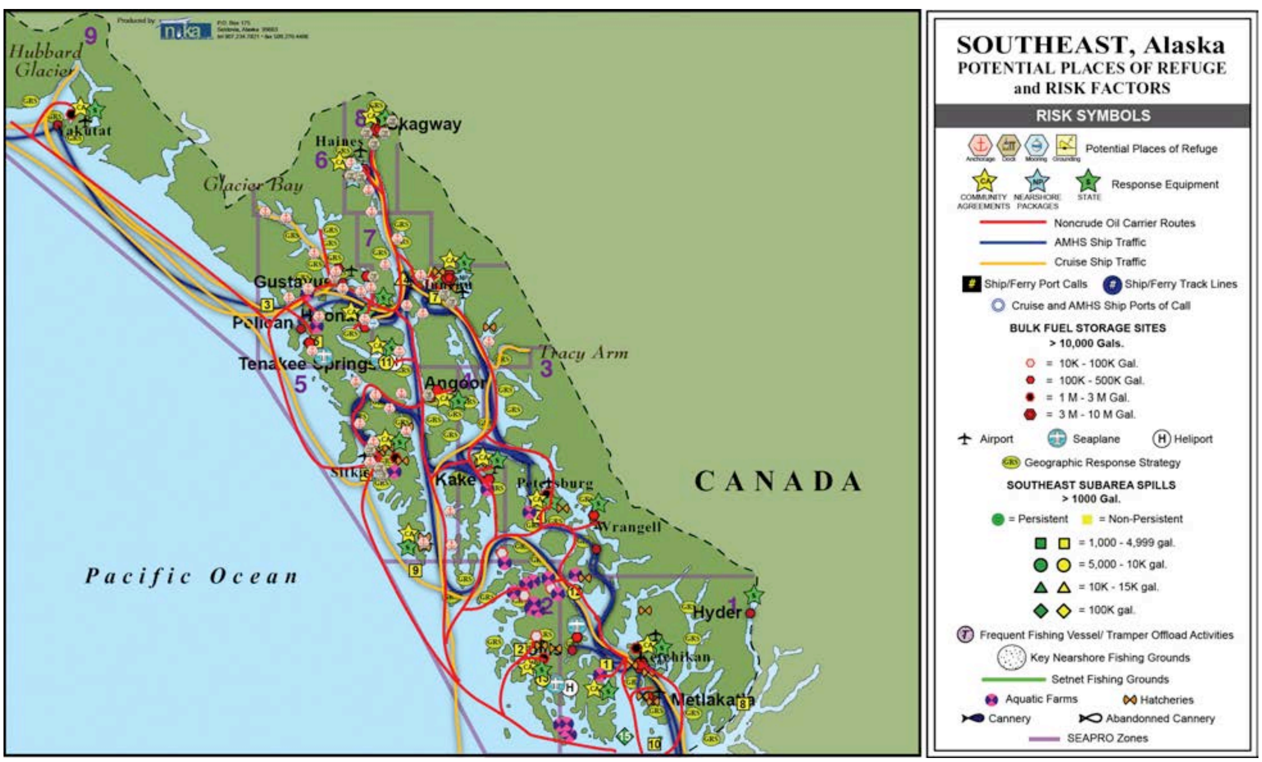

Figure 3.6 Summary of potential places of refuge identified for Southeast Alaska (ADEC and Nuka Research graphic)

4. WORLD-CLASS PREPAREDNESS AND RESPONSE ELEMENTS

4.1 Geographic areas are prioritized for protection from oil spills

Maximizing resource protection requires: (1) accurate information about potentially affected resources, (2) a process for prioritizing areas for protection, and (3) location-specific plans for the highest priority areas. Some areas may be sensitive enough that they should be avoided altogether by tankers and other large vessels through mandatory or voluntary routing or by designating an area to be avoided.

4.1.1 Marine and coastal resources are inventoried

Marine and coastal resources must be inventoried in order to identify the areas that are the highest priority for protection. Inventories should be easy to use and periodically updated. Maps should include all areas that could be affected by a marine spill, including inlets and islands (IPIECA et al., 2011). Obtaining — and maintaining — high quality information is critical.

EXAMPLES. Many places have coastal inventory maps or atlases. Examples of useful inventories in North America include the ShoreZone mapping methodology, which combines aerial imagery with the coding of habitat and other characteristics (used along the west coast of North America),[15] Sensitive Ecosystem Indices (used in British Columbia),[16] and Environmental Sensitivity Index (ESI) mapping (used around the US),[17] and the Coastal and Ocean Information Network mapping of resources on the east coast of Canada.[18]

OPPORTUNITY. Developing and maintaining an up-to-date resource showing coastal habitat and resources in an accessible, digital format will support efforts to build consensus both during planning and actual response activities. Most important is that the information is accurate and accessible. In addition to inventorying resources, mapping in advance of a spill could identify shoreline segments that will be used to guide Shoreline Cleanup and Assessment Teams (SCAT) during the response, as has been done along the California coastline (Haffner et al., 2011), and incorporate other response planning information such as response equipment, vessel locations, and/or local response strategies.

4.1.2 A process is in place to prioritize areas for oil spill protection

Areas may be prioritized for protection during a spill — or deemed worthy of additional protection measures — based on the presence of an environmentally sensitive habitat, threatened species, cultural or recreational resources, economic activities, or other critical infrastructure. Identifying the relative

[15] See: http://shorezone.org

[16] See: http://www.env.gov.bc.ca/sei/

[17] See: http://response.restoration.noaa.gov/esi

[18] See: http://coinatlantic.ca/index.php/component/content/article/54-links/541-coastal-resource-and-habitat-inventories

sensitivity of different shoreline areas in advance can inform both planning and response decision-making (IPIECA et al., 2011):

- *Before a spill has occurred*, engaging stakeholder groups and resource conservation agencies in the selection and prioritization of sites for oil spill protection can help foster realistic expectations.

- *After a spill has occurred,* decisions should be made regarding the type and extent of response operations (if any) for different locations based on the goal of minimizing harm. This is often referred to as achieving a "net environmental benefit," and requires an understanding of: (1) the ecological and socio-economic resources or values at risk, (2) past spills and research that may help to predict the potential impacts to those resources, and (3) the different response options available.

EXAMPLES. In the US, the sensitivity of different shoreline areas is identified as part of the Environmental Sensitivity Index maps, which include color-coding and a numerical value to describe an area's estimated sensitivity to oil considering both ecological and human uses, and maps for each season (NOAA, 2013b; Jensen et al., 1998). Australia uses Coastal Resource Atlases, which also provide information about shoreline sensitivity, ecological and human resources, and logistics/infrastructure, but do not use a numbering scale as this was thought to be too rigid to be useful in a response context (AMSA, 2013).[19]

OPPORTUNITY. An inter-agency, or multi-stakeholder process should be established to develop a shared prioritization of areas for protection along BC's coast. (This process can be expanded to develop geographic response plans; see Section 4.1.4.)

[19] The International Petroleum Industry Environment and Conservation Association, International Maritime Organization, and International Association of Oil & Gas Producers (2011) describe the basic elements of environmental sensitivity mapping.

Figure 4.1 The sensitivity of an area may be based on the species or habitat present, but may also be driven by recreational, cultural, and economic values.

4.1.3 Areas to be avoided are established as appropriate

Some areas may be identified as extremely sensitive to shipping impacts and can be closed to large vessel traffic to prevent oil spill impacts or other potential damage. At the international level, the IMO designates Particularly Sensitive Sea Areas (PSSA), which provide one mechanism through which an Area to be Avoided may be designated (IMO, 2013). This approach can be applied to other types of marine protected areas, as well, if the vessels of concern are not engaged in international shipping (as is the focus of the IMO'S PSSA approach) or the coastal state chooses an alternate approach. A vessel exclusion zone can also be implemented voluntarily, as has been done along the BC coast. Whether mandated or voluntary, it is important to communicate the restriction clearly and to monitor vessel traffic to ensure that the rules or guidelines are followed.

Alternatively, instead of designating a specific area to be *avoided,* the routes that certain vessels *should* follow (or, if mandated, *must* follow) can be established. This option may be the most logical in narrow passages, whereas the approach of designating areas to be avoided is likely to work best when there are many other options considered to be equally safe.

EXAMPLES. Figure 4.2 shows the internationally designated Area to be Avoided off the Pacific Coast of the Olympic Peninsula. This area has been a focus of education and outreach efforts to make mariners aware of the exclusion area (Galasso, 2000). In Stellwagen Bank, the concept has been used to minimize other shipping impacts: an active sensing system alerts shipping traffic when there are right whales near shipping lanes, and vessels are required to take additional measures (speed restrictions, extra lookouts) to avoid strikes. A similar alert system could be used to notify vessels if they are entering a protected or restricted area.

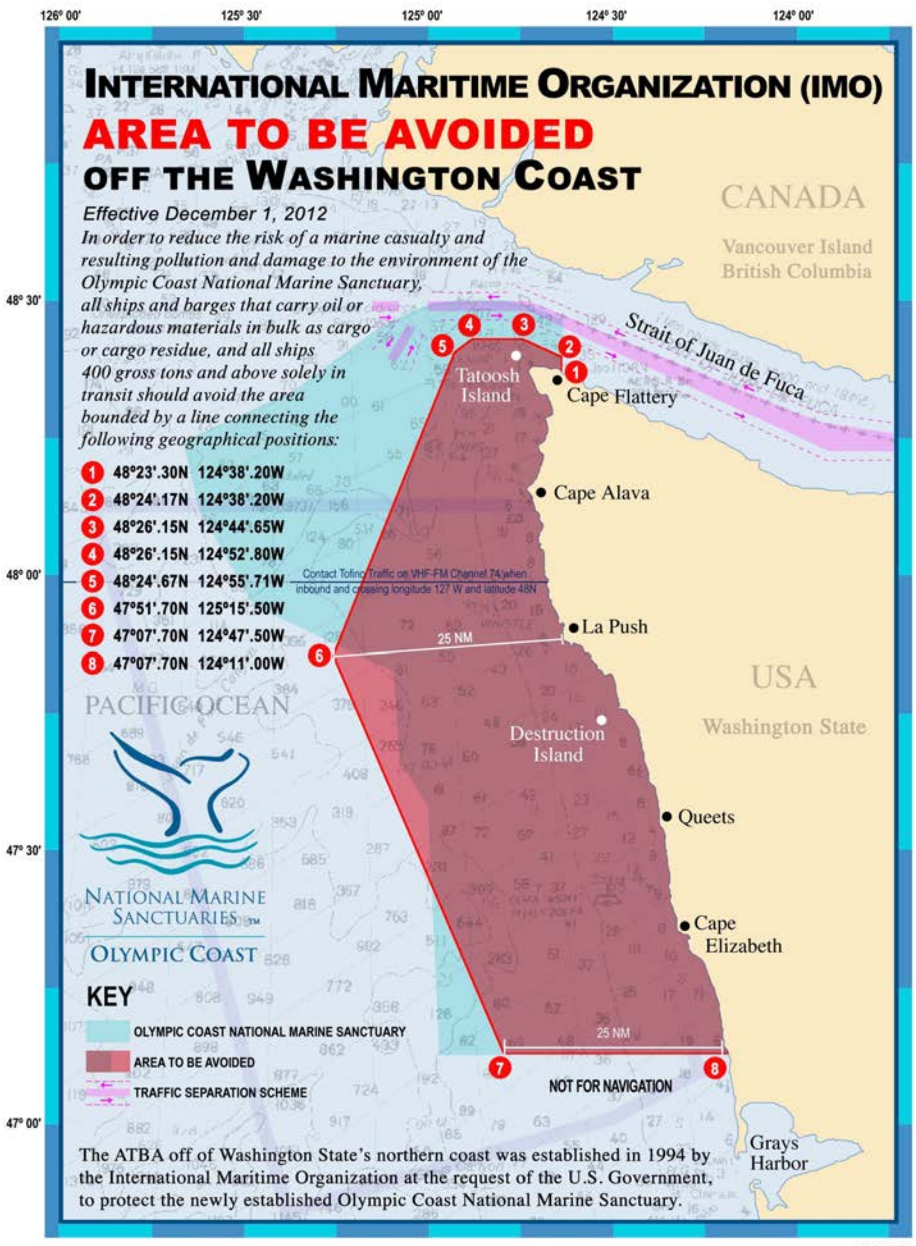

Figure 4.2 Voluntary area to be avoided off the coast of Washington State in the United States (Department of Ecology, 2012)

OPPORTUNITY. Laden tankers voluntarily stay 50 nautical miles offshore of BC, and there are tanker restrictions due to navigational hazards in part of the Inner Passage. Additional exclusion areas or the exclusion of other types of vessels from these areas should be considered based on a risk analysis and prioritization of sensitive areas.

4.1.4 Geographic response plans are developed for high priority areas

Even with a robust prevention system, it is possible for oil spills to threaten coastal resources. Geographic response plans (GRP) are location-specific strategies to protect vulnerable sites that are of particular ecologic or socioeconomic importance. GRPs can be designed to be implemented with locally available spill response resources: a GRP intended to protect a wetland area with boom or vessels that will not arrive on scene for several days is unlikely to be effective. GRPs should also specify clearly the goal of the strategy, resources needed, access points, typical conditions, and site-specific considerations (such as access limits or local hazards). They should be tactical plans readily available to field responders.

GRPs should be developed with input from local communities and First Nations who can identify the areas most important to them and provide input about local waterways and conditions. Systematic testing of GRP strategies provides an additional level of value to these plans, both by evaluating the effectiveness of specific tactics and by providing an opportunity for local responders to practice spill response methods and to validate logistical assumptions.

EXAMPLES. GRPs have been developed in many places, including several US states. The multi-stakeholder approach has been used to develop a GRP for portions of the coasts of Alaska, Washington, Oregon, California, and Massachusetts. In Alaska, GRP sites are prioritized based on: 1) their environmental sensitivity, cultural importance, and critical infrastructure, 2) risk of being impacted, and 3) the potential to protect them using best available spill-response tactics.

GRP field exercises are also conducted in several of these locations.

OPPORTUNITY. WCMRC has developed area plans that could provide an excellent starting point for a multi-stakeholder approach to prioritize areas and develop response plans suited to local conditions and resources. As these area plans were not available for review by the authors, their level of detail and any potential enhancements cannot be recommended. Sharing these plans publicly for review and input would begin the process of building a set of GRPs with input and support from key stakeholders.

