WCMRC
Western Canada Marine Response Corporation

Review of Trans Mountain Expansion Project

Future Oil Spill Response Approach Plan

Recommendations on Bases and Equipment

November 2013

TRANSMOUNTAIN

Table of Contents:

List of Tables:

List of Maps:

List of Figures:

List of Photos:

1. Introduction

The regulation of marine oil spill response is primarily defined in the *Canada Shipping Act, 2001* and administered by Transport Canada. The Act defines the requirement for oil spill Response Organizations (ROs) to be certified by the Minister; the requirement for all large vessels and oil handling facilities to have an arrangement with a certified Response Organization as a condition of operating in Canadian waters; and establishes planning standards that define minimum levels of capacity to be maintained by the Response Organization.

Western Canada Marine Response Corporation (WCMRC) is the Response Organization for the West Coast. Current planning standards require capacity to respond to oil spills of up to 10,000 tonnes in specified time frames which, in some cases, allow up to 72 hours plus travel time to deliver response equipment.

Trans Mountain Pipeline ULC (Trans Mountain) proposes to expand the capacity of the Trans Mountain Pipeline system. If approved the Trans Mountain Expansion Project (referred to as “TMEP” or “the Project”) will result in an increased number of tankers calling the Westridge Terminal to load crude oil cargo. Trans Mountain expects tanker traffic to increase from about 60 tankers per year to around 408 per year if Project is approved. Trans Mountain has asked WCMRC conduct a review of spill response planning standards and response capacity in the Salish Sea.

The purpose of this report is to describe enhanced planning standards and how they could be implemented to accommodate additional marine traffic that will result from TMEP. The study is meant to serve as a practical example of how response capacity could be enhanced to accommodate TMEP. Implementation of the plan would be subject to a number of factors and requires knowledge that will be gained through the outcome of the Federal and Provincial reviews of marine spill response, the National Energy Board review of TMEP, and further consultation with Aboriginal groups and other marine communities.

While the focus of this document is on enhancements it also demonstrates that WCMRC currently has equipment available well in excess of the current federal planning standards.

1.1 Plan Development

1.1.1 Background

Trans Mountain provided a marine risk assessment conducted by DNV [1](the “Risk Assessment”) which covered the Salish Sea area and in this report has been denoted as the Increased Response Area[2] (IRA). Based on the Risk Assessment, the following has been determined:

- Credible Worst Case (CWC) Oil Spill Volume due to an accident is deemed equivalent to the complete loss to sea of the entire contents of two loaded cargo oil tanks of a tanker

[1] Det Norske Veritas

[2] *The Increased Response Area refers only to the regions under which response standards are changed for this report. It includes the areas of both two and six hour response standards, and does not differ on spill size.*

- Based upon the Project parameters of partially loaded Aframax tankers, the CWC spill equates to a volume of 16,500 m^3 or an approximate 15,500 tonne release of heavy crude oil.
- The CWC in the case of a fully loaded Aframax class tanker of 120,000 DWT would equate to approximately 21,277 m^3 or a 20,000 tonne release of heavy crude oil. Under fully laden conditions an Aframax tankers corresponds with the maximum size of tankers allowed in Puget Sound in accordance with the US federal regulation (33 CFR 156.1303), which limits the maximum size of tankers calling Puget Sound to 125,000 DWT. Vessels calling in Puget Sound transit through waters sharing a common border between the US and Canada. While a 20,000 tonne CWC oil spill volume is larger than what is required for Project tankers it has been chosen to reflect the largest oil cargoes expected within the area.
- It is recommended by DNV to prepare an oil spill response to handle one CWC oil spill at any location along the tanker route within the study area, i.e. up to the 12 nautical mile limit (Buoy “J”).

Oil spill modeling was conducted as part of the Risk Assessment. The results showed that, subject to the actual prevailing environmental conditions, spilled oil would quickly reach the shorelines in the vicinity of the spill location. On a modeled mass-balance basis, if no response took place, then extensive shoreline oiling would occur with approximately 60% to 70% of the spilled oil impacting the shorelines. These impacts would also affect the significant number of marine parks and sensitive areas in the region.

A key takeaway from spill modelling is further knowledge of the time-lapsed spreading of the oil, which affirms that early and adequate response is necessary to achieve effective mitigation. To address this issue a proposed reduction in the currently applicable response times must be a consideration in developing additional plans to support the Project’s needs for oil spill response.

In addition to the Risk Assessment Trans Mountain also proposed the following principles for enhancements:

- **Augment capacity within the existing regime.** Where the need exists for additional response capacity, it should be met through an expansion of WCMRC’s resources.
- **Response capacity should reflect the risks.** Response capacity should be established based on consideration of probability and consequence with particular consideration to predicted spill volumes, material fate and behavior, and geographic setting including sensitive areas.
- **Investments should benefit affected communities.** Where new investment in response capacity is required, Trans Mountain will seek to maximize the benefit to First Nations and other communities along the transit route. Benefits may consist of capacity building, capital investment, training and provision of ongoing services.

1.1.2 Approach

The enhancements described in this report were derived in-part based on the following considerations:

- The Canada Shipping Act, 2001[3] (CSA, 2001) regulations and Transport Canada's Response Organizations Standards - TP 12401 E will be used to determine the Response Organization's (RO) equipment package for the CWC spill of 21,277 m^3 or 20,000 tonnes..
- Response equipment will be capable of meeting the time standards (Map 2-1). The proposed standards exceed the current legislated ones based on spill-size tiers and response zones (Table 2-1).
- The existing legislated standards will be used in this report as the fundamental compliance targets that will be met or exceeded. For instance, in the Port of Vancouver a two-hour response time is proposed, however, the Tier 1 and 2 response and equipment standards still must apply, as will the legislated standards in other response areas. The Tier 1 standard in the Port prevents the transfer of certain dedicated equipment outside the port area. While the existing federal standards are expected to change with current reviews of the spill response regime, the standards proposed as a baseline for this report are aggressive enough that it is doubtful they will fall short of pending changes.
- The Risk Analysis identified five locations where a tanker faced an elevated risk of an accident that could potentially lead to an oil spill from the vessel. These were subsequently used for both stochastic and deterministic drift modeling. The results have been used to support the proposals for response times, shoreline cleaning standards, base locations and equipment contained in this report.
- For the purposes of this report, an amended response area that will be termed the IRA.[4] The IRA is specifically focused on the needs of the TMEP and will generally extend from the marine terminal at Westridge though Burrard Inlet, Vancouver Harbour, along the traffic separation schemes south to Boundary Pass and Haro Strait, and through the Strait of Juan de Fuca to Buoy "J". WCMRC is required through CSA 2001 to meet specific response time standards assigned to certain locations within its Geographic Area of Response (GAR). Specific sub-regions inside the GAR relate to the area in southwestern BC, typically along the established shipping lanes, which are termed the Enhanced Response Area (ERA), and the Primary Area of Response (PAR). These are described in detail later. The IRA encompasses the ERA and PAR.
- WCMRC has utilized information garnered from its current benchmarking and mapping projects as well as information from the Gainford fate and behavior study[5].

1.1.3 Units of Measure

The federal planning standards are measured in metric tonnes. Volume measurements in this report will be in cubic metres. The conversion used is 940 kg/m^3, the upper density limit of the pipeline products.

To summarize standard measurements used in this report:

[3] *Canada Shipping Act, 2001: Response Organization and Oil Handling Facility Regulations SOR/95-405: 3.(1); 3.(2)(b); 3.(2)(i); 3.(2)(j); 4.(1)(a); 4.(1)(c); 4.(1)(e); 4.(1)(f); 4.(1)(g); 4.(2); 4.(2)(a); 4.(2)(b); 6.*

[4] *The Increased Response Area refers only to the regions under which response standards are changed for this report. It includes the areas of both two and six hour response standards, and does not differ on spill size.*

[5] *A Study of Fate and Behaviour of Diluted Bitumen Oils on Marine Waters, Dilbit Experiments – Gainford, Alberta.*

8,250 m^3 : 7,750 tonne

10,600 m^3 : 10,000 tonne

16,500 m^3 : 15,500 tonne

21,277 m^3 : 20,000 tonne

2. Current Oil Spill Response Standards

This section discusses the existing planning standards required under:

- *CSA, 2001 Response Organizations and Oil Handling Facilities Regulations*
- *Transport Canada's Response Organizations Standards - TP 12401 E*

2.1 Geographic Area of Response

Under the CSA, 2001, the total area covered by a certified RO is deemed to be the GAR and is further subdivided into the Designated Port, Primary Area of Response (PAR), and Enhanced Response Area (ERA). Tiered response times and equipment packages are associated with each of the three areas. The physical boundaries of each area are defined below.

The tanker route from TM's Westridge terminal includes the Port of Vancouver, the PAR from the southern Salish Sea through Boundary Pass and Haro Strait, and into the ERA of the Strait of Juan de Fuca.