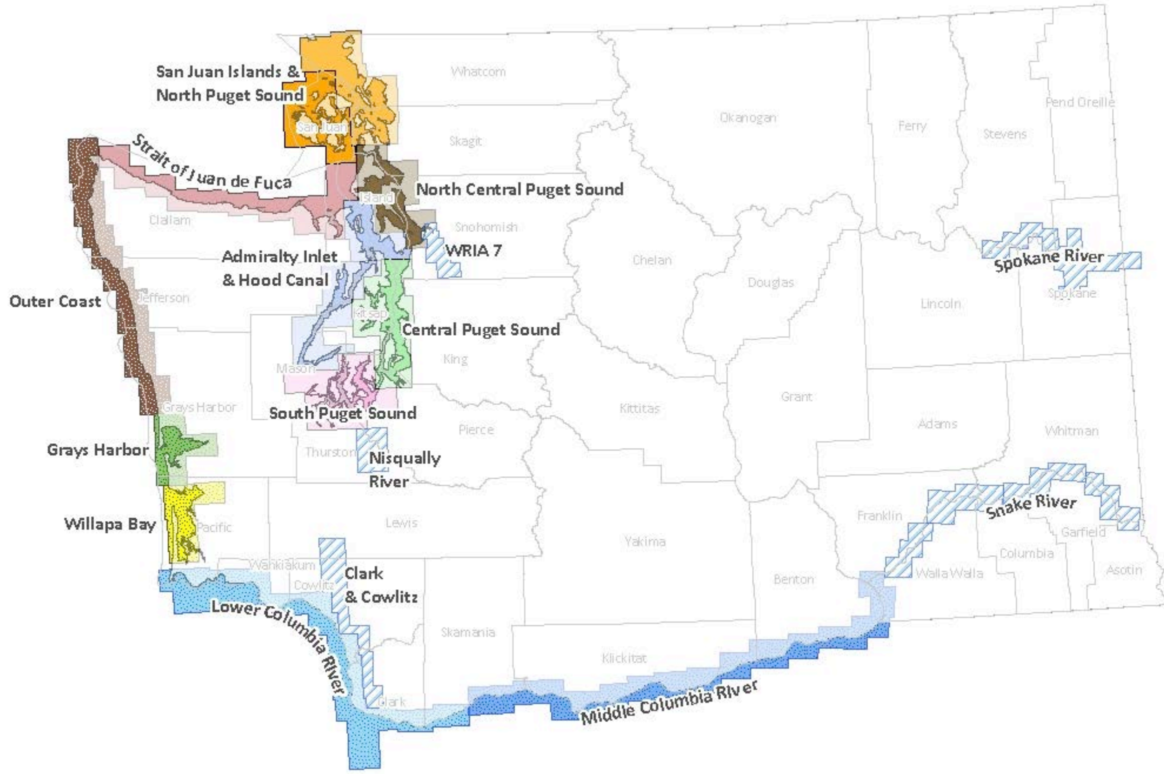

Figure 4.3 The State of Washington has developed GRPs for coastal and river areas statewide, each of which shows priority sensitive areas, logistics, protection strategies, and other information (Washington Department of Ecology image)

4.2 Contingency planning is comprehensive, integrated, and well understood by all relevant parties

Contingency planning is the process of gathering information, assessing spill risks, identifying potentially impacted resources, developing spill response strategies, and establishing procedures for mobilizing and deploying spill response resources. Effective contingency planning will be: (1) integrated agencies and companies or organizations who may participate in a response, (2) inclusive of all major spill functions,, (3) flexible and capable of achieving a worst-case response, and (4) designed with an understanding of the potential for environmental conditions to impact the response, and (5) developed with enough detail that specific response tactics are defined in advance (IMO, 2010).

One of the many lessons learned from the 2010 Deepwater Horizon well blowout was the need to improve and update both industry oil spill contingency plans and the United States's national and regional oil spill plans. The spill demonstrated the need to bolster worst-case scenario planning, to ensure that spill response plans were locally specific, and to provide ongoing mechanisms for cross-jurisdictional (local, regional, national) coordination before, during, and after a spill occurs (USCG, 2011).

The contingency planning process also ensures that sufficient equipment and personnel are available and ready to respond quickly and effectively; these are discussed in Sections 3.6 and 3.7, respectively.

4.2.1 Planning is integrated across jurisdictions and sectors

An effective spill response will require coordinated action from government agencies at all levels as well as from companies, organizations, and First Nations. The integration of the planning process is foundational to achieving the necessary level of coordination to minimize confusion. This integration means:

- Agencies and organizations with key response roles understand their own plans and processes in the event of a spill.
- Plans are widely shared, discussed, and applied during drills, exercises, and real events to ensure clarity about roles and responsibilities (and to reduce duplication of effort).
- Regular inter-agency meetings are used to share information, review plans, and foster joint preparedness initiatives. Standing or ad-hoc committees may be formed to work through issues such as the identification of priority areas, development of decision-making tools, evaluation of response technologies, and addressing emerging issues.

EXAMPLES. Area committees were established in the United States to integrate planning across federal agencies and with the primary state-level agency charged with spill response. These groups are responsible for ensuring that area contingency plans are up-to-date, which requires constant attention and effort. For example, the 2012 work plan for the Northern New England Area Committee included activities ranging from identifying lessons learned from exercises and actual responses (including the Deepwater Horizon response, even though it was out of the region), developing Geographic Response Plans, updating the Area Contingency Plan, and testing and evaluating potential incident command posts (Maine and New Hampshire Area Committee, 2012).

OPPORTUNITY. There is no established mechanism in BC for ongoing coordination among agencies, jurisdictions, response organizations, industry and stakeholders.[20] A standing committee or other structure should be considered, and would facilitate coordination on efforts like the management of oily waste, which falls under the province's jurisdiction even if overall response coordination may not. This coordination could begin with the government and be expanded to include other parties, or could exist as a government-only entity (federal and provincial), perhaps with public meetings.

The *Land Based Spill Preparedness and Response in British Columbia Symposium* held in March 2013 represents an excellent example of convening of key parties; something similar for marine spills could provide a launch point for an ongoing coordination or committee.

[20] A workgroup of federal agencies was convened in 2010 to improve interdepartmental coordination, per comments provided by the CCG on this draft.

4.2.2 Contingency plans address all major spill response functions

Contingency planning essentially encompasses all aspects of oil spill preparedness. The International Tanker Owners Pollution Federation, Limited (ITOPF) has developed a guidance document that addresses the key components of oil spill contingency planning; 10 key questions for assessing the adequacy of a contingency plan are summarized in Table 4.1.

Table 4.1 Ten key questions for assessing the adequacy of a contingency plan (ITOPF, 2013)

TEN QUESTIONS FOR ASSESSING THE ADEQUACY OF A CONTINGENCY PLAN (ITOPF, 2013)
1. Bearing in mind the probable movement of any spilled oil, has there been a **realistic assessment** of the scale and severity of the possible threat, and of the resources most at risk?
2. Have **priorities** for spill protection been agreed, taking into account the feasibility of the various protection and cleanup options?
3. Has a **strategy** for protecting and cleaning the various areas been agreed and clearly explained?
4. Have **all the functions** necessary for the response plan been allocated and the responsibilities of all those involved been clearly stated – are **all organizations and agencies** aware of their responsibilities?
5. Are the **levels of equipment, materials, and labor** sufficient to address the anticipated size of spill? If not, have back-up resources been identified and, where necessary, have mechanisms for obtaining their release and entry to the country been established?
6. Have temporary **waste storage** sites and **final disposal** routes for collected debris been identified?
7. Have the **notification and initial evaluation** procedures been fully explained and have arrangements been made for continual review of the progress and effectiveness of the cleanup operations?
8. Have the arrangements for ensuring effective **communications** between shore, sea, and air been described?
9. Is the plan compatible with plans for **adjacent areas** and other activities?
10. Have all aspects of the plan been **tested**?

Contingency plan implementation is an iterative process that requires continuous utilization and refinement of the plan contents. Exercises and actual oil spills should yield lessons that can improve the plan and its implementation. Frequent updates are a critical component of the planning process (Hollingsworth, 1991). Implementation must also be flexible enough to adjust to different scenarios. There must be a mechanism in place to input field observations and incident-specifics into response decision-making (IMO, 2010). Plans also need to ensure that responder health and safety needs will be met, including personal protective equipment, safety personnel, the development of site safety plans, and first aid/emergency response resources. It is important that planning consider the response activities that will be needed away from the oil recovery as well, such as wildlife response and shoreline cleanup, which can require thousands of people.

Scenarios are a valuable tool for contingency planning because they provide an opportunity to evaluate all major response functions for spills of various sizes, types, and locations. Scenarios provide a chance to examine how the thousands of details upon which good planning depends will be brought together.

EXAMPLES. The response scenarios used in the Prince William Sound Oil Discharge Prevention and Contingency Plan (RPG, 2012) developed under State of Alaska regulations provide all parties the opportunity to examine their assumptions about how resources will be used and to ensure resources are not being double-counted.

Using scenarios in spill response planning provides all parties the opportunity to examine their assumptions about how resources will be used and to ensure resources are not being double-counted.

OPPORTUNITY. WCMRC's contingency plan houses the critical operational details upon which a successful BC marine oil spill response depends, but is not available for public review. Public and government review of this plan would provide an opportunity to better understand and evaluate the capabilities in place, and to address any planning needs. A short series of unannounced drills could be conducted to test vessel operator familiarity with the notification procedures and plan (shippers are not otherwise responsible for any aspect of responding to spills from their vessels in BC).

4.2.3 Response planning standards ensure sufficient response capacity to respond to a worst-case spill

Planning standards are one tool for preparing a contingency plan that will serve the public interest. But to accurately assess response capacity, it is also critical to have a clear understanding of worst-case spill risks (OGP, 2011). The "worst-case" should consider not only the total loss of fuel from a vessel, but also weather weather conditions, location, and the maximum quantity that could potentially be spilled from the cargo and fuel tanks of a vessel or shore-based storage facility.

Planning standards identify minimum equipment requirements and response timing to ensure that operators have access to enough equipment to quickly respond to a spill anywhere in their area of operations. But the timing of spill response is just as critical as the quantity of equipment, because the opportunity to contain and recover a marine oil spill diminishes quickly over the first few hours and days. Because planning standards are key drivers of the level of preparedness, they way they are reviewed and understood for compliance purposes is very important (see Section 3.8.1). In order for a planning standard to address the worst-case spill, it should include an evaluation of potential spill volumes based on vessel sizes and traffic patterns.

Because a planning standard[21] will help determine the quantity and location of equipment and personnel that are on-hand for immediate deployment, the way that a contingency plan is evaluated for compliance with this standard is critical. There are several methods for ascertaining whether response resources are sufficient to clean up spills of various sizes. Response effectiveness can be estimated based on the capabilities of the equipment available to clean up a spill. It is important that such calculations take into account the ability of the equipment to encounter oil (which will change over time as oil spreads and weathers), the increasing amount of water/oil mixture that will be collected, the type of oil including the potential for oil sinking/evaporation, and other factors. As the US experienced in the Deepwater Horizon spill, poor capacity estimates can create unrealistic expectations of how response equipment will perform.[22] An important role of government review, therefore, is to align planning assumptions with reality.

EXAMPLES. While there are different approaches to planning standards, those that specify a spill size and response timeframe tend to drive the quantity, location, and type of response equipment available. In the bordering US areas, vessels are subject to a federal planning standard and, depending on where they travel, requirements set by the states of Alaska and Washington. These are summarized in Table 1, with a focus on the maximum response planning standards that relate to the quantity of equipment that must be on-scene by a certain time (in Alaska the time requirement refers to containing, controlling, and cleaning up the spill, not just having equipment on-scene.) There are other planning standards in each of these places as well that relate to shoreline cleanup, aerial surveillance, non-mechanical response, the availability of vessels of opportunity, and other response elements.

[21] It is important to note that a *planning* standard is different from a *performance* standard based on an actual response. A planning standard seeks to set expectations for a response, but the actual response may be quite different given the many variables involved.

[22] Since they were established in the 1990s, US regulators have used a set of calculations based on a percentage of skimmer nameplate capacity to determine compliance with federal vessel response plan regulations. In the Deepwater Horizon response, the inadequacy of this approach was evident, since far less oil was recovered than the calculations would have indicated. As a result, the Bureau of Safety and Environmental Enforcement commissioned a study (Genwest, 2012) to explore better options.

Table 4.1. Response planning standards in Canada, US, Washington, and Alaska

JURISDICTION	MAXIMUM RESPONSE PLANNING STANDARD[23]
Canada (federal)	Equipment *on-scene* to respond to 10,000t spill by 72 hours in Vancouver or the Juan de Fuca Strait. Response times for other areas add time for air, water, and land travel depending on the distance from Vancouver.
US (federal)	Resources *on-scene* to respond to worst-case discharge (entire vessel cargo), with a cap of 35,632t (262,000 bbl.). Time requirements vary depending on location; for most areas, resources must be on-scene from 24-72 after discovery of the spill. (33 CFR 155.1050 and App. B, Parts 3-5)
Washington (state)	Equipment *on-scene* to respond to worst-case spill (entire vessel cargo and fuel) by 72 hours plus travel time from shore (WA-173-182-450)
Alaska (state)	Equipment to *contain, control, and cleanup* 40,800t (300,000 bbl.) of spilled oil within 72 hours in any area of state waters; must use scenario to demonstrate sufficient equipment to clean up a worst-case discharge (18 AAC 75.438)

OPPORTUNITY. The 10,000t response standard (see Volume 1) falls well short of the worst-case discharge (or even a moderately bad spill, given the size of the vessels in the area). As discussed in Volume 2, a large cargo ship would have the potential to release 12,000 cubic meters of its own fuel (roughly (roughly equating to 12,000t). The largest tanker cargo volume, based on 2011-2012 data, was 210,000 cubic meters in the Strait of Juan de Fuca or on the outer coast, or 127,000 cubic meters in the Georgia Straits. In the north, based on current traffic, the largest tanker cargo volume was 57,000 cubic meters, which is still more than five times the size spill for which WCMRC is required to be prepared. Shorter timeframes for required delivery of response equipment should be established to take advantage of the limited window-of-opportunity to maximize on-water recovery during the early hours and days of a marine oil spill.

Additionally, response capacity should be evaluated based on the most realistic assumptions possible, considering the operating environment and type of product that may be spilled. Many factors impact the ability to contain, recover, and store oil spilled to water. Compliance with any planning standard related to on-water recovery should consider as many of these factors as possible to provide the best possible estimate of how much oil could be recovered. Instead, capacity should be evaluated using the Response Options Calculator (as demonstrated in Volume 1) or a similar model.

[23] Conversion factor used: tonnes of oil equivalent = bbl./0.136

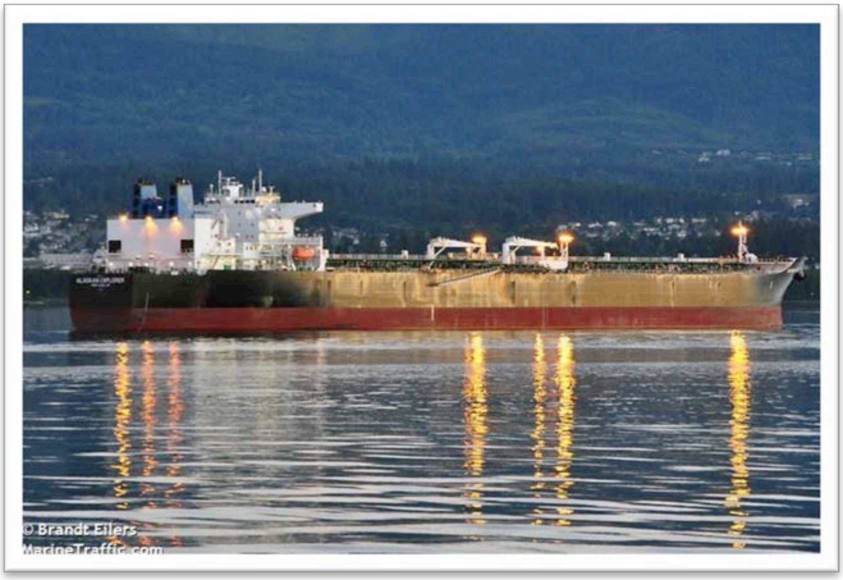

Figure 4.4 The Alaskan Explorer was the largest tanker to travel in BC waters in 2012, with a cargo capacity that is more than nine times larger than the spill volume to which WCMRC is required to be prepared to respond. (Brandt Eilers photo, marinetraffic.com)

4.2.4 Response operating limits are identified and mitigation measures established

Different operating environments and changing weather may facilitate or limit a spill response. Planning, equipment acquisition, and prevention measures should be informed by an understanding of the conditions in which the equipment, vessels, and perhaps most important, *people* deployed in a response can perform effectively. Contingency plans should describe these limits, as is required in Alaska where plan-holders must describe the "realistic maximum response operating limits" and the alternative approaches they will deploy when limits are exceeded.[24]

A response gap analysis provides a fuller understanding of the implications of weather conditions on a response by estimating how often response operations in a certain area would be precluded by adverse weather conditions. This requires gathering data on weather conditions (typically to include wind, ocean conditions, temperature, and visibility) and an understanding of the limits of the response as a whole based on its individual components. When weather data is compared to the response limits, it is possible to estimate the percentage of time throughout the year or during a particular season when a response would be impaired or impossible (Nuka Research, 2006b). A response gap analysis informs seasonal restrictions on operations or closure limits.

EXAMPLES. Response gap analyses have been conducted for Prince William Sound (Nuka Research, 2006a), the north coast of BC (Terhune, 2011; Nuka Research, 2012), and the Canadian Arctic (SL Ross, 2011). Mitigation measures for times when operating conditions preclude response are required in State of Alaska contingency plans. Seasonal drilling restrictions are in place in the US and Canadian Arctic to limit oil drilling or require modified operations during times when response is not possible or would be severely impaired.

[24] See Alaska regulations at: 18 AAC 75.425(e)(3)(D).

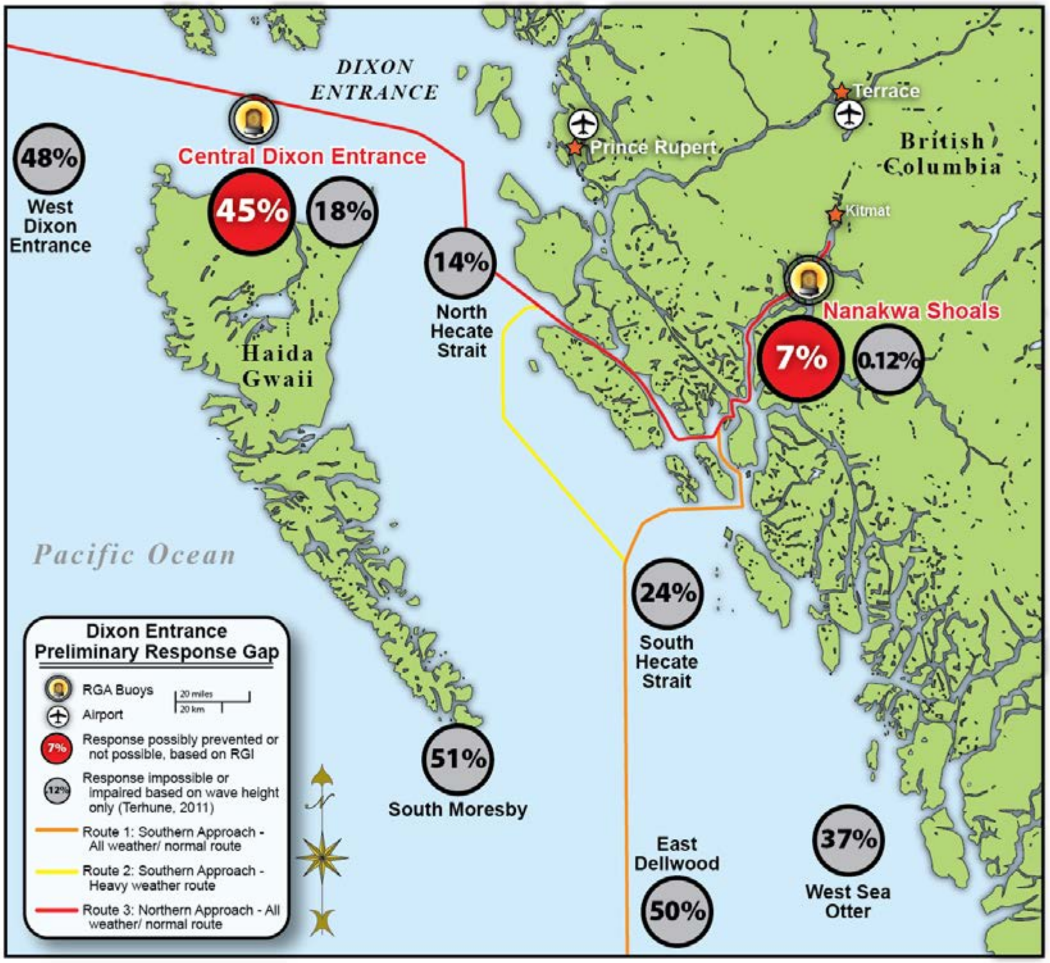

Figure 4.5 A 2012 response gap analysis estimated that a mechanical spill response would be precluded by environmental conditions 45% of the time at Central Dixon Entrance, but only 7% of the time at Nanakwa Shoals (Nuka Research, 2012).

OPPORTUNITY. Conduct a response gap analysis for key shipping routes along the coast to understand how often ships move through the area when an effective response could not be mounted. Currently, Canada's response organization requirements state that equipment must be capable of operating in Beaufort Force 4 conditions.[25] This represents winds of 28-28 km/hr and small waves (Environment Canada, 2007). While this is an important recognition of the relationship between environmental conditions and the effectiveness of response equipment, it does not address the following:

- **The impact of other environmental conditions on response effectiveness or the ability to respond at all.** Even when wind and waves are moderate enough that on-water containment and recovery equipment can be deployed, other conditions may preclude a response. Fog, clouds, and darkness, as well as temperature and strong currents can also limit a response (Nuka Research, 2006).

[25] SOR/95-405

- **The combined impact of different factors on a response.** Interactions between environmental factors are also important to consider; for example, a combination of cold and strong winds can cause a freezing spray that will impede a response sooner than cold or wind alone (Nuka Research, 2006).

- **Alternative options or mitigation measures.** How will operations be modified or response strategies adapted when conditions preclude or limit the effectiveness of a response? This should be considered and incorporated into appropriate planning and/or procedural policies. A response gap analysis should be conducted to determine how often this could be expected in different locations.

4.2.5 Operational tactics are defined

Equipment in warehouses is useless unless it can be organized quickly into on-water response efforts that are effective at recovering or treating spilled oil. Tactics should be developed in advance and practiced to determine their effectiveness in different conditions in the targeted geographic area and their suitability to the types of oil that could be spilled. Tactics manuals or technical guides are commonly used to describe strategies for on-water recovery, shoreline clean-up, and tracking and surveillance, including the equipment and other resources needed and safety considerations. While overarching plans may focus on procedures to mobilize and sustain a response and to coordinate decisions, tactics spell out the details of exactly what equipment is needed, how it will be used, who will use it, and what training and gear the users will need. Tactics therefore must align with equipment inventories. (See Section 3.6.1.)

Tactics manuals or technical guides are commonly used to describe strategies for on-water recovery, shoreline clean-up, and tracking and surveillance, including the equipment and other resources needed and safety considerations.

EXAMPLES. The State of Alaska has developed a general Spill Tactics for Alaska Responders (STAR) Manual (Nuka Research, 2006c), and many response organizations have their own manuals based on their equipment and locations.

OPPORTUNITY. WCMRC provides its inventory in the WRRL and on its website. Clarity is needed about which CCG resources are available for a response in BC, as this is a key aspect of planning. The authors encourage that this inventory be made available and included in the WRRL, or otherwise shared with the interested agencies and stakeholders. A process should be put in place for tracking resources *during* a response, if one is not already included in contingency plans.

4.3 Sufficient equipment can be deployed quickly to respond to a worst-case spill

A robust spill response system requires sufficient equipment to encounter, contain, and remove or treat as much oil as possible. Equipment should be: (1) accurately inventoried, (2) strategically located, stocked, and maintained, and (3) the best available for the relevant operating environments and potential spilled substances. Adequate logistical support functions must also be delivered and sustained, ranging from launching response boats to housing and feeding responders.

4.3.1 Resource inventories are up-to-date, accessible, and accurate; resources are tracked during a response

The development and maintenance of updated, accurate oil spill response equipment inventories is critical to effective contingency planning and spill response. Most spill responses involve a combination of government and contractor resources, so equipment inventories should be developed cooperatively (IMO, 2010).

Spill response resource inventories should be as comprehensive as possible, including equipment owned by oil spill response organizations, government, operators, and private vendors. The inventory should contain equipment specifications and should identify ownership and storage location, and whether there are ancillary or accessory components necessary for its use. The inventory should be widely available and there must be a process in place for continually updating it (Crawford et al., 2005).

During a spill response, resource tracking is also critical. New technologies allow for real-time tracking of resources using a geospatial data interface so that resource locations can be displayed on a map. Integrating equipment lists and resource data into geospatial platforms may facilitate resource tracking during a spill.

EXAMPLES. The Western Response Resource List (WRRL), which is used to track spill response resources along the Pacific Coast of the US and Canada, can be integrated with a tool called the Response Tracking Manager (RTM) to provide real-time status information (Calderon et al., 2008).

Similar map-based tools were used to track response resources during the 2010 Deepwater Horizon well blowout in the US (Briggs et al., 2011). In addition, the Environmental Response Management Application (ERMA) is a new tool developed in the US that combines data from the ESI maps with other data that can be used to inform response planning or activities. The ERMA application is broader than just oil spill response and may include information such as evacuation routes or tsunami debris in addition to spill response plans, equipment, or plans (NOAA, 2013a).

OPPORTUNITY. WCMRC provides its inventory in the WRRL and on its website. Clarity is needed about which CCG resources are available for a response in BC, as this is a key aspect of planning. The authors encourage that this inventory be made available and included in the WRRL, or otherwise shared with the interested agencies and stakeholders. A process should be put in place for tracking resources *during* a response, if one is not already included in contingency plans.

4.3.2 Response caches are strategically located, stocked, and maintained

Determining the optimal type, quantity, and location of response equipment stockpiles is a key component of oil spill preparedness, and should be determined systematically based on the presence and degree of spill risks. Spill scenarios or computer models may be used to aid the process of determining optimal location and composition of response resource caches (IMO, 2010). Response caches should be developed with the following considerations:

- *Mobilization of resources to a spill site.* Typically, resources cascade into a spill site based on proximity. Some jurisdictions have established minimum criteria for the amount and type of equipment that must be available to respond to a spill within various time limits.

- *Maintenance activities to ensure that equipment used infrequently is ready when needed.* This may include maintenance, license renewal, safety inspections, and enhancement or repairs. Maintenance activities should follow a schedule and should be well documented (Lamarche and Samson, 2008).

- *Potential use of all possible response strategies.* In addition to mechanical recovery, which is typically the preferred approach, chemical countermeasures such as dispersants or shoreline cleaning agents may enhance overall response capacity. In-situ burning may also be a preferred response option in certain situations or environments. These strategies must be promptly deployed to be effective, and some related non-mechanical resources may have different storage or maintenance requirements (Clark et al., 2008). A monitoring protocol should also be established and agreed upon in advance so that command management and other interested parties can understand the effectiveness of the tools being used.

For remote areas, it may be beneficial to supply, train, and exercise local community responders to be able to respond quickly to a spill in their area.

EXAMPLES. The Washington Department of Ecology launched a program in 2008 to "survey, assess, inspect and test through deployments all public and private response equipment in the state." Five years into the project, significant improvements have been realized, and the inspections will be complete July 1, 2013. The program has fostered better agency-industry cooperation and has encouraged more large-scale drills to be conducted. The process has provided state regulators with a better appreciation for response-contractor responsibilities and has facilitated a better awareness of mobilization and deployment parameters (Martinez and Pilkey-Jarvis, 2011).

Other communities have developed response capacity (both equipment and trained responders) in a number of places, including Alaska (Bushell and Jones, 2009), Washington (IOSA, 2008), and Massachusetts (MassDEP, 2013), as well as the Philippines (WWF Global, 2001).

Australia has identified dispersants as a key response tool because of its large and remote coastline. The Australian Maritime Safety Authority is developing a list of approved dispersant products based on its own testing protocols. It oversees the stockpiling of these resources at strategic locations around the country (Irving, 2013).

OPPORTUNITY. WCMRC continues to enhance its equipment stockpiles, which far exceed the levels mandated under Transport Canada requirements. However, as presented in Volume 1, the federal requirements are designed to address a spill that is much smaller than the potential worst-case, and are also geared towards the higher traffic areas in the south. . Additional consideration is needed to ensure equipment stockpiles are strategically stocked, maintained, and geographically distributed.