2.2 Designated Port

The Port of Vancouver is a Designated Port under the planning standards requiring the allocation of a certified RO. The Port's boundaries are defined as all the Canadian waters of Boundary Bay; the waters bounded by a line drawn from a point on shore originating at the Canada-United States border on Point Roberts due west along the international border to a point 123° 19.3'W, then north to a point 49° 14'N, 123° 19.3'W, then to a point 49° 15.5'N, 123° 17'W; and the waters of Burrard Inlet east of a line drawn between Point Atkinson Lighthouse and Point Grey.

2.3 Primary Area of Response (PAR)

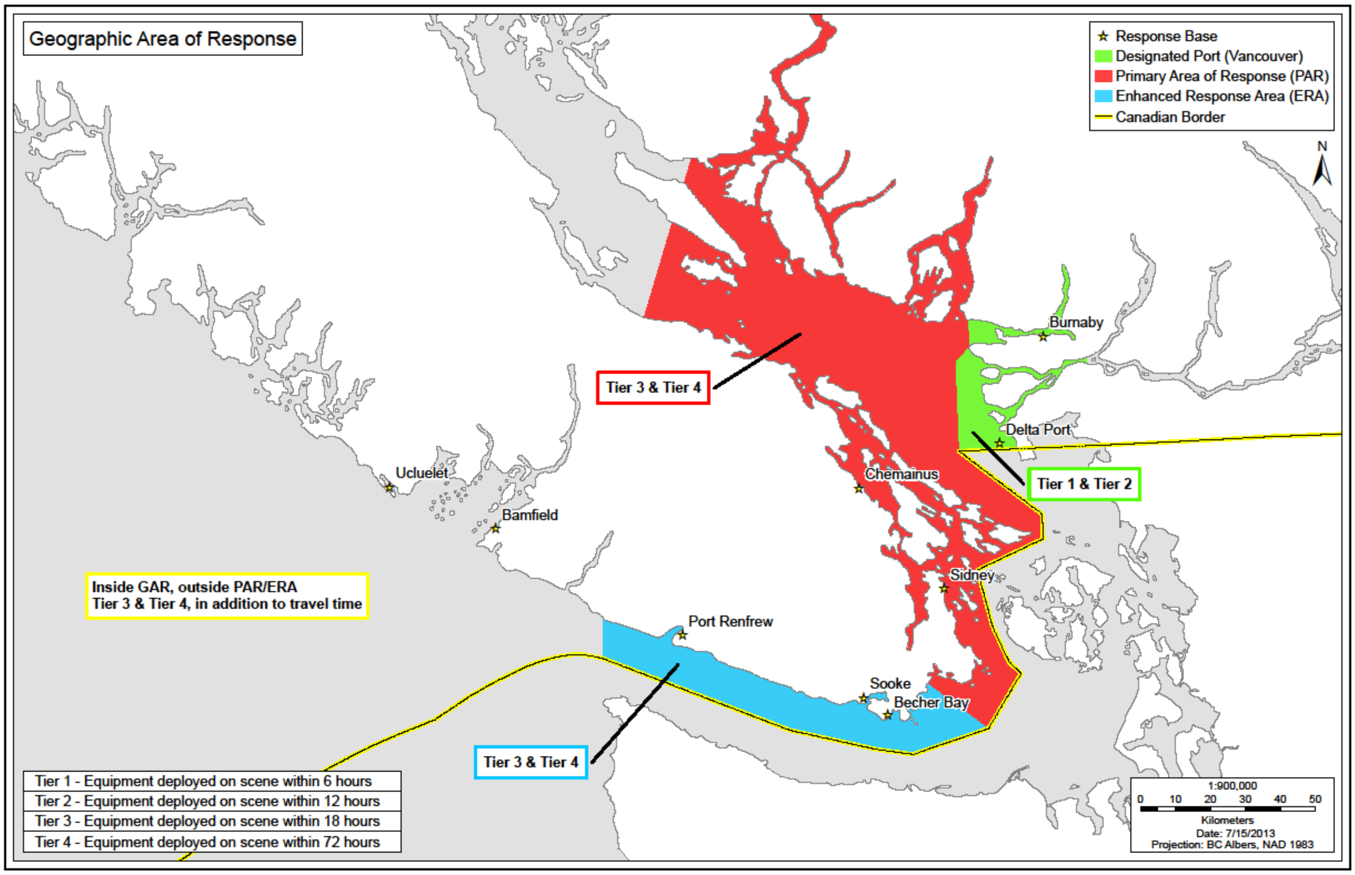
Because a majority of large spills (>1,000 tonnes) occur outside port boundaries where vessels converge, the Canadian Coast Guard (CCG) identified PARs as areas associated with designated ports that require a specific level of response capability and mobilization within designated times. The PAR for the Port of Vancouver is defined as to contain all of the Canadian waters between the northern boundary of a line drawn from the point 49° 46.5'N, 124° 20.5'W on the mainland, through Texada Island, to the point 49° 22.5'N, 124° 32.4'W on the shore of Vancouver Island, and the southern boundary consisting a line running along the 48° 25'N parallel from Victoria, eastward, to the Canada-United States border.

2.4 Enhanced Response Area (ERA)

Marine areas not covered under the above designation, but holding a higher risk of oil spills due to traffic convergence and volume of shipping, were identified as ERAs. The Strait of Juan de Fuca ERA comprises all the Canadian waters between the western boundary of a line drawn from Carmanah Point on Vancouver Island to Cape Flattery, Washington State, and the eastern boundary consisting of a line running along the 48° 25'N parallel from Victoria, eastward, to the Canada-United States border.

Although the PAR and ERA are defined separately in practice the definitions do not affect the planning standard requirements for each area. The standards are in effect the same for both.

Map 2-1: Existing Geographic Area of Response and Response Planning Standards



2.5 Response Times and Capacity

Response times, under current planning standards, nominally comprise mobilization, travel and deployment. These times are discussed in greater detail below:

- **Mobilization** is measured from notification to the time the equipment is underway. This may include the necessary time to contact responders, the duration of time for them to travel to the base and equipment and gear loading there. For planning purposes, we typically assume an average mobilization of two hours for any personnel or equipment. Continuous 24/7 staffing at certain bases will proportionately reduce mobilization times at those locations. Mobilization times may vary elsewhere depending on equipment locations and logistical support.
- **Travel time** is the time necessary to transport equipment from pre-positioned locations to the spill site. Planning travel speeds, provided in CSA, 2001 are: ground = 65 km/h; water = 6 knots; air = 100 knots. However, due to the distance between suggested base locations, the potential for adverse

weather in the Salish Sea, and the sensitivity of the environment, the future response plan shall utilize vessels capable of speeds between 10 and 20 knots.

- **Deployment time** is the time necessary to assemble and configure the equipment to render it operational for its intended function. Deployment time will vary depending on the type, size, and quantity of equipment; it is assumed that multi-purpose vessels with integrated skimming abilities can reduce deployment times. Deployment times also take into account mandatory safety briefings on the incident, current weather related issues at sea, and spill site flammability and toxicity issues.

On-water recovery operations for oil spills in sheltered waters and unsheltered waters are to be completed within 10 operational days after the day on which the equipment is first deployed in the affected operating environments.

2.6 Summary of Current Planning Standards

A summary of response times and capacity requirements is provided in Table 2.6-1 below.

Table 2-1: Federally Mandated Response Organization Response Times by Tier and Area

Area Type	Response Organization Tier 1 150 tonnes	Response Organization Tier 2 1,000 tonnes	Response Organization Tier 3 2,500 tonnes	Response Organization Tier 4 10,000 tonnes
Designated Port (PMV)	**Deployed** on-scene in Designated Port (dedicated resident equipment) 6 hours from time of notification	**Deployed** on-scene in Designated Port 12 hours from time of notification	**Not Applicable**	**Not Applicable**
Inside PAR/ERA	**Not Applicable**	**Not Applicable**	**Delivered** on-scene within the PAR/ERA from time of notification 18 hours	**Delivered** on-scene within the PAR/ERA from time of notification 72 hours
Outside PAR/ERA; Inside GAR	**Not Applicable**	**Not Applicable**	**Delivered** on-scene 18 hours from time of notification plus travel time	**Delivered** on-scene 72 hours from time of notification plus travel time hours

3. Criteria for Enhanced Oil Spill Response Standards

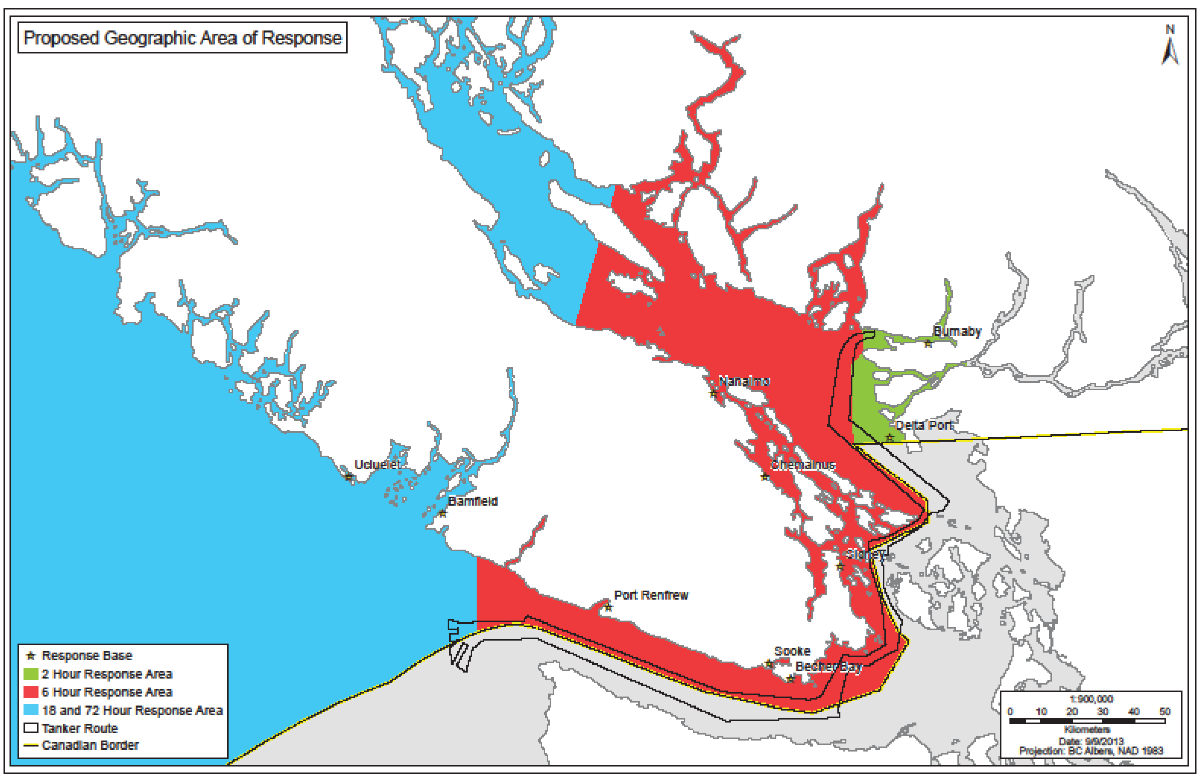
3.1 Increased Response Area (IRA)

A simplified division of the GAR has been proposed for this report which combines the PAR and ERA into one region which will be referred to as the Increases Response Area

Thus there will be three areas of response:

- **Inside Port Boundary**
- **Inside IRA**, this is defined as all areas within or adjacent to the shipping lanes between Port Metro Vancouver and Buoy "J".
- **Outside IRA,** but within the existing GAR of WCMRC.

Map 3-1: Proposed Increased Response Area – Trans Mountain Expansion Project



3.1.1 Credible Worst Case Spill Volume

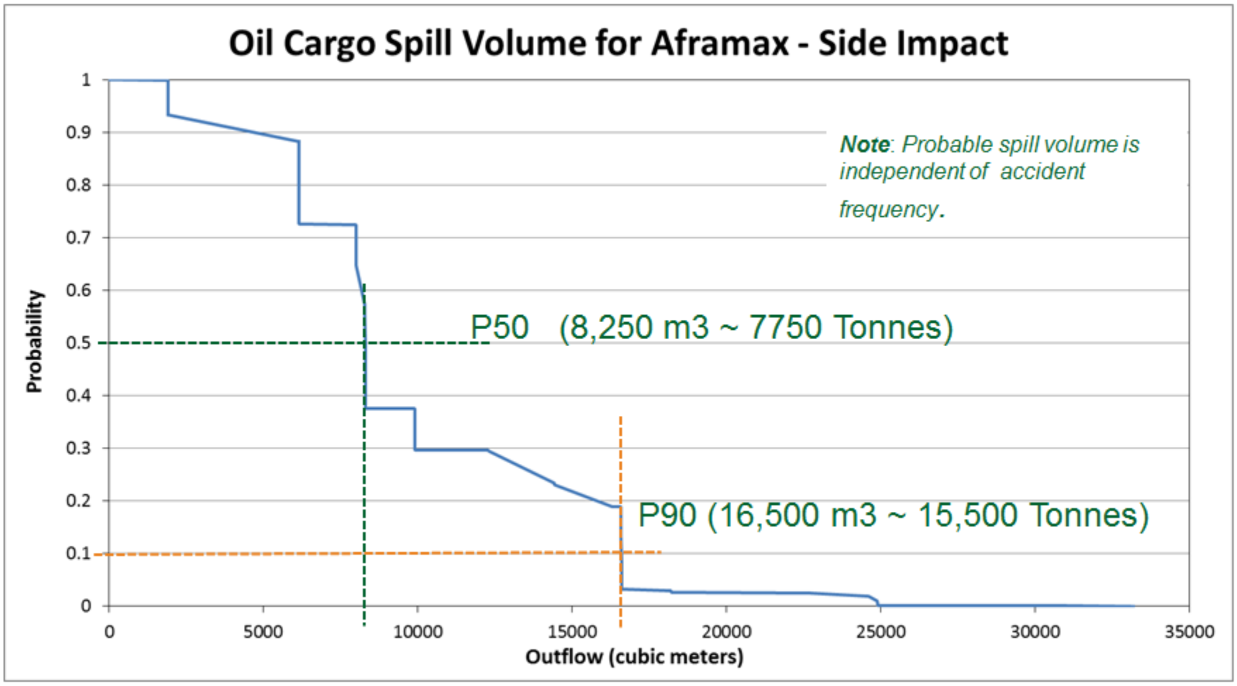
Trans Mountain provided a marine risk assessment conducted by DNV (the "Risk Assessment") which covered the area of the IRA. Based on the Risk Assessment, the following has been determined:

- Credible Worst Case (CWC) Oil Spill Volume due to an accident is deemed equivalent to the complete loss to sea of the entire contents of two loaded cargo oil tanks.

- Based upon the Project parameters of partially loaded Aframax tankers, the CWC spill equates to a volume of 16,500 m^3 or an approximate 15,500 tonne release of heavy crude oil.
- CWC in case of a fully loaded Aframax class tanker would equate to approximately 21,000 m^3 or a 20,000 tonne release of heavy crude oil. At up to 120,000 DWT the size of a fully laden Aframax corresponds with the US federal regulation (33 CFR 156.1303) that effectively limits the maximum size of tankers calling Puget Sound to 125,000 DWT. Vessels calling in Puget Sound transit through waters sharing a common border between the US and Canada. While a 20,000 tonne CWC oil spill volume is larger than what is required for Project tankers it has been chosen to reflect the largest oil cargos expected within area.
- It is recommended by DNV to prepare an oil spill response to handle one CWC oil spill at any location along the tanker route within the study area, i.e., up to the 12 nautical mile limit (Buoy "J").

Based on this, the planning standard used to design the enhanced planning standards for the IRA will be set at 20,000 tonnes; this is essentially the CWC discharge volume of a fully loaded Aframax class tanker.

Figure 3-1: Cumulative Probability of Spill Volume for Partially Laden Aframax (provided by Trans Mountain)



Based on all results of DNV's Monte Carlo simulation (10,000 simulated accidents x 5 repeats) that led to an outflow from tanker

3.2 Oil Spill Tier Sizes

Federal planning standards currently cap the upper level of response capacity for a Tier 4 Response Organization at 10,000 tonnes. This report recommends a new voluntary, "Tier 5," response level that exceeds the Canadian Coast Guard guidelines. The new level would plan for a 20,000-tonne spill from inside the port boundaries all along the tanker route that transits the Salish Sea[6] region of south British Columbia as far as Buoy "J".

The proposed Tier 5 would augment the Tier 4 legislated level of 10,000 tonnes.

- Tier 1= 150 tonnes
- Tier 2= 1000 tonnes
- Tier 3= 2500 tonnes
- Tier 4= 10,000 tonnes
- ***<u>Tier 5= 20,000 tonnes (credible worst case discharge from a fully laden Aframax tanker)</u>***

3.2.1 Worst Case Oil Spill

DNV in their report has indicated that the historical oil spill data shows that the probability for an accident with loss of all oil cargo onboard a modern double hulled tanker is so low that it does not represent a credible worst case discharge (CWCD) scenario; at the time of this plan being developed there has not been a total loss at sea of a double hulled tanker of the type used for the Project. Thus, according to DNV, such a scenario is not considered as credible worst case scenario for the purpose of this oil spill response capacity assessment.

However, the possibility of a total loss of all cargo (Worst case discharge [WCD]) oil spill, although debatable, is perceived in some regimes as a credible risk; as an example, the State of Washington in the US requires ROs to have arrangements in hand to deal with such worst case through contract with additional oil spill response organizations to meet the WCD volume for each geographic area a tanker transits. WCMRC too has mutual aid agreements in place with spill response organizations in Canada and the US (Section 4.1.4) that would allow the cascading in of considerably more equipment and personnel that what has been described in this report. Such amounts of extra equipment can be called upon in case of an oil spill in excess of the capacity proposed to be held in the region in support of Project-related tankers (Section 5.2).