Additionally, a plan for training and equipping local communities could be incorporated into an overall effort to engage stakeholders along the coast in developing and achieving a world-class system.

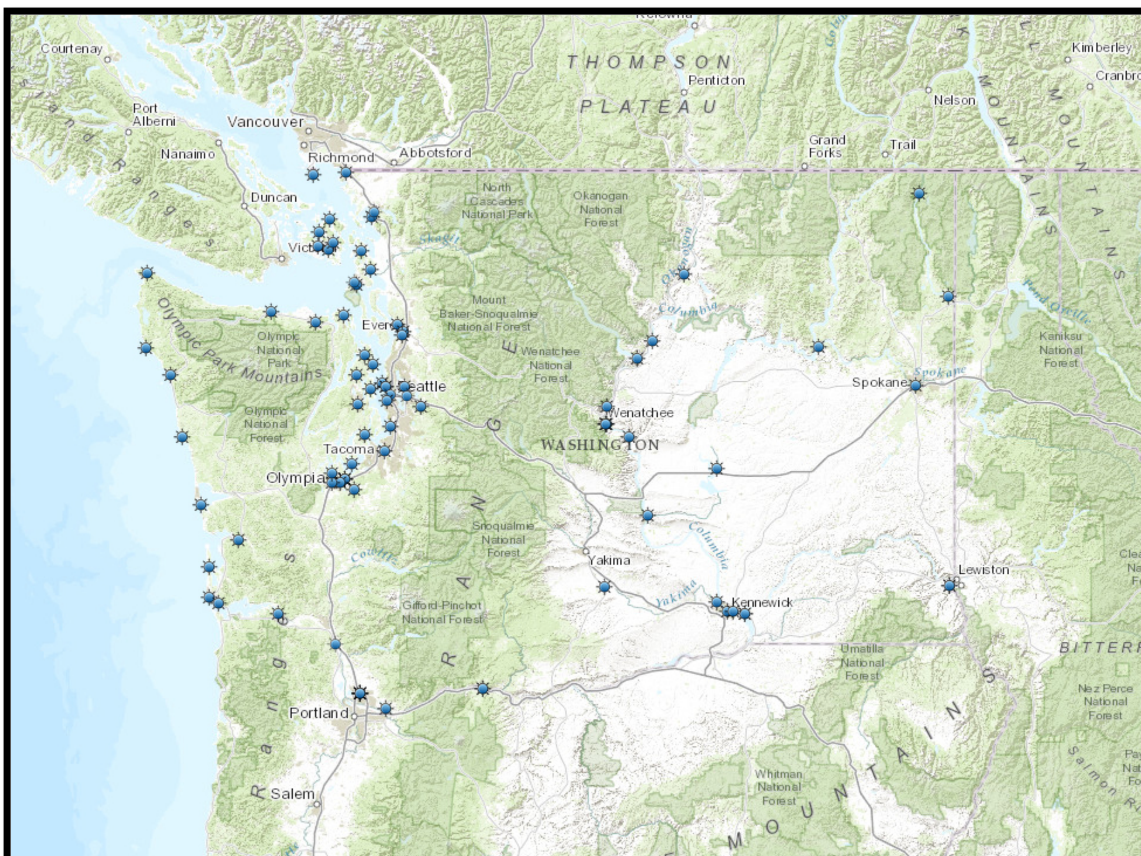

Figure 4.6 This ArcGIS map shows equipment trailers located throughout the state (Department of Ecology)

4.3.3 Equipment is the best available for the operating environments, environmental conditions, and potential spilled substances

Different types of response equipment are suited to different operating environments, weather conditions, and spilled substances. Equipment should be selected and tactics should be developed based on the conditions expected in a given area, ensuring that:

- *The best available technology is used.* It may be hard to agree on what is the "best" technology for a given purpose, and, in the best case, technological improvements will mean that this continues to evolve. There should be a mechanism for ensuring that those selecting and procuring response equipment are tracking — if not driving — technological changes and continually evaluating whether equipment upgrades would enhance recovery in their context.

- *Equipment is suited to potential operating environments and environmental conditions.* Different water depths, wave heights, winds, and other features that define the "operating environment" warrant different types of equipment and tactics.

- *Equipment is suited to the substances that may be spilled.* Most mechanical response equipment has been developed for response to conventional crude oil spills. Current oil spill tracking, containment, and recovery rely heavily on the spilled product staying on the surface of the water for it to be seen (either by people or with sensing technologies), contained, and recovered with a skimmer, burned, or chemically dispersed. If the oil sinks, which heavier oils are more likely to do, then these functions may be severely compromised, especially in deep water or when waves are present (Michel, 2006; BMT Cordah, 2009). Equipment should be selected or developed with an understanding of the likely fate of the products being transported if they are released into marine waters.

EXAMPLES. State of Alaska regulations require contingency plans to include a discussion of the best available technology and a comparison of its equipment to other available systems or technologies. The same regulations also specify that the State of Alaska should have a conference every five years to share examples of emerging technologies. While there are different views of what is "best," these requirements provide mechanisms that encourage periodic reevaluation and consideration of the equipment being used in light of new technologies.[26]

OPPORTUNITY. While WCMRC's stockpiled resources meet the federal requirements, its equipment capable of responding in the offshore environment is limited (see Volume 1). A future system for the west coast of Canada must consider more than just vessel numbers and size, but also the potential for

[26] 18 AAC 75.425(e)(4)

significant spills of different types of product, including heavy products such as heavy fuel oils and diluted bitumen. A better understanding is needed of how diluted bitumen will behave when spilled, and of diluted bitumen's persistence in the environment (Hollebone, 2012). A significant research effort, already underway, is needed to understand the fate and behavior of spilled diluted bitumen, and to develop suitable response measures. Industry seeking to move this product – thereby creating risk in the system – should take the lead on funding research and developing technology, but with extensive opportunity for independent peer review and government oversight.[27]

Figure 4.7 This conceptual diagram of the actual number of vessels involved in one location during the Deepwater Horizon on-water response shows the potential scale of response resources that may be involved in a major on-water recovery effort. (Deepwater Horizon Unified Command website)

4.3.4 Logistical support is in place to support the response

A major spill response will require significant logistical support, including command and control facilities, accommodations and food for response personnel, transportation of people and equipment, waste management, and communications. While many of these things will be readily available in a

[27] The joint industry-government program in Norway is one model. Another is the Arctic Oil Spill Response and Technology Joint Industry Program launched under the International Association of Oil and Gas Producers in 2012. For more information, see www.arcticresponsetechnology.org. A model similar to the latter approach would benefit from broader engagement by government regulators and rigorous independent peer review.

developed port area, significant planning and resources are required to ensure that these needs are met in a more remote location. Local facilities and infrastructure should be identified in advance.

EXAMPLES. The Prince William Sound Regional Citizens' Advisory Council has identified the equipment that would need to come from outside the region to mount a major response. This is one part of the logistical considerations that will be important (Gundlach and Reiter, 2001). The State of Alaska is also implementing a project to anticipate the resources and logistical support that would be required for a marine spill response in the Arctic (DeMarban, 2012).

OPPORTUNITY. Logistical support has been tested in limited ways in the north coast through CANUSDIX exercises, with deficiencies highlighted each time, especially in the north (see Volume 1; also note that the bi-national Joint Contingency Plan has been recently updated). Logistical support planning should be conducted by WCMRC with both federal and provincial government input to ensure the ability to track and recover oil, to get people and equipment on-scene quickly, and to sustain those people in remote areas for long periods of time.

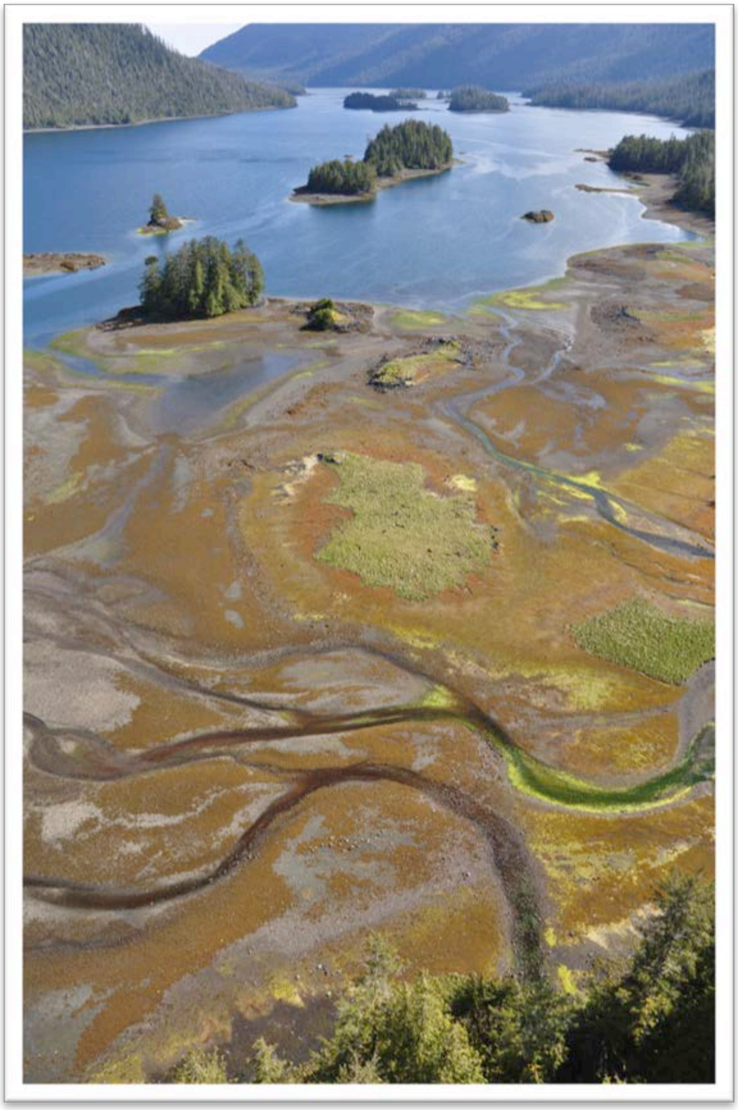

Figure 4.8 Spill response in remote areas such as Rose Inlet on Moresby Island, Haida Gwaii, requires additional planning to mobilize and sustain personnel, equipment, and vessels. (Photo credit: Mary Morris)

4.3.5 Spills can be detected, tracked, and modeled as needed to perform the response

An effective on-water response can only be implemented if the responders know where the oil is. They can find the oil with tracking buoys, satellite imagery, aerial surveillance (often with remote sensing equipment such as infrared, radar, or ultraviolet sensors), or visual observations from aircraft or vessels. Clouds, fog, and darkness may significantly hamper effective surveillance. Spill movements can be modeled to help responders anticipate what *may* happen, but ultimately visual tracking of the actual movement of oil is critical (Exxon Mobil, 2008).

EXAMPLES. Spill surveillance and tracking are common elements of contingency plans. Since no model is perfect, and visual surveillance may tell only part of the story (especially if hampered by clouds or darkness), the best picture of the way that oil is moving or expected to move may come from combining models and regular inputs from visual surveillance. Researchers at the University of Florida used this approach in predicting the trajectory of the Deepwater Horizon spill in the Gulf of Mexico. In describing this effort, they emphasize the importance of continuing to collect and update oceanographic data (Liu et al., 2011).

OPPORTUNITY. Canada's National Aerial Surveillance Program (NASP), discussed briefly in Volume 1, is an excellent resource to support spill response operations, since the program already dedicates aircraft to detecting oil spills. The Marine Aerial Reconnaissance Teams (MART) and Integrated Satellite Tracking of Pollution (ISTOP) can supplement NASP. Currently NASP has one aircraft dedicated to west coast operations and should consider whether additional planes are needed to ensure adequate coverage in light of vessel traffic increases or to provide services when the dedicated aircraft is undergoing maintenance. Environment Canada can also provide modeling to inform a response, but this will require accurate inputs based on an up-to-date picture of the situation.

4.4 Sufficient personnel are available to respond to a worst-case spill

Trained spill responders are critical to marine spill response. To realize full response capacity, there must be sufficient numbers of trained and (as appropriate) certified personnel who can be quickly transported to a spill site to operate response equipment, as well as people to take over later phases of the response or even just the next shift in the short-term. At its most basic, planning should include clear information on the number of personnel needed, where they will come from, and the level and type of training that each needs in order to mount a worst-case response.

4.4.1 Trained responders and response managers are available to staff a significant, prolonged response

The number of people required for a spill response will depend on its location, the extent to which shoreline is oiled (shoreline cleanup is typically more labor intensive than on-water operations), and, of course, the size of the spill. Historic numbers have ranged from more than 500 people during the peak of the response for a 450t spill to 10,000 people during the most labor-intensive period of the Exxon Valdez response (Exxon Mobil, 2008). (See Figure 4.9.) With turnover during the response, the total number of personnel involved may be even higher.

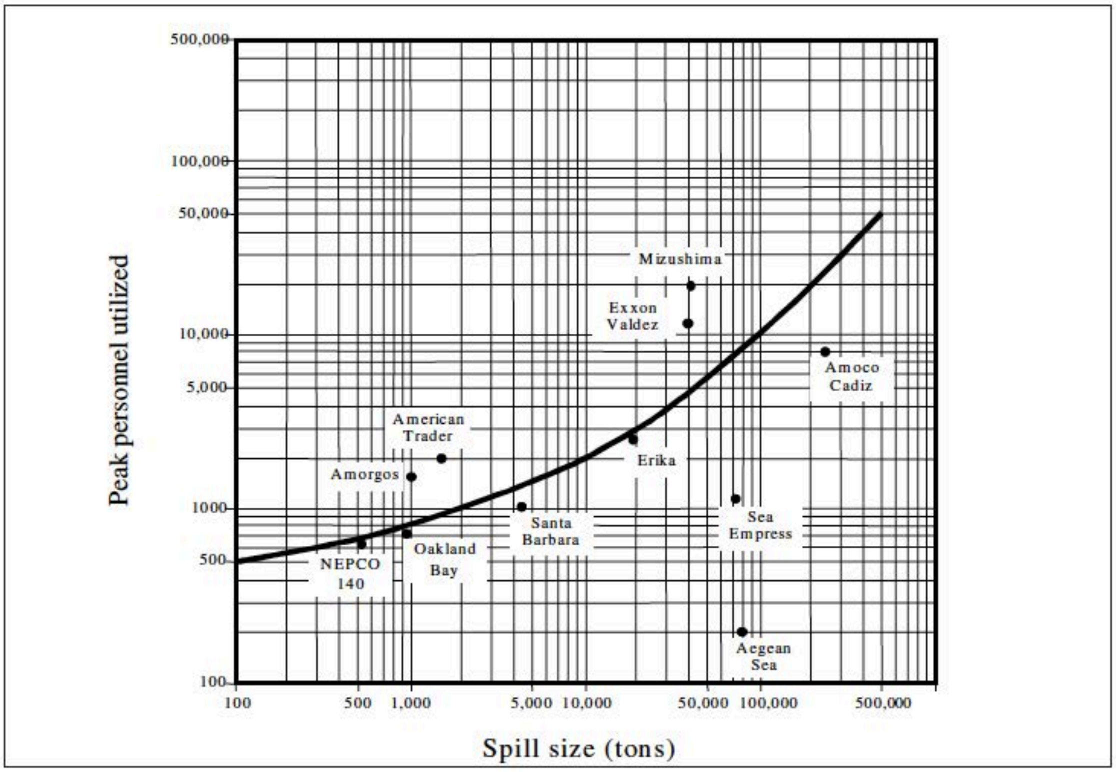

Figure 4.9 Estimated number of personnel required to respond to major oil spill based on past spills showing that upwards of 10,000 people could be involved in a major marine spill response its peak. Each person will require food, shelter, etc. (Exxon Mobil, 2008)

Rosters, including contact information and level of training, should be actively managed and frequently updated. The number of response managers and field responders in the roster of an organization, agency, or company that may be called to a spill response should be higher than the number needed to account for the fact that not everyone will be available at all times (key positions should have designated alternates). The number and qualifications of people needed should take into account the planned length of shifts, the manpower required for all aspects of the incident management system, and the feasibility of bringing new people to potential spill locations as needed.

Not only are fishermen likely to be among the most affected by an oil spill, but they are often among the best positioned to help, using their knowledge of local waterways, vessels, and marine operations to do everything from shuttling personnel to setting boom to recovering oil. Like any other responder, fishing vessel crews need to be trained to fulfill their assigned tasks safely and effectively. It is also important to have an accurate listing of vessels (including type) and personnel (including training and qualifications). When ensuring the number of crews and vessels that will be available during any given time, it is important to consider the potential fluctuation of vessels available depending on the fishing season and home port locations.[28]

[28] A local fishing season may be disrupted by a spill such that vessels are available to participate in the response, but in the off-season there may be fewer crew in the area.

EXAMPLES. Companies shipping oil through Prince William Sound, Alaska, rely on contracts with approximately 275 fishing vessels to meet their response requirements under state law. The fishing vessel program provides annual training in response operations and safety and maintains a database of fishing vessels and responders that is divided into three tiers based on vessel size and corresponding capability. Periodic exercises test planning assumptions and response readiness related to this program (RPG, 2012).

The Marine Institute at Memorial University in Newfoundland conducts a training program for interested members of the local fishing industry. This voluntary program provides an opportunity for fishing vessel crews to be trained in advance of a spill through a CCG-approved course. The program does not specify the role these vessels will play in a response nor does it ensure a certain level of readiness, but it does give interested crew the chance to contribute meaningfully if a spill response is necessary. (Rustad, 2011)

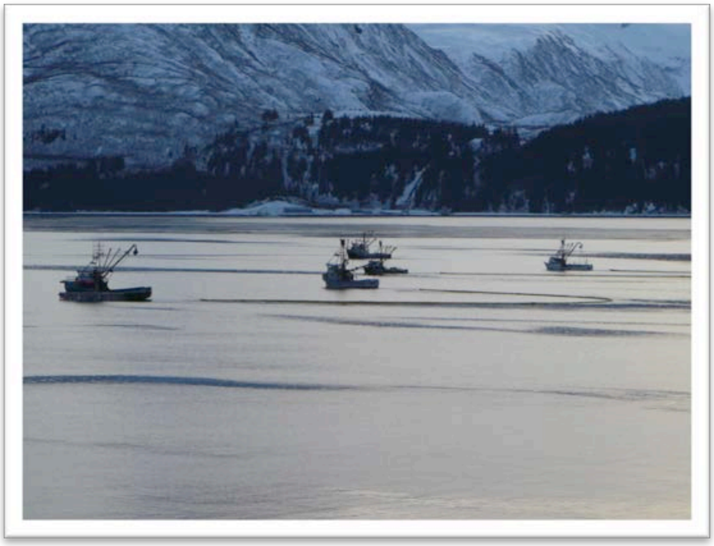

Figure 4.10 Fishing vessel crews practice boom deployment in Prince William Sound (PWSRCAC photo)

OPPORTUNITY. WCMRC's approximately 27 person full-time staff is supplemented by 100 fishing vessels and crew and 100 contractors trained annually to support full-timers as needed (WCMRC, 2012). The number of personnel required for a spill response will vary depending on the location (especially the extent of shoreline cleanup required) and other factors. While bringing personnel from out of the region is a viable strategy, the source, number, and qualifications (and how those qualifications will be deduced and/or verified) of the thousands of people who would be needed for a significant spill should be identified as part of the planning process. This can be demonstrated through a scenario in a contingency plan and tested periodically through unannounced call-out drills. Planning should include identifying where spill personnel will come from, how long it will take to mobilize them to a spill site, what mix of skills they will need, and how they will be trained (or their skills confirmed through a certification or previous training). Similar to fishing crews, not everyone will be available to respond at any given time so the roster of potential responders must exceed the number actually needed.

4.4.2 All responders and response managers use the same incident management system

For an effective, integrated response, decision-makers require a comprehensive picture of the situation. Additionally, personnel at all levels must have clear, implementable guidance to make quick decisions ranging from what on-water response tactic to implement to how much food to procure. The Incident Command System (ICS), originally developed to organize wildland fire fighters, is increasingly being used worldwide to respond to a wide range of emergency situations, including oil spills. This system is scalable to adapt to incidents of all sizes. When applied to oil spills, ICS is typically led by a Unified Command structure that facilitates joint decision-making and management by federal, provincial, and responsible party representatives.

EXAMPLES. The ICS structure and Unified Command is used throughout the US, by WCMRC, and at the provincial level in BC.

OPPORTUNITIES. While some federal agencies already use ICS and Unified Command, Transport Canada only recently announced a plan to adopt ICS (TC, 2013), though specifics about the timeline and training of personnel are not known. Transitioning to ICS and Unified Command would align the federal response system with that commonly used by industry and other governments, and provide a means of bringing the lead agencies and industry representatives together through the Unified Command.

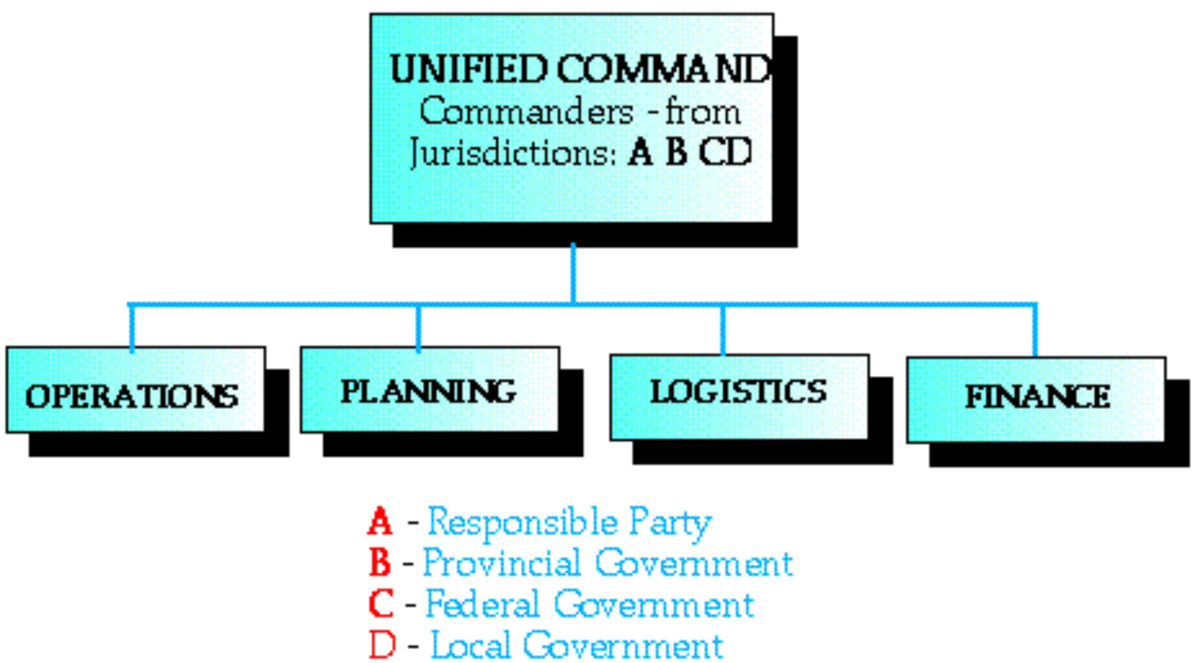

Figure 4.11 The ICS structure used by Environment Canada has a Unified Command including the responsible party, federal government, provincial government, and local government (Environment Canada website: http://www.env.gov.bc.ca/eemp/resources/icsintro.htm)

4.4.3 Responders are well-trained and regularly exercised

Response managers and response personnel must be trained to fulfill their necessary roles under tight timelines and often under extreme pressure. A response system should strike a balance between having a large number of people trained in advance and providing for training at the time of the response to account for the fact that some people are bound to need additional training to fill the necessary roles (IMO, 2010).

Training takes place in the field and in the classroom, or, increasingly, on online platforms. Ultimately, field training and a combination of classroom and online training is needed. For the organization, agency, or company responsible to deliver a certain number of personnel with the appropriate qualifications, training records should be kept up-to-date and training refreshed as needed, especially since personnel turnover can be a challenge (IMO, 2010). Since actual spills occur infrequently, all aspects of a response should be practiced regularly through a combination of planned exercises (in the field or "table top" exercises) and unannounced drills.[29]

Exercises should reflect the range of conditions in which a spill might occur and incorporate aspects of the response ranging from early actions like selecting a place of refuge and making initial notifications of a spill to how oily waste will be managed, wildlife rehabilitated, and shoreline cleaned several days or weeks into a response.

EXAMPLES. Many types of certification programs can be used to demonstrate responder capacity and skills. The key is to determine which programs are required and to ensure the programs are available and enough responders have completed them to fulfill the requisite functions. A regular program of drills and exercises is also important; see examples in Section 3.10.

OPPORTUNITY. Clear mechanisms should be established to ensure that responders being brought in are adequately trained and exercised. WCMRC should share information about their responder qualifications and a training program put in place with targeted numbers of people to receive each necessary type of training to ensure that there will be enough people to fulfill the required functions, whether they are in BC already or come from other areas.

4.4.4 Volunteers are managed to maximize their effectiveness

It is common for members of the public to want to help during a spill. Some volunteers will be affiliated with an organization, while others will show up independently. People who show up voluntarily may be engaged as such, or hired as a temporary workforce. This decision should be determined in advance, and a plan should be in place for managing volunteer participation in the response. All parties who may be involved in the process should have an understanding of the applicable laws, training requirements, logistical considerations (including tracking people and resources), health and safety needs, and applicable worker's compensation requirements.

[29] Drills are also important to verify planning assumptions and should be a crucial part of government oversight of responder readiness.

The contingency plan should anticipate, to the extent possible, the experience or skills of potential volunteers and how they will be kept safe, transported, fed, and maybe even housed, depending on the location (Tucker and O'Brien, 2011). Internet and media outlets can be used to tell the public what skills are needed and how and where people can help, and also can be used to issue cautions about the potential health effects of handling spilled oil without protective equipment (NRT, 2012). As with fishing vessels and crew, having a docket of potential volunteers with information about their location, skills, and abilities can facilitate effective management.

EXAMPLES. The US National Response Team developed guidelines for the use of volunteers after the Deepwater Horizon spill (NRT, 2012). After more than 1,200 people volunteered for the Cosco Busan spill response in 2007, the State of California created the California Volunteers Disaster Corps[30], which trains volunteers in a wide range of emergency management tasks. This program is not used only for spill response, and its method of tracking, training, certifying, deploying, and overseeing responders ultimately increases its success because it serves different kinds of emergencies.

OPPORTUNITY. There is no known plan in place to manage large numbers of people showing up voluntarily to participate in a spill response. WCMRC and the appropriate government agencies should ensure that a plan is in place, including determining whether or not volunteers would need to be converted to a workforce.

[30] See: http://www.californiavolunteers.org/disastercorps/

Figure 4.12 More than one million volunteers showed up to help with the Hebei Spirit spill cleanup in Korea in 2008, many without training or safety equipment. (Photo: http://english.chosun.com/site/data/html_dir/2007/12/10/2007121061005.html)

4.5 A process is in place to restore damaged resources and promote ecosystem recovery after a spill

The impacts of a large oil spill may be felt over weeks, months, years, or decades (EVOSTC, 2009). This reality needs to be acknowledged up front and a process put in place to determine whether impacts have occurred, to assess those impacts, to establish a restoration plan (if any), to implement that plan, and to monitor the results over time. Experts in the local ecology should be incorporated into all phases of the response, but particularly in determining cleanup and restoration plans and conducting post-spill monitoring (IMO, 2010). Having baseline information available about coastal resources and economic activity will facilitate the process of identifying impacts and determining restoration goals or cleanup endpoints. This relates to the inventorying of resources discussed in Section 3.4.1.

EXAMPLES. Restoration and compensation requires identifying the scale and nature of the damage attributed to the spill. This can begin as soon as the spill has occurred, or, better yet, can be put in place in advance of a spill to help identify baseline information about priority areas and anticipate data needs and tools for a response. In Washington state, agencies have used a risk assessment of Puget Sound and subsequent spill trajectory analyses to identify areas that would most likely be impacted by a spill and the resources there for remediation. (Lehto et al., 2011)

OPPORTUNITIES. A process should be created to identify, prioritize, develop, and monitor restoration projects and ensure that there is funding available for their full implementation.

5. WORLD-CLASS SYSTEM ELEMENTS

5.1 Government ensures compliance and transparency

Government must have strong enforcement mechanisms available in its oversight of any industry preparedness requirements. These may vary widely depending on the legal structure and approach of a given country. In addition, many parties have an interest in the effectiveness of a spill response in the areas they care about, and may have valuable information to provide. Sometimes this information can be most constructively channeled into the development of specific protection plans, but the opportunity for public review and comment on broader oil spill contingency plans provides transparency about the planning assumptions, the extent of resources available for the response, and how they will be used.