3.3 Reponses Times

Response time will be defined as the time between receipt of spill notification and initial on-site deployment of countermeasures, provided it is safe to do so. The following information was considered in determining the enhanced response times:

- an analysis of crude oil properties;
- simulation of oil fate and behaviour at points along the tanker route;
- the influence of other vessels in the area; and
- the possible base locations.

[6] By definition, the Salish Sea includes the Straits of Georgia, Puget Sound and the Straits of Juan de Fuca.

Based on this analysis the following times were used to apply to vessels commencing on-scene spill counter measures.

- Within the Port of Vancouver (existing boundaries including Delta Port) - Two hours to commence response on a spill up to 2,500 tonnes size.
- Outside Port of Vancouver to Buoy“J” - Six hours to commence response on a spill up to 2,500 tonnes size.
- Additional equipment necessary to deal with a 20,000 tonne oil spill will be cascaded in within 36 hours of initial notification for entire IRA.
- Offshore of Buoy “J” (outside IRA) existing legislated response time (72-hours + travel time) will remain in effect.

Under the proposed standards, there will be no separate time for allocated to mobilization and travel. This means RO will need to reduce travel time. As such additional base locations will become essential drivers to meeting the more aggressive response times discussed in this report.

3.4 On Water Recovery Time

The expanded Westridge Marine Terminal, like the upstream pipeline, will continue to be capable of handling a wide range of petroleum types. However, as is the case today, the majority of crude oil loaded from the expanded terminal is expected to be heavy crude oil, primarily diluted bitumen.

While the petroleum transported on the Trans Mountain pipeline is limited by tariff to a maximum specific gravity of 0.94 and viscosity of 350 cSt[7] and will float if released into water, a portion of spilled petroleum could submerge or sink if left to weather for an extended period. To inform the Risk Assessment Trans Mountain commissioned a program of testing of diluted bitumen. The testing program included a ten day weathering test for two types of diluted bitumen as well as testing to assess the effectiveness of skimming equipment, dispersants, and in-situ burning. The tests were attended by a wide range of regulators and other agencies who were invited to attend.

The study’s multi-disciplinary project team consisted of Witt O’Brien’s (acting in a management role); Polaris Applied Sciences (undertaking the project science); and WCMRC (supporting the equipment test). This team was tasked with designing and executing a controlled test to evaluate the fate and behavior of dilbit discharged into a simulated marine environment similar to that of Burrard Inlet (Vancouver, BC, Canada) where the Westridge Terminal is located.

The diluted bitumen showed properties and weathering behavior similar to other heavy crude oils. During the course of the ten days test the diluted bitumen floated on the water and could be retrieved effectively using conventional skimming equipment. The report documenting the testing program (Witt O’Brien’s [2013]) is listed in Appendix B and is available as a supplementary supporting reference document to the Termpol studies.

The results of these tests support the federal standard of continued use of a ten day period for on water recovery operations. On-water recovery operations for oil spills in sheltered waters and unsheltered waters are to be completed within 10 operational days after the day on which the equipment is first deployed in the affected operating environments.

---

[7] **Centistokes (cSt)** is an unit of kinematic viscosity. The kinematic viscosity of water is about 1.0038 centistokes.

3.5 Summary of Future Oil Spill Standards

Table 3-1: Proposed Enhanced Response Organization Response Times by Tier and Area

Area Type	Response Organization Tier 1 150 tonnes	Response Organization Tier 2 1,000 tonnes	Response Organization Tier 3 2,500 tonnes	Response Organization Tier 4 10,000 tonnes	Enhanced Response Organization Tier 5 20,000 tonnes
Inside Port Boundary	On-Scene and commence deployment of counter-measures in 2 hours	On-Scene and commence deployment of counter-measures in 2 hours	On-Scene and commence deployment of counter-measures in 2 hours	Delivered on-scene from time of initial notification within 36 hours	Delivered on-scene from time of initial notification within 36 hours
Inside PAR/ERA (IRA)	On-Scene and commence deployment of counter-measures 6 hours	On-Scene and commence deployment of counter-measures 6 hours	On-Scene and commence deployment of counter-measures 6 hours	Delivered on-scene from time of initial notification within 36 hours	Delivered on-scene from time of initial notification within 36 hours
Outside PAR/ERA ; Inside WCMRC's GAR				Delivered on-scene 72 hours from time of notification plus travel time 72 hours + travel time	Delivered on-scene 72 hours from time of notification plus travel time 72 hours + travel time

4. Meeting Enhanced Response Standards

The Risk Analysis identified certain locations where a tanker faced an elevated risk of an accident that could potentially lead to an oil spill from the vessel. Using WCMRC's experience as well as information from the Risk Assessment (e.g. hypothetical accident locations, hypothetical locations where there is increased probability of an oil spill, the possible volume of the oil spill) , the following thresholds are recommended:

- Throughout the GAR: 1) the existing Canada Shipping Act, 2001, (CSA 2001) time requirements will continue to be met based on an estimated response vessel transit speed of 6 knots; and 2) all spilled oil ultimately recovered off the water in 10 operational days
- To comply with CSA, 2001 regulations affecting the other obligations of the RO (i.e., WCMRC), a response to an unrelated Tier 3 and Tier 4 oil spill occurring in any other location within the organization's GAR will be met by the existing legislated response times plus the time necessary to travel at legislated planned speed to the incident from the nearest response base.

The key to meeting the preceding thresholds will be reaching the site quickly and responding to the spill in an effective manner. As such appropriate consideration should be given to:

- Properly equipped and staffed additional bases to address the needs and risk at each location (e.g., a base in the Sanich Peninsula vicinity will better serve the Turn Point area identified earlier as a higher risk route segment).
- Response efforts that will combine the cascaded capacity of multiple bases.
- Shoreline oiling - an area where the minimum Federal response requirement is considered too low for the region - is an issue requiring further consideration and the possible allocation of more resources.
- The beneficial assimilation of lessons learned from past exercises and tests, such as the Gainford oil tests.

Two equipment packages are visualized: one for bases east of Race Rocks and the other for bases located west of Race Rocks. Each package has been tailored to meet challenges unique to the area, be it weather, strong current, remote location, logistics, etc. This approach has led to the creation of equipment lists that have excess capacity necessary for achieving a goal of 20,000 tonne certification for anywhere in the IRA. The plan will allow flexibility in equipment movement based on need.

Further work is required to determine the final disposition of the enhancements described here. Some of the factors that will influence the requirement for enhancements include; the final outcome of the Federal and Provincial reviews, review of TMEP by the National Energy Board, and further consultation with Aboriginal and marine community groups In addition to these results final definition of a response program requires definition of plans to address recruitment and training, organizational development, waste and wildlife management.

4.1 Other Initiatives

4.1.1 Federal and Provincial Reviews

As a certified response organization, WCMRC has consistently met or exceeded the planning standards and requirements identified in the regulations under the *Canada Shipping Act, 2001.* These standards and requirements sought to mitigate the risks identified in the late 1980s and early 1990s, following the EXXON Valdez oil spill. The Canadian Government commissioned the *Public Review Panel on Tanker Safety and Marine Spills Response Capability* in 1990. The panel's report, commonly referred to as the Brander-Smith Report, included a recommendation that was key in the development of the Canadian marine oil spill response regime, including the 10,000 tonne response capability.

A Federal Tanker Safety Panel is reviewing Canada's Ship-Source Oil Spill Preparedness and Response. The Panel will conduct a broad review of the current Regime for oil handling facilities and ship-source oil spill preparedness and response. Based on this review, the Panel will submit their findings, along with any recommendations, to the Minister of Transport, Infrastructure and Communities. Amongst other things the review will assess the current federally mandated oil spill response capacity of 10,000 tonnes and examine if the current regulated response capacity of 10,000 tonnes is a world-class standard, as well as the costs and benefits of changing this requirement; The Panel was appointed in March 2013 and is meant to provide an assessment of the existing oil spill response regime south of 60° north latitude by November 15, 2013.

July, 2012, the government of British Columbia outlined five minimum requirements that must be met for the Province will consider the construction and operation of heavy oil pipelines within its borders. One of these requirements called for a world-leading marine oil spill response, prevention, and recovery system for British Columbia's coastline and ocean; a system to manage and to mitigate the risks associated with heavy oil shipments.

The West Coast Spill Response Study, prepared for the Province of BC by Nuka Research was released on October 10, 2013. It provides key elements for a world class system that includes spill prevention, preparedness, response and recovery. The study consists of three volumes and includes a number of recommendations. The Province comments that while the federal government is the lead for marine spills and is already taking some important steps to improve the system, the study concludes more federal resources are needed to protect the west coast. BC will continue to work with the Government of Canada and push for changes necessary to ensure world-class requirements and regulations are in place.

4.1.2 WCMRC Benchmarking Study

The equipment specifications associated with this plan (including size, speed and capabilities) have been determined in-part from an assessment of Response Organizations around the world. Equipment has been chosen to meet the unique challenges presented from British Columbia waters and geography. All equipment must fit within the current planning standards and support proposed enhancements.