5.1.1 Government authorities review and audit industry contingency plans

Government authority to review and approve (and, if plans are insufficient, to reject) industry contingency plans establishes oversight over preparedness levels and assurance that the plan meets standards that protect the public's interest. Plan reviews should be rigorous and ensure that plans are actionable and practical, in addition to meeting planning standards on paper (Ornitz and Champ, 2002). Areas of weakness or uncertainty should be tested and improved through drills and exercises.

Contingency plans also should be available for public review and input. Plans can be made available for review simply by posting the latest version on agency or company/organization websites and having a public comment period.

EXAMPLES. US oil spill contingency planning regulations typically require an operator to periodically review and update them, and to submit those updates to regulators for review and approval. Alaska and Washington provide public comment periods as part of each plan review and renewal process (in Washington all planning documents are posted on the Department of Ecology's website; in Alaska they are made available upon request).

Public input can be invited in different ways: in Alaska, for example, a public comment period is built into state regulators' review of the plans during which interested members of the public or the organizations who represent them can review the plan and provide regulators with their comments and suggestions (18 AAC 75.455). Another approach, as is employed in BC's Recycling Regulation, is to require that private entities submitting plans (in this case to set up recycling programs) must use their own process for stakeholder input before submitting the plan to the Ministry. In this case, the Ministry allows flexibility in the approach, but recommends that the industry's draft plan be posted online for at least 45 days and that four meetings be held around the province for stakeholder input (BC Ministry of Environment, 2012).

OPPORTUNITIES. The WCMRC contingency plan is approved by Transport Canada. Rigorous evaluation of the ability to achieve at least a 10,000t response planning standard is needed, and this evaluation should factor in response times, limitations to response effectiveness, and the potential that spreading and weathering might diminish recovery rates. Capabilities and planning assumptions should be demonstrated though drills and exercises , and made accessible to interested stakeholders (see Section 5.1.2)..

The WCMRC contingency plan is not available for public review and there is no opportunity for public comment or input from other agencies. The Government of Canada announced in June 2013 that it intends to introduce measures in Parliament that would make emergency plans for offshore exploration and production activities available to the public (CBC, 2013); this same step should be taken for plans related to vessel spills.

5.1.2 Stakeholders are actively engaged

There are several types of organizations that typically seek to engage other interests with those responsible for spill response planning. The composition and funding of these organizations determines the nature of their interaction with these other interests and the contribution they will make to the overall success of the system. Such organizations exist along a spectrum: at one end, certain organizations focus on information sharing, perhaps to enhance the engagement of scientists in the response planning process or to facilitate communication about potential risk and planning activities to local communities; at the other end, organizations entirely independent of direct influence by industry provide “citizen oversight” of response operations that threaten their interests, or of all measures to prevent or respond to an oil spill.

EXAMPLES. Examples of engaged organizations include:

- *Sharing information and different perspectives:* Since the 1970s, the Sullom Voe Oil Spill Advisory Committee has provided input to oil spill prevention and response organizers at this northern United Kingdom terminal. Today, this group works closely with the Shetland Oil Terminal Environmental Advisory Group (SOTEAG), which conducts environmental monitoring, gives feedback on spill plans, and participates in exercises. SOTEAG is managed by a group of local officials, university experts, and industry representatives. Other members include area groups with an interest in natural resources and environmental protection, and observers representing the local port, power station, and Sullom Voe Terminal. SOTEAG brings in independent scientific experts to evaluate its monitoring efforts (SOTEAG, 2013).

- *Information and shared action between two industries:* One Ocean, in Newfoundland and Labrador, facilitates collaboration between the local fishing industry and oil and gas companies active in province exploration and production. One Ocean focuses on issues of interest to these two sectors, as opposed to a wider range of “public” interests. It is funded by the oil and gas industry, with in-kind contributions from the fishing industry (Rustad, 2011).

- *Citizen oversight:* Recognizing the role complacency played in the Exxon Valdez oil spill, the US Congress mandated that oil companies operating in Prince William Sound and Cook Inlet, Alaska, fund two Regional Citizens Advisory Councils (RCAC). The companies do not control the organizations beyond some limits on advocacy and litigation. The councils collaborate with government regulators and companies about oil spill prevention and response, even as most of the general public may not have the time or expertise to engage (Stephens, 1994). There has been discussion about creating RCACs in the Gulf of Mexico region and in the US Arctic.

Groups also vary depending on the geographic area of interest; in the current Regional Advisory Council structure in Canada, for example, there is one group for the west coast; in Alaska, the two citizens' advisory councils are focused on more targeted areas (Cook Inlet and Prince William Sound).

OPPORTUNITIES. The Regional Advisory Councils provide an opportunity for different stakeholders to collaborate and to observe drills. For more rigorous citizen oversight and involvement, a model along the lines of the citizen advisory councils in Alaska should be considered. The Alaskan model involves a staffed, fully-funded organization that can deliver oversight, community outreach and engagement, technical analysis, and research as needed. If this model is pursued, it will be important to ensure a reliable funding source. Also, there may need to be multiple groups to attend to the issues specific to different parts of the coast. A citizens' oversight representing municipalities and/or First Nations in a specific area could also provide valuable input to the provincial and federal agencies.

Figure 5.1 Community members from the Gulf of Mexico coast affected by the Deepwater Horizon oil spill region met with representatives from Alaska in June 2013 to plan for the establishment of RCAC in the Gulf of Mexico. (J. Brayton Matthews,* On Wings of Care *photo)

5.1.3 Effective enforcement mechanisms are in place

Enforcement will include oversight of the implementation of spill prevention and preparedness regulations, as well as ensuring that the party at fault in a spill is penalized accordingly. Enforcement mechanisms will vary depending on the legal regime under which a prevention and response system operates, but government regulators must have the ability to ensure that operators comply with all prevention, preparedness and response requirements. This may range from penalizing vessel operators for safety violations to auditing training records to conducting unannounced response drills or exercises to verify planning standards are being upheld.

Enforcement and penalties will vary under different legal regimes, but they must always be adequately funded (i.e., with enough inspectors) and designed to discourage violations.

EXAMPLES. In the European Union, individuals and companies may be tried as criminals for marine pollution incidents if their actions are found to be negligent or intentional.[31] In the US, criminal charges have been brought against individuals and companies for marine spills both before and after the Oil Pollution Act of 1990 made it illegal to discharge oil into US waters. Additionally, spill liability limits are lifted in cases of willful negligence or gross misconduct (Richardson, 2010; Nixon et al., 1999).

OPPORTUNITY. The Government of Canada announced in March 2013 that it would review its enforcement mechanisms and penalties (TC, 2013). This review should encompass prevention and response, and should ensure that clear standards are set and that oversight agencies have the resources needed for enforcement.

Figure 5.2 After the 1996 North Cape barge oil spill in Rhode Island, criminal penalties were levied against the companies that owned the barge and the tug involved, as well as the president of the barge company and skipper of the tug. (E.R. Gundlach photo)

[31] Directive 2005/35/EC,

5.2 All parties actively pursue continuous improvement through research and development and the testing of planning assumptions

A spill response system will only remain world class with ongoing innovation and improvement. A research and development program should therefore be integrated into spill response planning to provide an opportunity to test and apply new technologies. New approaches to response management should also be considered periodically, such as the emerging potential of social media to gather information about a spill and to communicate with the public (Baron and O'Leary, 2011). Planning assumptions must continually be tested and revised based on lessons learned from exercises, drills, actual responses, and changes to the context like new operations or new products being transported.

5.2.1 A research and development program is in place

As the technology for the extraction and transportation of oil advances, so must the technology used to respond to oil spills. The financial drivers for technological development in this area are less predictable than for other markets due to the unpredictability and infrequency of large spills, so a concerted effort by both the public and private sector is needed.

EXAMPLES. In Norway, the "Oil Spill Response 2010" initiative created a public-private partnership to "address the continuous need for better and more effective oil spill response technology" (Jensen et al., 2011). NOFO, the industry response organization in Norway, committed to purchasing the first unit of any resulting technologies that achieve commercialization, but the developing enterprise was expected to commit at least one-third of funding (while retaining intellectual property rights) (Jensen et al., 2011). The XPRIZE Foundation in the US ran a competition to develop response technologies, eventually awarding $1.4 million to two teams for their spill recovery technology (XPRIZE Foundation, 2011).

OPPORTUNITY. A goal-oriented research and development program should be created and funded by industry, with government primarily acting in an oversight capacity. This could also be done collaboratively at the regional, national, or international level. Efforts already underway to understand the fate and effects of petroleum products such as diluted bitumens can support the development of new response technologies (or selection of the best existing technologies).

Figure 5.3 The Elastec / Marine team won the $1 million XPRIZE for its on-water recovery device. (photo courtesy of XPRIZE Foundation)

5.2.2 Planning assumptions are verified through exercises, field trials, and drills, and plans are updated to reflect lessons learned

A robust oil spill exercise program will help foster a strong responder base and encourage realistic assumptions in spill response plans. Planned exercises, unannounced drills, and actual oil spills all provide an opportunity to test and verify contingency plans and responder readiness. When a contingency plan is used during a real or simulated event, planners and responders gain insight into how well the plan functions. Field trials, drills, and exercises can all help to identify weaknesses in the system, whether related to the placement or use of equipment, environmental conditions, or other factors.

The Washington Department of Ecology oversees plan holders' implementation of a three-year drill cycle in which up to 15 different drill objectives are tested and the results incorporated, as needed, into their contingency plans.

Lessons learned should inform revisions to the contingency plan and direct future research and development efforts. Unfortunately, this critical feedback loop is not always realized. This is particularly true for lessons learned by individual operators because there are few mechanisms in place to allow regulators or other operators and responders to learn from each other's experience (Franks et al., 2011). This learning process starts with documenting what happened in the exercise itself, but cannot stop there (Franks et al., 2011). Drill and exercise requirements for industry are likely to be specified by government, whether at the statutory, regulatory, or policy level.

EXAMPLES. The Washington Department of Ecology oversees plan holders' implementation of a three-year drill cycle in which up to 15 different drill objectives are tested and the results are incorporated, as needed, into their contingency plans. The Department's strategy specifies that conducting a *variety* of trials is important to foster "realistic and robust drills that fully test the effectiveness of oil spill plans" (Washington Department of Ecology, 2012).

OPPORTUNITY. WCMRC, as the sole marine oil spill response organization for Western Canada, is required to include an exercise strategy in its contingency plan. A set of unplanned drills should also be conducted, and specific planning assumptions should be identified that need to be tested or demonstrated through exercises.

5.2.3 Incident reviews support continuous improvement

Since large spills are infrequent, it is important to learn as much as possible when they do happen. Lessons learned from actual spills must be shared widely and incorporated into planning . Reviews should be public and should consider all aspects of the response. A review may be voluntary or required by regulation, and it is only a first step: changing planning, practices, or technology to build on lessons learned from the review is critical.

EXAMPLES. US Coast Guard policy requires an Incident-specific

Preparedness Review (ISPR) that involves outside reviewers who have substantive expertise related to the event but who were not directly involved in the event (USCG, 1997). The ISPR from the Deepwater Horizon spill in the Gulf of Mexico has informed this report.

OPPORTUNITY. Transport Canada and the CCG should commit to conducting an incident review with reviewers who were not directly involved in the response if a major spill ever occurs.

5.2.4 Data on spill causality and "near misses" are compiled, analyzed, and used to inform changes to system

Compiling and analyzing data on oil spills and "near misses" that could have resulted in oil spills can inform efforts to prevent future spills. To help prevent a spill, data must include uniform and reliable information about the underlying cause or causes of the incident.

Most government databases only include spills above a certain size and may not have adequate information about causes to identify trends. Entry fields in these databases are often too simplistic to capture the many and often highly nuanced causes underlying an incident or accident, and entries may not be updated after an investigation reveals more information (Grabowski, 2005).

Also, data collection should include near-misses because incidents that could have resulted in a spill can highlight weaknesses in a system, even if no spill occurred (Heinrich, 1931). But while the IMO requires shippers to collect near-miss data, they are not required to share this information (IMO, 2002a).

Whether comprehensive data including near-misses is collected or the data is limited to actual spills, the information should be publicly available. Regulators and companies should analyze the data periodically to determine whether changes in procedures, training, or equipment would prevent similar incidents in the future without causing unintended consequences elsewhere in the system.

EXAMPLES. The Pacific States/BC Oil Spill Task Force developed an agreement among its US members in 1997 to incorporate specific terms, data fields, and oversight into its databases on spill incidents using a shared "Data Dictionary." The agreement was updated in 2012 (Pacific States/BC Task Force, 2012).

OPPORTUNITIES. BC has been an observer to the process in the Pacific States/BC Oil Spill Task Force. By joining this effort, BC would facilitate future causal analysis and comparison of lessons learned with US states to the north and south.

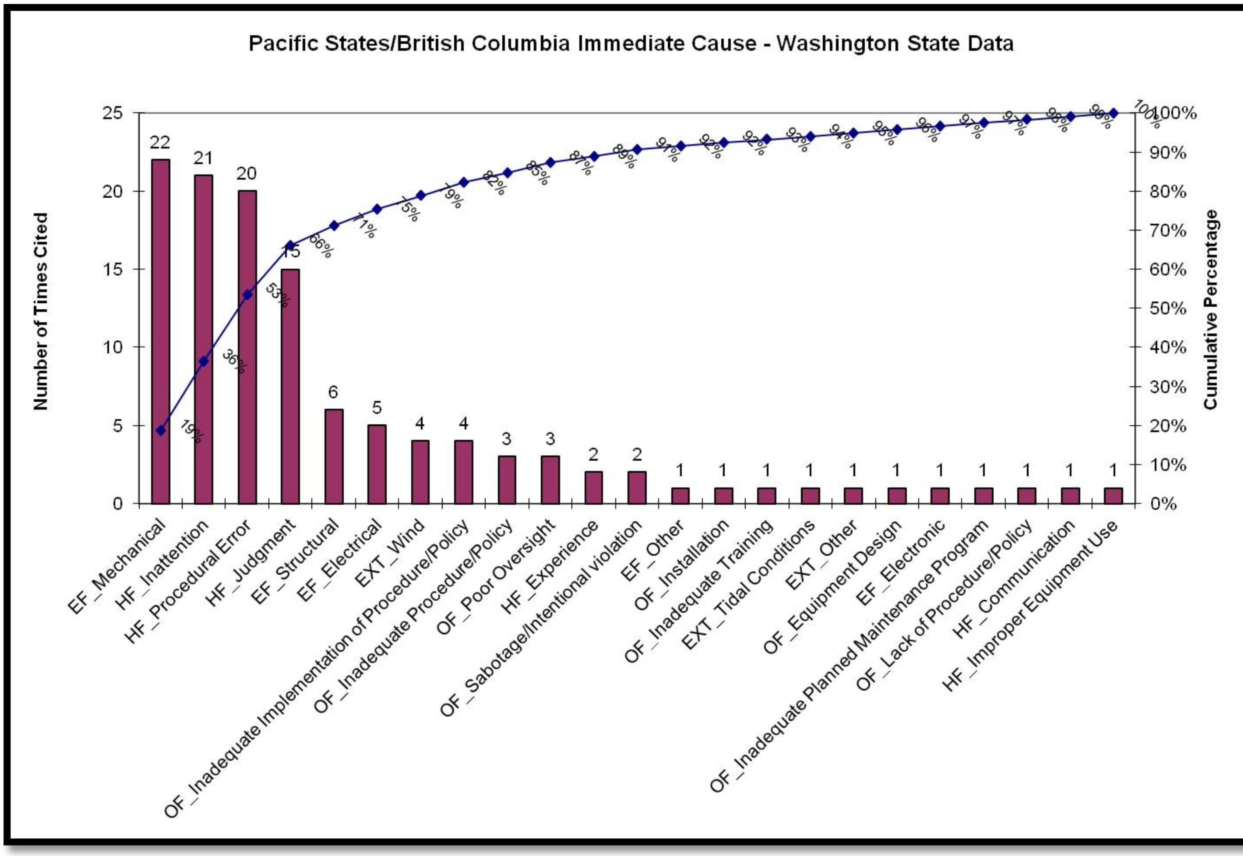

Figure 5.4 The development of a "data dictionary" that set standards for assigning spill causality has facilitated more in-depth exploration of spill trends in Washington State. (Washington Department of Ecology)

5.3 Financial mechanisms and resources meet needs from initiating the response through recovery

An oil spill will have direct and indirect costs that are likely to be borne by diverse parties ranging from the polluter to government agencies participating directly in the response to communities unable to access resources and ecosystem services as they usually would.

5.3.1 Sufficient funds are available from industry and/or government to fully implement planning, response, and recovery

The responsibility of the "polluter," or ship-owner, to pay for the consequences of the polluting incident has become widely recognized under the polluter-pays principle (OECD, 1972), and is applied to marine oil spills in several countries including Canada (Veiga, 2004). Ultimately, preparedness, response, and recovery or restoration are paid for through a combination of complex mechanisms including industry fees to WCMRC (for preparedness) or to WCMRC or another entity to implement a response, industry payments to cover costs incurred by others during a response, and federal and international funds in place to cover costs that exceed industry's liability or where there is not a responsible party or that party is unable to pay.

Where the polluter-pays approach is applied (and where the polluter is known), sufficient funding must be available from the company or its insurers and liability limits, if any, must be high enough that the response is fully implemented and communities are compensated for both direct and indirect losses.

Government also has ongoing costs associated with overseeing industry's preparedness in a system based on the polluter-pays principle and ensuring its own high level of readiness. Government activities may be funded through taxes collected from industry (such as a tax per quantity of oil shipped to or from a certain port) or the public.

EXAMPLES. Like Canada, the US also applies the polluter-pays approach. In the US, shippers are responsible for having a certain level of spill response preparedness in place and the federal government maintains an Oil Spill Liability Trust Fund paid for by a per-barrel tax on oil that is produced in or imported to the US The fund is used to pay for both emergency and on-going activities that exceed or fall outside of the responsibility of operating companies' obligations under the polluter-pays system. These expenses include, but are not limited to, federal government costs to oversee spill preparedness activities or to maintain their own readiness, spill response activities implemented by government, and compensation for spill impacts. The US government increased liability limits for vessels in 2006 and is revisiting the limits again after the Deepwater Horizon spill (albeit from a different industry) to ensure the fund remains adequate. Other options proposed include increasing the per-barrel tax and including the actual owner of the oil as a liable party (Fleming, 2010).

OPPORTUNITY. The Government of Canada announced in March 2013 that it would review liability and compensation rules for oil spills by the fall of 2013 (TC, 2013). This was followed by the announcement in June 2013 that it intends to introduce a measure to increase liability limits for companies with offshore exploration and production activities (CBC, 2013). Limits for marine vessel spills, currently established in the federal Marine Liability Act,[32] should be revisited as well.

The relationship between the Act, the implementation of the Ship-source Oil Pollution Fund, and the province's Spill Cost Recovery Regulation[33] should be examined to ensure that the polluter-pays principle will be fully implemented in practice and that all parties suffering losses from the spill will be duly compensated.

Funding to ensure an adequate level of preparedness by both government and industry needs to be considered as well. If the level of preparedness expected of WCMRC and the government is increased to achieve a world-class system, additional funds from industry to WCMRC may be needed.

[32] S.C. 2001, c. 6, Sec. 51
[33] B.C. Reg. 321/2004

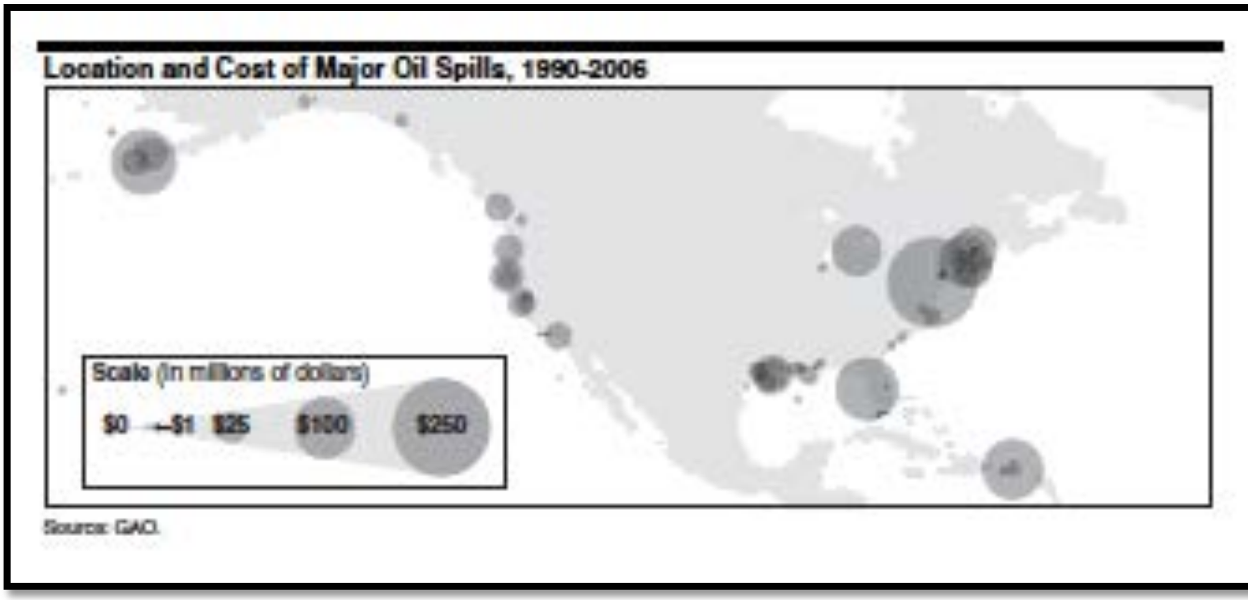

Figure 5.5 The US government estimated the costs of major oil spills in US dollars from 1990 – 2006; this does not include Deepwater Horizon, which will have significantly higher overall costs than these historic spills. (GAO, 2007)

5.3.2 Fair compensation is awarded for environmental, fiscal, and social impacts

Communities affected by the spill may suffer a wide range of impacts and so should be fairly compensated for their losses. In some cases, measuring costs (especially non-market costs) can be challenging, and agreeing on what constitutes "fair" compensation even harder. A process should be established to identify these losses, establish a monetary value of the losses (or other compensation like a restoration project), and ensure compensation is delivered. This process can coincide with the assessment of natural resource impacts for the purposes of restoration, but should also encompass social impacts.

EXAMPLES. Currently in the US, B.P. continues to compensate parties for losses resulting from the Deepwater Horizon oil spill. The company has paid $8.2 billion to individuals and businesses and $1.4 billion to government agencies since 2010[34] (BP, 2013).

OPPORTUNITY. A process should be established to assess losses and award compensation; doing so outside of lawsuits can actually reduce costs overall and allow the benefits to reach even those who do not have the resources to or interest in filing a lawsuit.

[34] Some of the funds to government are reimbursement for expenses incurred during the response, not compensation for damaged resources or associated losses.

6. SUMMARY OF RECOMMENDATIONS

This section summarizes the opportunities to enhance the marine spill prevention, preparedness, response, and recovery system that were identified in Sections 3-5.

While these recommendations are fairly high level, each will require actionable plans, timelines, and parties responsible for its oversight. Some of the following recommendations can be implemented immediately, while others require changes in regulation or policy. Some necessitate additional analysis to ensure that the intended purpose is achieved without creating unintended consequences. For example, a rescue tug that is not able to arrest a drifting containership of the size expected would not achieve the intended purpose of having a rescue tug. (It is outside the scope of this study to conduct this level of analysis.)

The tables below list the characteristics of a world-class response and summarize the recommendations related to each described in Sections 3-5. A color-coding system is used to present our assessment of the extent to which each characteristic is currently achieved on Canada's west coast.

	Feature is not present or is minimally present
	Feature is partially present, or is present but likely to require enhancement
	Feature is mostly or fully present

Table 6.1. Summary of recommendations related to PREVENTION elements

FEATURE	ASSESSMENT	OPPORTUNITY
Vessel operations surpass international safety and spill prevention standards		
Vessels meet or surpass international requirements		Foreign vessels visiting BC's ports are likely to be flagged to countries that are ranked fairly well by the Paris Memorandum of Understanding Port State Control program may need to be scaled up as vessel traffic increases Continue to track and report the number of vessel inspections and the results of those inspections
Vessels operate in a corporate safety culture that goes beyond compliance		Harmonize with existing incentive/recognition programs in neighboring jurisdictions Adopt Green Award or other incentives in ports beyond Vancouver
Vessel traffic is monitored and, in higher risk areas, actively managed to prevent accidents		

FEATURE	ASSESSMENT	OPPORTUNITY
Vessel movement data is compiled and archived for analysis		Improve accuracy and quality of AIS data and integrate with other databases if possible Make MCTS readily available for analysis Periodically analyze vessel traffic data for trends and to evaluate prevention measures
Vessel traffic is actively managed in high-risk areas		Consider which measures used in the Vancouver area will be warranted farther north as traffic changes; based on risk analysis and understanding how they have worked in Vancouver/Georgia Strait
Marine pilots are required for large vessels transiting certain waterways		With the Pacific Pilotage Authority, determine the number of pilots needed for future traffic and implement a plan to ensure there are enough qualified pilots available
Escort vessels accompany certain vessels in high-risk operating areas		Analyze whether changes in vessel traffic in the north warrant escorts in some areas, and whether escorts should be used for large vessels in addition to laden oil tankers
Rescue and salvage resources can be on-scene quickly enough to be effective after an incident or spill		
Emergency towing resources are available for rapid deployment		Determine how rescue towing will work along the coast, whether with an escort or dedicated rescue tugs or tugs of opportunity
Marine firefighting resources are available for rapid deployment	Not determined	Determine how marine firefighting needs will be met throughout the area, including with what resources, by whom, and in what timeframe
Salvage resources are available for deployment as needed to be effective		Determine how salvage needs will be met throughout the area, including with what resources, by whom, and in what timeframe
Potential places of refuge are identified in advance		Identify potential places of refuge *in advance* to streamline decision-making when a vessel is in distress Incorporate input from key stakeholders and integrate with spill response planning and resource placement

Table 6.2. Summary of recommendations related to PREPAREDNESS elements

FEATURE	ASSESSMENT	OPPORTUNITY OR COMMENTS
Geographic areas are prioritized for protection from oil spills		
Marine and coastal resources are inventoried		Inventory coastal resources by updating and validating existing databases and by creating geospatial data management tools to overlay sensitivity data with response planning and management tools
A process is in place to prioritize areas for spill protection		Establish an inter-agency, or, better yet, multi-stakeholder process to develop a shared prioritization of areas for protection
Areas to be avoided are established as appropriate		Consider establishing additional areas to be avoided and/or vessel routing Consider applying existing tanker exclusion area to other vessels (beyond just those laden tankers traveling south from Alaska) based on a risk analysis and prioritization of sensitive areas
Geographic response plans are developed as appropriate		Make existing WCMRC area plans available and increase, enhance, and test them, as appropriate, with input from diverse stakeholders Develop GRP for areas of the coast not currently covered by WCMRC area plans GRP should be incorporated into planning documents and made publicly available
Contingency planning is comprehensive, integrated, and understood by all relevant parties		
Planning is integrated across jurisdictions and sectors		Establish a standing committee or other structure to engage all government agencies in a cohesive planning process with transparency and opportunity for input from other groups
Contingency plans address all major spill response functions	Not determined; plans not available	WCMRC's contingency plan houses the critical operational details upon which a successful response depends, but it is not available for public review. It should be made available and assessed. A short series of unannounced drills could be conducted to test shippers familiarity with the notification procedures and plan (shippers are not otherwise responsible for any aspect of responding to spills from their vessels in BC).
Response planning standards ensure sufficient response capacity to respond to a worst-case spill		Increase the response planning standard of 10,000t and establish more aggressive response timeframes for the entire coast Review the method for determining compliance with the standard to ensure that it considers storage capacity, type of product, and the spread of spilled oil, among other factors