A clear definition of world-leading spill preparedness and response is required. Further, an understanding must be determined of which response practices lag or lead in terms of what is considered world-leading. Finally best management practices must be implemented to close the gap where it is required to meet world-leading status.

As a result, WCMRC is currently:

- conducting a benchmarking exercise to identify the best management practices (BMPs) that have been adopted by leading spill response organizations around the world;
- identifying those BMPs that are relevant to our west coast of British Columbia operating environment along with conducting a gap analysis of these BMPs to determine how WCMRC current practices compare; and
- developing a strategy with tactics and timeline to close those gaps in a Five Year Plan (i.e., a roadmap).

While the results of this study are currently being summarized, early reviews of equipment worldwide have shown that larger, faster, and more unsheltered water capable vessels should be incorporated into the West Coast environment. These lessons have been incorporated in this report.

4.1.3 WCMRC Mapping Project

WCMRC intends to develop specific oil spill Geographic Response Strategies (GRS) that will form part of area Geographic Response Plans (GRPs) and priority Shoreline Cleanup Assessment Techniques (SCAT) for the coastal shoreline of British Columbia. To accomplish this, WCMRC has started to develop the methodology, processes and tools needed to build a GRS and SCAT.

As a demonstration project WCMRC has developed a working GRP system for the areas surrounding the Westridge Terminal - a selected shoreline within Vancouver Harbour, east of Second Narrows to Port Moody, and north to Belcarra. The results of the demonstration project proved valuable and will be carried out through the province in the coming years. The project is seen as a necessary requirement given today's vessel traffic volumes and is not necessarily in response to increased tanker traffic; however, the enhanced GRPs will prove invaluable in large scale responses. WCMRC is aided in this endeavour by scientific and technical assistance from Strategic Natural Resource Consultants.

The scope of this project includes five tasks:

1. Data acquisition, data management, and information technology development specific to the GRS and pre-SCAT
2. Standards and procedures for the GRS and SCAT
3. Pilot area stratification using shoreline sensitivities and shoreline types
4. GRS and SCAT pilot and standardized data collection, and field testing/production of the GRS (two-pager) and SCAT
5. Pilot review and project refinement

The end result will be a coastal map with response plans and protection strategies predefined, not dissimilar to Washington State Geographic Response Plans (GRPs).

An example of a site specific GRP near the Westridge terminal facility is shown below.

Figure 4-1: Example - Site Specific GRP

Rocky Point Mudflats		GRS # 8-3-005	
Location	49° 17.06'N 122° 50.69'W	Seasonality	Spring, Summer, Fall (Higher sensitivity)
Site Status	27-Aug-13		
Waterbody	Burrard Inlet - Port Moody and mudflats at head of inlet		
Resources at Risk	Aquatic Mammals, shorebird, raptors		
Strategy Objective	Exclusion	Protect mudflats from oiling - birds and mammals present	

Anchor	Boom 1 - 3500 feet Lat	Long
1	49° 17.40'	122° 50.86'
2	49° 17.01'	122° 50.90'
3	49° 16.87'	122° 50.92'

Recommended Equipment	
Amount	**Description**
3500 feet	General Purpose Boom
4	Danforth Standard Anchor Kits (If required by currents)
50 feet	1/2" Polysteel Rope
1	Broadwater Vessel
1	Landing Craft

Recommended Personnel		
Number	**Personnel**	**Qualifications**
1	Supervisor	
3	Labourers	Boom Technician
1	Vessel Operator	SVOP
1	Vessel Operator	Masters 4

4.1.4 Mutual Aid Agreements

WCMRC also has a number of mutual aid agreements in place with both Canadian and US counterparts that provide WCMRC the ability to call on those resources for assistance and equipment in case of large oil spill. Mutual Aid is a formal agreement among responders to lend assistance across jurisdictional boundaries when required. Mutual Aid Agreements have been formed between WCMRC and three other organizations:

- Southeast Alaska Petroleum Response Organization (SEAPRO);
- Eastern Canada Response Corporation (ECRC); and
- Marine Spill Response Corporation (MSRC).

As a result of these agreements, organizations train and exercise together, ensure equipment is compatible, share communication frequencies as well as best management practices. In addition to WCMRC's agreements, Joint Marine Contingency plans exist between Canada and the US.

5. Response Bases Requirement

Response times, forward base locations and equipment levels have been identified as key to effectively dealing with oil spill contingencies that may occur throughout the IRA. A combination of regulatory guidance, spill-size probability studies, and identified geographic regions were used to determine the allocation of resources necessary to meet these response thresholds. Response base locations and corresponding deployment times have been suggested as part of a set of specific criteria that addresses the area's unique logistical constraints. Clearly, the faster the response is initiated, the more effective the cleanup. In addition to response times, the type of operating environments also determines the required equipment mix.

For comparative purposes, Map 2-1 details tiered response levels required by federal regulations. As mentioned earlier, the response times and resources discussed in this document support TMEP to a level that exceeds current legislated thresholds. The proposed base locations are based on a comprehensive review of risk along the navigational route between their Westridge Terminal and Buoy"J". Map 5-1 details the tiered response levels committed to by Trans Mountain.

5.1 Response Base Locations

This section describes considerations used to determine candidate response base locations and equipment allocated to these bases.

- Area East of Race Rocks

  This area is predominantly sheltered water, but with strong currents and tidal flows. There are fewer logistical challenges to be met and good connections by road, water and air are available. Port of Vancouver has more vessel traffic than any other Canadian port and therefore a higher possibility to receive a request for service from a vessel within port jurisdiction. Equipment based here should therefore be capable of responding in a short time and then dealing with an oil spill in such an environment.

- Area West of Race Rocks

  This area is predominantly unsheltered water, and at certain times of the year could face stronger weather patterns. With intermittent rocky shorelines and many areas difficult to reach by road or air, the area west of Race Rocks will rely on response supported by water transport. Equipment based here should therefore consist of the type that is more robust and capable of dealing with the local conditions if response is called for.

- Combined response to Credible Worst Case (20,000 tonne)

  Finally the mix of equipment between bases should be such that multiple bases can be selectively assigned to deal with a spill of up to 20,000 tonnes size and more importantly deliver the required equipment to the location within 36 hours of being notified. The allocation of resources to both sheltered and unsheltered water have been selected to maintain a good balance between speed and effectiveness of response at all locations within the IRA.

5.2 Summary of Response Bases

Without having physically checked all available sites at this stage, WCMRC is unable to stipulate exact base locations, especially that requiring vessel moorage. So the locations discussed here are only preliminary at this time. It is clear, given current vessel traffic and with the possibility of the Vancouver Airport fuel facility in the Fraser River, that the Roberts Bank area is underrepresented. As a result, a spill response base capable of delivering a two-hour response time, should be located in the Delta Port region; and such a location would be able to serve the requirements of TMEP as well.

Two elevated risk areas identified by the analysis of traffic along the tanker route are the turn points in Boundary Pass and Haro Strait. A response base on the Saanich Peninsula will be necessary to address the 6 hour response times designated for these risk areas. A Saanich Peninsula base offers close proximity and existing marine infrastructure. Other possible sites include, Cow Bay, Maple Bay, Deep Bay, Sidney and the CCG facility in Pat Bay. Issues surrounding the area centre around availability of moorage for a large barge and supply ship.

A new base on the Saanich Peninsula would render the existing facility at Duncan somewhat redundant making spill response needs better met by a Nanaimo area facility which would cover traffic out of Vancouver Harbour and be responsive to non-tanker traffic in the Salish Sea.

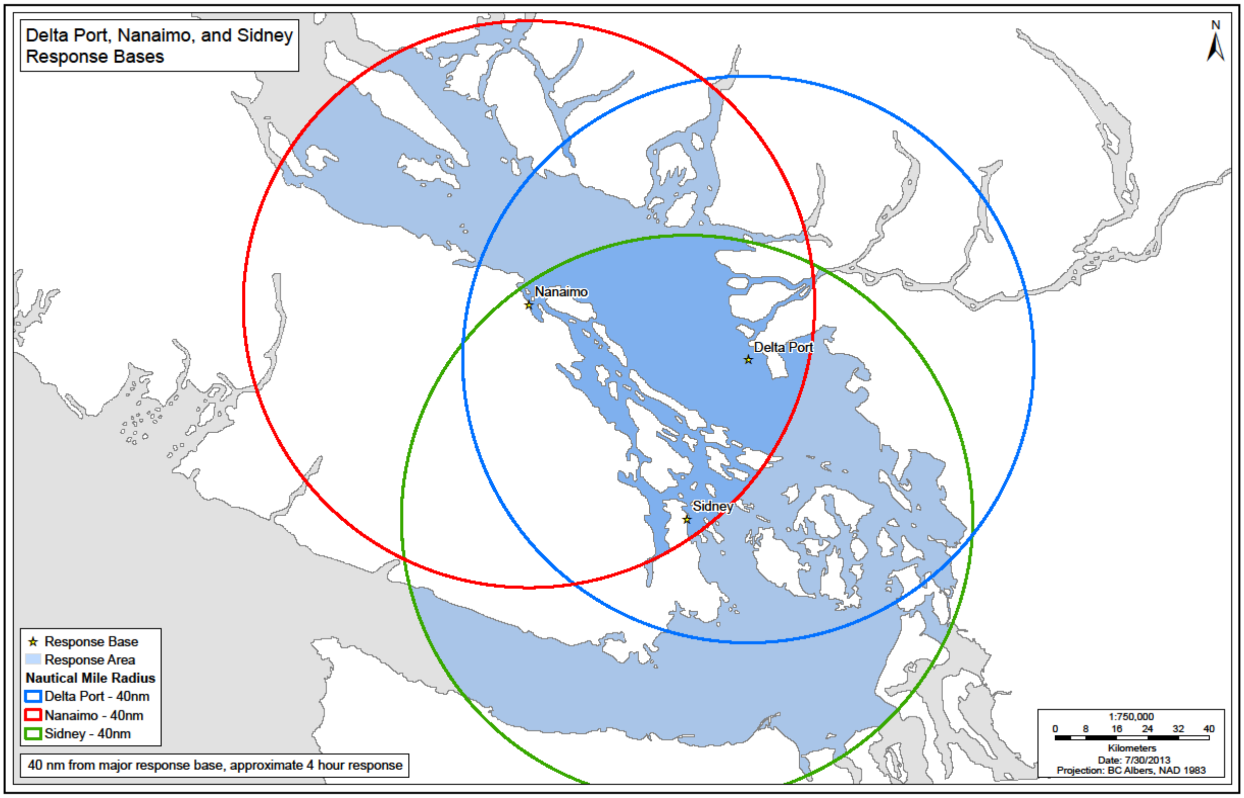
The most feasible locations to address Race Rocks and the Strait of Juan de Fuca are Sooke and Becher Bay. Currently, WCMRC has vessels moored at facilities in Esquimalt but a new response base established west of Race Rocks would assist in making the six hour response mandate much more viable. Given appropriate mooring facilities, the vessels currently moored in Esquimalt may be relocated to other operating areas.

Finally, a base is needed to service the west coast of Vancouver Island and offshore incidents; the feasible candidates are Ucluelet and Bamfield.

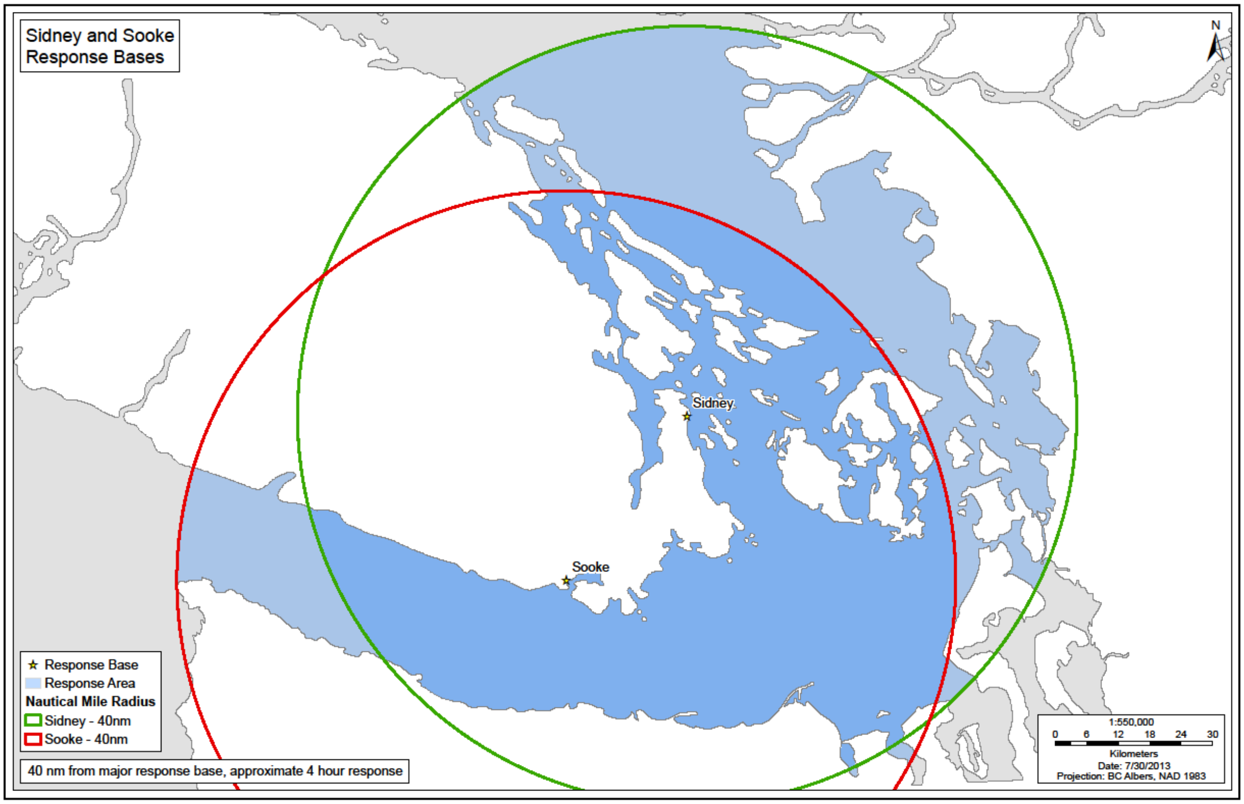
In summary, to address current and future spill risks from tankers and other large vessel traffic, four additional response bases will be needed to meet the time and equipment standards proposed. 24/7 operations would need to be located in the Port Metro Vancouver zone, as well as somewhere on the Saanich Peninsula.

Using federal guidelines to calculate the maximum response capacities that could be leveraged from the proposed equipment package, Table 5-3 provides an example of how the total response capacity in the region could be distributed on a risk informed basis, subject to further development of geographic response plans. The table relies on the ability to cascade resources amongst bases to achieve the highest coverage possible.

Map 5-1: Response Bases - Delta Port, Nanaimo, and Sidney



Map 5-2: Response Bases - Sidney and Sooke



Map 5-3: Response Bases - Sooke and Ucluelet

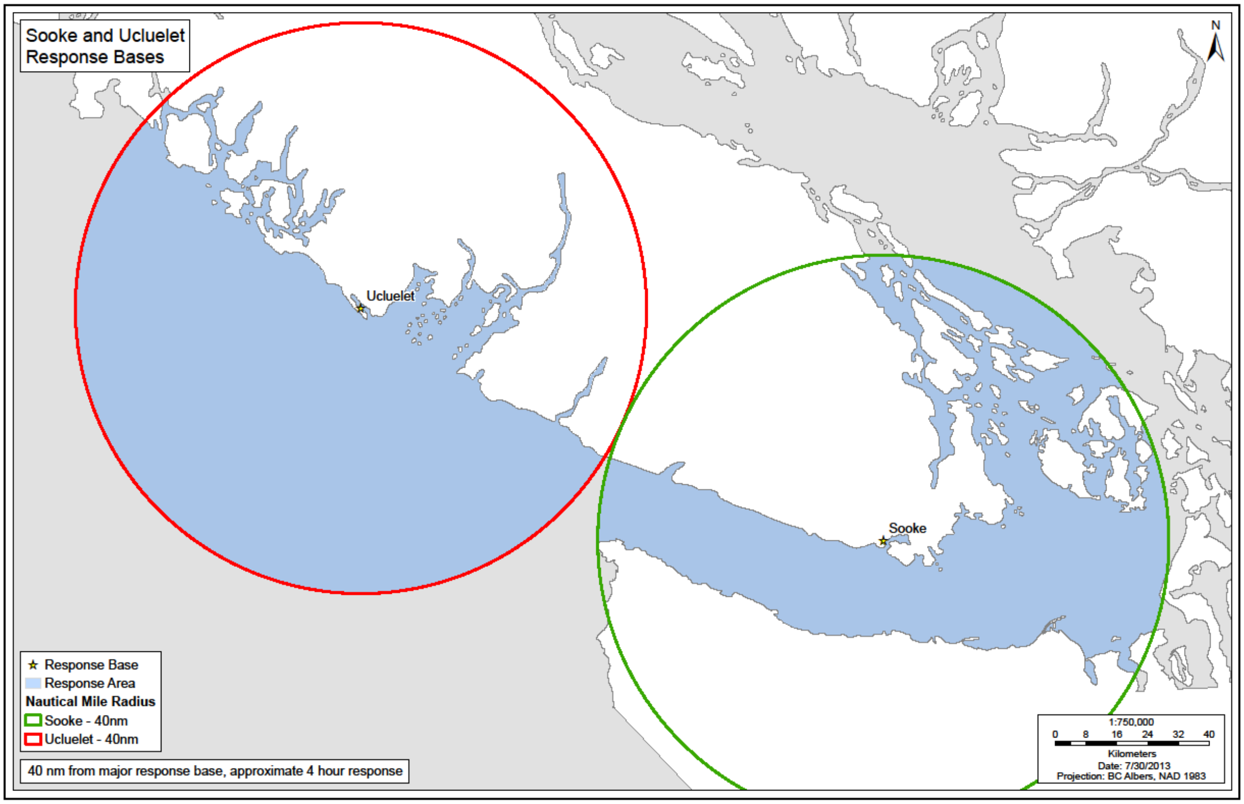


Table 5-1: Vessel Travel Times, Rounded Up to Nearest Hour, No Tidal/Current Effects