FEATURE	ASSESSMENT	OPPORTUNITY OR COMMENTS
Response operating limitations are identified and mitigation measures established		Conduct a response gap analysis for key shipping routes along the coast to understand how often ships are moving through areas where an effective response could not be occur Acknowledge response limitations in planning and identify mitigation measures or alternatives that will be employed when those limits are exceeded
Operational tactics are defined	Not known; guide not complete or not available for review	WCMRC tactics guide should be public and analyzed to ensure that response resources are cached appropriately to implement the tactics
Sufficient equipment can be deployed quickly to respond to a worst-case spill		
Response inventories are up-to-date, accessible, and accurate; resources are tracked during a response		WCMRC has gone above and beyond the required amount of response equipment, and provides its inventory in the WRRL and on its website. Clarity is needed about the CCG resources that would be available for a response in BC. A process should be put in place for tracking resources *during* a response, if one is not already included in contingency plans.
Response caches are strategically located, stocked, and maintained		WCMRC has located some equipment on the north coast, despite the fact that they are not required to do so. However, as presented in Volume 1, the response resources remain inadequate and additional analysis should be conducted to determine the level of resources needed and the best place to locate them.
Equipment is the best available for the operating environments, environmental conditions, and potential spilled substances		Increase resources suitable to open water and offshore conditions Demonstrate the ability to respond to a spill of heavy oil
Logistical support is in place to support the response		Develop publicly available scenario or plan to ensure that adequate logistical support is available for a significant spill response even in remote areas. (If this is already included in WCRMC plan, it should be vetted by a multi-stakeholder group.)
Spills can be detected, tracked, and modeled as needed to perform the response		Can be considered to be mostly in place Existing surveillance programs should be included in spill response planning, if they are not already Consider whether additional aircraft are needed to provide coverage to entire west coast in case of increased shipping
Sufficient personnel are available to respond to a worst-case spill		
Trained responders are available to staff a significant, prolonged response		WCMRC should identify additional spill response personnel, including where they will come from Test availability of sufficient personnel periodically through unannounced call-out drills

FEATURE	ASSESSMENT	OPPORTUNITY OR COMMENTS
All responders and response managers use the same incident management system		Federal government should transition to using the ICS structure with a Unified Command, including a plan to train personnel as needed
Responders are well-trained and regularly exercised	Not clear	Establish process to ensure the qualifications of outside responders, and share information about the qualifications and training of response organization personnel
Volunteers are managed to maximize their effectiveness		Establish plan to manage large numbers of volunteers or to convert them to a workforce
A process is in place to restore damaged resources and to promote ecosystem recovery after a spill		
A process is in place to restore damaged resources and promote ecosystem recovery after a spill		Create a process to identify, prioritize, develop, and monitor restoration projects and ensure that there is funding available for their full implementation

Table 6.3. Summary of recommendations related to elements of the SYSTEM

FEATURE	ASSESSMENT	OPPORTUNITY OR COMMENTS
Government ensures compliance and transparency		
Government authorities review and audit industry contingency plans		Rigorous evaluation of the ability to achieve a 10,000t (or, ideally, larger) response planning standard is needed WCMRC contingency plan should be available for public review and input
Other stakeholders are actively engaged		Consider establishing regional advisory councils based on the Alaska model to complement existing groups
Effective enforcement mechanisms are in place		Enforcement mechanisms should be reviewed with a focus on Port State Control inspections
All parties actively pursue continuous improvement through research and development and the testing of planning assumptions		
A research and development program is in place		A goal-oriented research and development program should be created and funded. Results from the recently announced Department of Fisheries and Oceans contract to develop spill countermeasures should be widely shared.

FEATURE	ASSESSMENT	OPPORTUNITY OR COMMENTS
Planning assumptions are verified through drills and exercises, and plans are updated to reflect lessons learned		Specific planning assumptions should be identified that need to be tested or demonstrated through a combination of planned exercises and unannounced drills
Incident reviews support continuous improvement		Transport Canada and the CCG should commit to conducting an incident review if a major spill ever occurs Incident review(s) should be made public and should be conducted by experts who did not participate directly in the response
Data on spill causality and “near misses” are compiled, analyzed, and used to inform system changes		Data should be compiled according to the format recommended by the Pacific States/BC Oil Spill Task Force
Financial mechanisms and resources meet needs from initiating the response through recovery		
Sufficient funds are available from industry and/or government to fully implement planning, response, and recovery		Liability limits should be significantly increased to reflect potential spill costs, or should be eliminated completely
Fair compensation is given for environmental, fiscal, and/or social impacts		A mechanism should be created to assess losses and to award compensation

7. DISCUSSION

Driven primarily by federal mandates and port-specific planning, the west coast of Canada currently benefits from several marine oil spill prevention, preparedness, and response-related initiatives. However, there is a shared commitment from government and industry to ensure that this system achieve "world-class" status. In this report, we have identified many areas of improvement that we hope will add to the ongoing conversation.

While the focus of this report has been the 11 features of a world-class system that we have developed, we also offer high-level recommendations that relate to the processes, relationships, and context in BC according to our own observations.

7.1 World class cannot be achieved overnight, but can start today

A world-class system cannot be created overnight and, in fact, will never really be complete. Determining which gaps are most important to fill and exactly how to fill them will take time and, in some cases, additional analysis or changes to regulations.

7.1.1 Prioritize activities by level of complexity and resource requirements

Although it will take time to achieve a world-class system, items that do not require additional analysis or significant resources should be implemented in the near-term. As discussed in Section 7.2, making key documents publicly available would be a relatively simple first step. GRPs can be developed and tested with input from key stakeholders following processes that have been developed and refined in other jurisdictions. Even without establishing a standing committee, a workshop or forum such as the symposium on land-based spills held in March 2013 could be held to start the process of communicating across organizational boundaries. "Low hanging fruit" items should be identified and implemented as soon as possible.

7.1.2 Recognize that world class is necessarily dynamic

Because continuous improvement is one of the features of world-class planning, and readiness requires constant vigilance and regular maintenance, a world-class system will never be "finished." Research and development should bring new tools into the picture. The incorporation of lessons learned from drills or actual spills into planning documents should continue to improve upon the uses of the tools available. World class is more than a single report, study, or workshop, and the results of such efforts will have more meaning if they are cohesive and iterative.

7.2 World class relies on a shared vision and plan of action

At its most basic level, a shared vision cannot be achieved unless there is a shared understanding of the current system and the ways it should be enhanced. Over the past several months of researching and considering marine oil spill prevention and response on Canada's west coast, we benefitted from the willingness of many agency officials to provide information about their efforts and programs. In addition, many resources at the federal level were readily accessible on the Transport Canada website. However, some key documents and pieces of information were neither accessible to us nor to those at the provincial level in British Columbia who are concerned about potential impacts to their coastal resources. While the hesitation to share "works in progress" or to acknowledge shortcomings is understandable, better transparency is necessary for effective collaboration.

7.2.1 Integrate current efforts

There are several agencies and levels of government responsible for oil spill prevention or response, and even more agencies and organizations that steward resources that could be impacted by a marine oil spill on the west coast.

It is apparent that communication among agencies on these issues is extremely limited. Enhanced information-sharing would be an important first step towards developing a world class strategy and a road map for how to get there.

The recently created Tanker Safety Panel represents an important effort to gather information from different perspectives, including through interviews and a public comment period. Additionally, a pan-Canada marine spill risk assessment was announced in February 2013 by Transport Canada. Many recommendations have already been cataloged in recent reports and audits of spill response capacity in BC, including by the Commissioner of the Environment and Sustainable Development (2010), the Pacific States/BC Oil Spill Task Force (2011), and Living Oceans Society (EnviroEmerg Consulting Services, 2008). It is important that these studies interrelate to facilitate a shared vision of any system improvements, a realistic and implementable timeline for achieving changes, and a mechanism for evaluating whether they are achieving their intended purposes.

7.2.2 Build on existing efforts to strengthen cross-border collaboration

There is also extensive opportunity and need for coordination across the Canada-US border. Not only are many of the largest vessels passing through BC's waters essentially exempt from the requirement to pay fees to WCMRC because the are on their way to or from US ports instead of BC ports (see Volume 2), but jurisdictions in both countries are, and should be, concerned about the potential increases in vessel traffic in the future. (An Aleutian Islands Risk Assessment is contemplating the increase in shipping from western North American ports, and Washington is conducting a Vessel Traffic Risk Assessment.)

On the west coast of Canada, it is very likely that resources in the US are closer than those in other parts of the country. Given the number of vessels passing near the BC coast en route to US ports (see Volume 2), it is also very possible that spill impacts felt in BC could result from a vessel traveling to or from the US There is an opportunity to further build on the decade of work by the Pacific States/BC Oil Spill Task Force to enhance preparedness and response across the west coast of North America. In 2011, this group released a set of recommendations based on extensive workgroup effort. These recommendations address general response issues as well as challenges to implementing a trans-boundary response; many of the former are included here. While cross-border response has not been the focus of this study, the success of such a response could make a significant difference to the protection of BC's coastal resources.

The Task Force will re-visit its recommendations in 2016 (Pacific States/BC Oil Spill Task Force, 2011). In the meantime, this resource should be used today to identify areas that require additional effort to implement the recommendations, and to create a timeline and action plan for their implementation.

7.2.3 A layered approach is needed to incorporate local efforts into a cohesive whole

Local efforts are critical building blocks, but without a vision of how they come together, the pieces will not combine to make a cohesive and resilient whole.

To date, port areas have been a focus of prevention and response preparedness efforts on the west coast. This is demonstrated both in the way that the response organization timeframes are defined using "Designated Ports" as the areas requiring the fastest response times for equipment deployment (see Volume 1), and also through the initiative taken at the port level to establish prevention measures and to anticipate and mitigate future risks. The Prince Rupert Port Authority (DNV, 2012a) and Port Metro Vancouver (DNV, 2012b) have both initiated studies to inform their understanding of the risks posed by current and anticipated vessel operations. To their credit, the ports have made these studies more readily available on their websites than have much of the pertinent federal agencies that hold information about spill response planning and resources.

While ports and other groups with interest in a specific area (such as regionally based citizens' advisory councils or First Nation groups, for example) attend to the local-level issues of concern, it is the role of the provincial and, ultimately, federal agencies to take the big picture approach and ensure that appropriate level attention and resources are committed to the west coast and seaward through Canada's Exclusive Economic Zone.

7.2.4 Develop and commit to a coordinating mechanism

After achieving a baseline level of transparency, a coordinating structure such as a standing inter-agency or multi-jurisdictional committee can further enhance the system by reviewing and considering changes to prevention measures and response preparedness. Such a structure would provide a mechanism to incorporate new information and lessons learned into the system. This could be fostered at the local level through a Harbor Safety Committee-type organization and/or citizen's advisory council, but should also be considered for the entire coastline as part of the layered approach referenced in Section 7.2.3.

7.3 World class requires self-awareness

Achieving a world-class system requires closely examining strengths and weaknesses, evaluating the ways that the system can be improved, determining how that will happen, and creating accountability to ensure that it does. Responses to the rare oil spill often leave the public frustrated and concerned that "more could have been done" to prevent, prepare for, or respond. It is therefore the shared responsibility of all key players to critically examine existing systems to ensure that the public understands what can and cannot be done after marine oil spills.

An important common element to many of the assessment tools and best practices discussed in Section 2 is that they all provide a mechanism to continually compare results against past performance or desired future outcomes, to adjust the system, and to ultimately progress toward some defined state. Today's recommendations *should* seem stale tomorrow, as progress is made and as "best" or "world-class" standards in the field evolve.

8. CONCLUSION

The BC government has established the goal to realize a world-class marine oil spill prevention, preparedness, and response capacity in western Canada.

The purpose of this three-volume study was to provide an objective, external analysis of the system currently in place (Volume 1, Marine Oil Spill Prevention and Response Capacity Assessment), describe the level of oil spill threats from present and future vessel activities (Volume 2, Vessel Traffic Analysis), and, with this final report, to offer a baseline assessment of both the capabilities and limitations of the current system, with recommendations for filling gaps in all aspects of oil spill readiness.

In developing this study, we have reviewed and synthesized a great deal of information, and mined our collective experience as oil spill professionals, contingency planners, and data analysts. We were struck by the observation that most of the major progress that has been made in oil spill prevention, preparedness, and response, in North America and worldwide, has been catalyzed by a major oil spill. The initiative of the BC government and the complementary initiatives of federal agencies to achieve improvements to western Canada's marine oil spill regime ahead of a major incident is a notable and critical first step toward world class planning.

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Appendix A. Acronyms

ADEC	Alaska Department of Environmental Conservation
AIS	Automated Identification System
ARPEL	Regional Association of oil, gas, and biofuel companies in Latin America and the Caribbean
Bbl	Barrels (unit)
BC	British Columbia
CCG	Canadian Coast Guard
EMSA	European Maritime Safety Agency
ERMA	Environmental Response Management Application
ETS	Emergency Towing System
EU	European Union
GRP	Geographic Response Plan
ICS	Incident Command System
IMO	International Maritime Organization
IPIECA	International Petroleum Industry Environmental Conservation Association
ISPR	Incident-specific Preparedness Review
ISTOP	Integrated Satellite Tracking of Pollution
I-TAC	Industry Technical Advisory Committee
MART	Marine Aerial Reconnaissance Teams
MCTS	Marine Communications and Traffic Services
NASP	National Aerial Surveillance Program
NOAA	National Oceanic and Atmospheric Association
NOFO	Norwegian Clean Seas Association for Operating Companies
PPA	Pacific Pilotage Authority
PPOR	Potential Place of Refuge
PSAMS	Preparedness Standard and Measurement System
PSSA	Particularly Sensitive Sea Areas
RCAC	Regional Citizen Advisory Council
RTM	Response Tracking Manager
SCAT	Shore-side Clean-up and Assessment Teams
SIRE	Ship Inspection Report Program
SOTEAG	Shetland Oil Terminal Environmental Advisory Group
STAR	Spill Tactics for Alaskan Responders
TC	Transport Canada
USCG	United States Coast Guard
WCMRC	Western Canada Marine Response Corporation
WRRL	Western Response Resource List

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Appendix B. Authors

This report was researched and written by Nuka Research and Planning Group, LLC. Brief biographical sketches are provided for the authors.

Elise DeCola, Lead Author

Elise DeCola is the operations manager of Nuka Research, and she was the lead author for this study. Her professional career began in legislative affairs in 1996, where her first assignment as a marine environmental policy fellow was to develop a state-level oil spill prevention and response law in the wake of a major New England fuel barge spill. She has since worked on oil spill policy research and contingency plan development and review in the US, Canada, and Europe. She regularly conducts field preparedness exercises for oil spill responders in the Northeast, and publishes regularly on the topic of oil spill preparedness. Ms. DeCola holds an M.A. in Marine Affairs from the University of Rhode Island and a B.S. in Environmental Science from the College of William and Mary in Virginia.

Sierra Fletcher, Contributing Author

Sierra Fletcher is a Project Manager at Nuka Research and was a contributing author for this report. She has more than ten years of experience analyzing US state, federal, and international policies on environmental issues including oil spill prevention and response and product stewardship. She contributes policy analysis, facilitation, and technical writing to Nuka Research's work on both the east and west coasts of North America. Ms. Fletcher has a M.A.L.D. in Environmental Policy from the Fletcher School of Law and Diplomacy at Tufts University and a B.A. from Yale University.