	Distance & Speed	Burnaby	Delta Port	Chemainus	Sidney	Sooke	Becher Bay	Port Renfrew	Ucluelet
Burnaby	Distance	N/A	34 nm	44 nm	52 nm	93 nm	85 nm	127 nm	170 nm
	Speed-6 knots		6 hrs.	8 hrs.	9 hrs.	15 hrs.	15 hrs.	22 hrs.	29 hrs.
	Speed-10 knots		4 hrs.	5 hrs.	6 hrs.	10 hrs.	9 hrs.	13 hrs.	18 hrs.
	Speed-20 knots		2 hrs.	3 hrs.	3 hrs.	5 hrs.	5 hrs.	7 hrs.	9 hrs.
Delta Port	Distance	34 nm	N/A	28 nm	24 nm	69 nm	63 nm	102 nm	148 nm
	Speed-6 knots	6 hrs.		5 hrs.	4hrs	11 hrs.	11 hrs.	18 hrs.	25 hrs.
	Speed-10 knots	4 hrs.		3 hrs.	3 hrs.	7 hrs.	7 hrs.	11 hrs.	15 hrs.
	Speed-20 knots	2 hrs.		2 hrs.	2 hrs.	4 hrs.	4 hrs.	6 hrs.	8 hrs.
Chemainus	Distance	44 nm	28 nm	N/A	24 nm	64 nm	58 nm	99 nm	142 nm
	Speed-6 knots	8 hrs.	5 hrs.		4hrs	11 hrs.	10 hrs.	17 hrs.	24 hrs.
	Speed-10 knots	5 hrs.	3 hrs.		3 hrs.	7 hrs.	6 hrs.	11 hrs.	15 hrs.
	Speed-20 knots	3 hrs.	2 hrs.		2 hrs.	4 hrs.	3 hrs.	5 hrs.	8 hrs.
Sidney	Distance	52 nm	26 nm	24 nm	N/A	39 nm	34 nm	77 nm	117 nm
	Speed-6 knots	9 hrs.	5 hrs.	4hrs		7 hrs.	6 hrs.	13 hrs.	20 hrs.
	Speed-10 knots	6 hrs.	3 hrs.	3 hrs.		4 hrs.	4 hrs.	8 hrs.	12 hrs.
	Speed-20 knots	3 hrs.	2 hrs.	2 hrs.		2 hrs.	2 hrs.	4 hrs.	6 hrs.
Sooke	Distance	93 nm	69 nm	64 nm	39 nm	N/A	8 nm	39 nm	82 nm
	Speed-6 knots	15 hrs.	11 hrs.	11 hrs.	7 hrs.		2 hrs.	7 hrs.	14 hrs.
	Speed-10 knots	10 hrs.	7 hrs.	7 hrs.	4 hrs.		9 hrs.	4 hrs.	9 hrs.
	Speed-20 knots	5 hrs.	4 hrs.	4 hrs.	2 hrs.		1 hr.	2 hrs.	5 hrs.
Becher Bay	Distance	85 nm	63 nm	58 nm	34 nm	8 nm	N/A	43 nm	90 nm
	Speed-6 knots	15 hrs.	11 hrs.	10 hrs.	6 hrs.	2 hrs.		8 hrs.	15 hrs.
	Speed-10 knots	9 hrs.	7 hrs.	6 hrs.	4 hrs.	9 hrs.		5 hrs.	10 hrs.
	Speed-20 knots	5 hrs.	4 hrs.	3 hrs.	2 hrs.	1 hr.		3 hrs.	5 hrs.
Port Renfrew	Distance	127 nm	102 nm	99 nm	77 nm	39 nm	43 nm	N/A	52 nm
	Speed-6 knots	22 hrs.	18 hrs.	17 hrs.	13 hrs.	7 hrs.	8 hrs.		9 hrs.
	Speed-10 knots	13 hrs.	11 hrs.	11 hrs.	8 hrs.	4 hrs.	5 hrs.		6 hrs.
	Speed-20 knots	7 hrs.	6 hrs.	5 hrs.	4 hrs.	2 hrs.	3 hrs.		3 hrs.
Ucluelet	Distance	170 nm	148 nm	142 nm	117 nm	82 nm	90 nm	52 nm	N/A
	Speed-6 knots	29 hrs.	25 hrs.	24 hrs.	20 hrs.	14 hrs.	15 hrs.	9 hrs.	
	Speed-10 knots	18 hrs.	15 hrs.	15 hrs.	12 hrs.	9 hrs.	10 hrs.	6 hrs.	
	Speed-20 knots	9 hrs.	8 hrs.	8 hrs.	6 hrs.	5 hrs.	5 hrs.	3 hrs.	

Table 5-2: Driving Distances Between Selected Response Bases (km)

RESPONSE BASES	Duncan	Chemainus	Sidney	Sooke	Becher Bay	Port Renfrew	Bamfield	Ucluelet
Duncan		20	80	72	72	90	137	232
Chemainus	20		100	91	91	103	150	216
Sidney	80	100		58	58	130	216	312
Sooke	72	91	58		19	71	208	303
Becher Bay	72	91	58	19		90	208	303
Port Renfrew	90	103	130	71	90		159	316
Bamfield	137	150	216	208	208	159		191
Ucluelet	232	216	312	303	303	316	191	

Map 5-4: Proposed Geographic Area of Response – Response Times

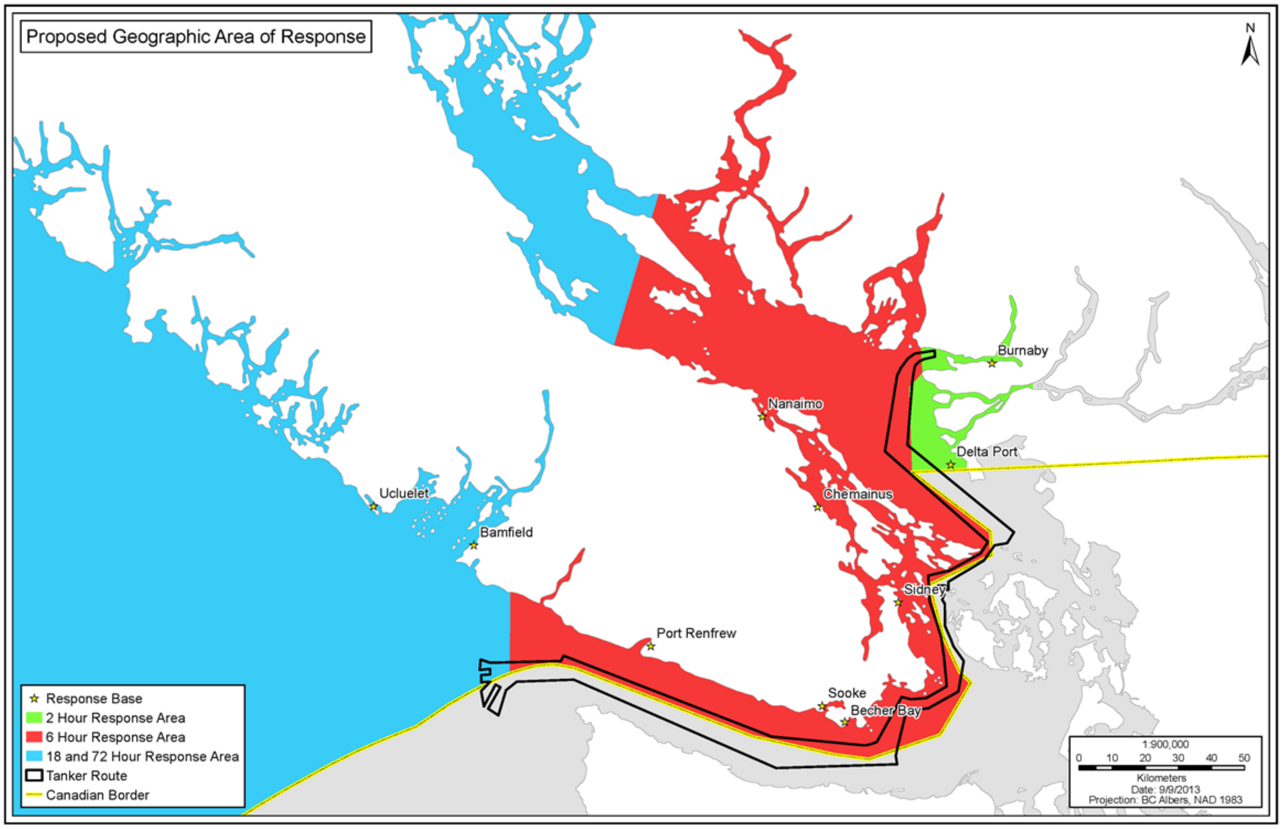


Table 5-3 Possible Response Base Capacities Proposed for Future Oil Spill Equipment Staging Areas

Example of Distribution of Proposed Equipment to Staging Areas	Response Capacity	
	m^3	tonnes
Burrard Inlet (Burnaby) [A]	9,550	9,000
Delta Port area [A]	1,350	1,250
South Vancouver Island (Nanaimo – Chemainus area)	2,800	2,650
North Saanich Peninsula (Sidney area) [A]	11,900	11,200
South Vancouver Island (Victoria – Sooke area)	4,700	4,400
Southwest coast of Vancouver Island (Port Renfrew – Ucluelet area)	1,600	1,500
Total Capacity at Bases	31,900	30,000
[A] These locations would require full-time staff, 24-hours/day, 7-days/week.		
In addition, Community response packages will be allocated (150 tonnes) × ten locations	1,600	1,500

5.3 24-Hour Operations

The on-water recovery plan is based on a 24-hour per day operational period. Responders will be trained and equipped to operate safely in night time conditions. Generators and lighting units will be available to illuminate all working areas to required standards. Personal illumination will be provided, as required. Infrared and night-vision cameras as well as X-band radar will be used to further facilitate night operations. Dedicated vessels and vehicles will be available for personnel rescue, medical evacuation, and transportation. It is expected that WCMRC will staff bases in Sidney area, Delta Port, and to some extent Burnaby on a 24/7 basis to meet the tighter time standards. While adding significant costs to operations, having on site staff will reduce mobilization times for responses to the areas of increased hazards along the tanker route.

6. USCG and Washington State Standards

Given the tanker route travels a common waterway, a description of the United States Coast Guard (USCG) standards is relevant to the proposed standards discussed in this report. USCG standards for a tank vessel in ocean environments is included in Appendix B to this report.

Fundamental differences exist between Canadian vessel planning standards and United States vessel planning standards. The most obvious yet easily overlooked difference is in the units of measure. Being a metric country, Canadian regulations almost always refer to oil quantities in metric tonnes with the occasional reference to cubic meters. The metric tonne is a unit of weight while the cubic meter is a unit of volume. Although a conversion factor, based on product density, can be applied some accuracy is sacrificed in the process. In United States oil spill regulations, the American Petroleum Institute (API) barrel (at 42 United States gallons-per-barrel) is cited as the unit of measure. There are no United States regulations cited in metric tonnes or cubic meters.

In Canada, federal regulations administered by the CCG govern oil spill planning and response. In the United States two levels of government regulations apply to oil spill planning and response: federal (administered by the USCG) and state (administered by individual states). Thus a US port bound tank vessel transiting United States waters is required to comply with federal regulations ***and*** the regulations of as many individual states as jurisdictional state waters the ship crosses. State regulations may never be less stringent than federal regulation but they may be more rigorous than the federal standards. Foreign flag tank vessels transiting the territorial waters of the United States by right of innocent passage are exempt from compliance with United States tank vessel planning standards under regulation 33 CFR 155.1015 (c)(7).

Organizations that remove spilled oil are termed Response Organizations in Canada and Oil Spill Removal Organizations (OSROs) in the United States. Both countries are similar in that they employ a certification program to classify organizations according to their capacities to remove spilled oil. Although the terminology is different, the similarity extends to meeting requirements for tiered levels of response based on specific response time, volume and operating environment (i.e. sheltered versus unsheltered waters; nearshore versus offshore). Currently, the highest certification a Canadian RO can achieve is a 10,000-tonne capacity linked to a specific GAR. In the United States, the highest certification an OSRO can receive is termed Worst Case Discharge Tier-3 (WCD3). The United States OSRO classification is similar in spirit, though not identical, to the Canadian system.

Key differences between the Canadian planning standards and the United States planning standards lie in the number of certified response organizations, the planning volumes and ***who*** is responsible for meeting the requirements for that planning volume.

- Only four ROs are currently certified in Canada and of those, only one, WCMRC, has a GAR for the waters conjoining British Columbia and Washington State. Many OSROs of differing capacities are certified by the USCG.
- Canadian ROs plan for a Credible Worst Case discharge (CWC) based on a statistical risk assessment, however the RO must only demonstrate resources for the time-weighted removal of spilled oil up to the RO's certified volume (i.e. 10,000 tonnes). In the United States, the vessel or planholder must certify resources for the removal of the Worst Case Discharge (WCD), defined as the loss of the ship's entire cargo and fuel complicated by adverse weather. As such, the WCD for a large ship may exceed the recovery capacity of any single OSRO even though that OSRO may

have highest WCD3 certification. In such a case, the planholder would be required to contract with additional OSROs to meet the WCD volume for each geographic area the vessel transits.

The risk assessment document developed through research by DNV provides the rationale for using Credible Worst Case as the criteria to use for oil spill planning standards based upon the type of tankers (modern double-hull Aframax class) used by the project, the stringent acceptance criteria of such tankers, the high standard of risk reducing measures already in place and those proposed in future by TMEP including the use of additional escort tugs, oversight by authorities as well as the historical records of the region and the terminal.

Note: WCMRC as the sole Federally certified RO for the entire coast of BC exceeds the minimum equipment criteria necessary to meet the 10,000 tonne certified capacity. WCMRC also has a number of mutual aid agreements in place with both Canadian and US counterparts that provide WCMRC the ability to call on those resources for assistance and equipment in case of a large oil spill.

7. Summary of Proposed TMEP, US and Washington State Standards

Table 7-1: Comparison - Canadian Response Organization with US Federal and Washington State

ITEM	PROPOSED CANADIAN RESPONSE ORGANIZATION TO PROVIDE FOR TMEP (metric units)	US FEDERAL OSRO LEVELS -for WCD3 rating (both metric & imperial units) APPENDIX B	WA STATE REQUIREMENTS FOR COVERED VESSELS -based on highest standard for specified geographic area (both metric & imperial units)
Spill Size Planning Volume Based on Free Oil Spilled	To be based on Credible WCD (CWC) from statistical risk assessment with Aframax tankers, - 20,000 tonnes (fully loaded) Additional response equipment and resources available from mutual aid partners through prior agreements.	WCD of loss of ship's entire cargo and fuel complicated by adverse weather (for typical tank vessels calling in Puget Sound: 349,022 - 1,028,588 bbl or 47,607-140,299 tonnes)	WCD of loss of ship's entire cargo and fuel complicated by adverse weather (for typical tank vessels calling in Puget Sound: 349,022 - 1,028,588 bbl or 47,607-140,299 tonnes)
Response Times	For proposed TMEP RO: Tiers 1 & 2 in 2-hours; Tier 3, 4 &5 in 6-hours. CWC equipment to be on-site within 36-hours.	Nearshore High Volume Port WCD3: in 60-hours for containment boom, EDRC and TSC resources	Response times are area specific (i.e., San Juan Islands, Padilla Bay, Dungeness etc.) but generally more stringent than federal requirements with significant recovery thresholds mandated at 24-hours and 48-hours
Operational Days	Must complete on-water recovery in 10-days regardless of volume spilled, up to maximum of RO's rated capability.	Not specified	Not specified
Fluid (oil & water) Volume Recovered per Day	9,966 tonnes (73,051 bbl) (based on 20,000 Tonne Equipment Package computations)	50,000 bbl or 6,820 tonnes (based on requirements for classification as a WCD3 OSRO)	60,000 bbl or 8,184 tonnes (generalized from region-specific/time-weighted statutory requirements in WAC 173-182)
Percentage of Resource Capable of Shallow Water (6'-10') Operations		Nearshore: 20%; Offshore: 10%	Specified by geographic region with ≤10' designated as shallow water threshold
Overall Boom Requirement	19,575 m	30,000 feet or 9,144 m (based on requirements for classification as a WCD3 OSRO)	55,000 feet or 16,764 m (generalized from region-specific requirements)

Table 7-1: Comparison - Canadian Response Organization with US Federal and Washington State (continued)

ITEM	PROPOSED CANADIAN RESPONSE ORGANIZATION TO PROVIDE FOR TMEP (metric units)	US FEDERAL OSRO LEVELS -for WCD3 rating (both metric & imperial units) APPENDIX B	WA STATE REQUIREMENTS FOR COVERED VESSELS -based on highest standard for specified geographic area (both metric & imperial units)
On-water Storage	29,898 tonnes (219,152 bbl)	100,000 bbl or 13,640 tonnes (based on requirements for classification as a WCD3 OSRO)	Unless specified by geographic region, 25% of WCD (87,256 - 257,147 bbl or 11,902 - 35,075 tonnes) must be dedicated on-water storage mandated to arrive within 24-hours.Region-specific storage is generally capped at 2X EDRC.
Access to Rescue Tug	Under consideration, may be replaced by additional tug escort	N/A	Must have contracted access to Emergency Response Towing Vessel (ERTV) at Neah Bay
Vessels of Opportunity (VOO)	Tug of opportunity exist in the area, but not considered for planning standards.	N/A	To be phased in...For each geographic region the planholder transits there must be a prescribed number of VOO
Group-5 Oils (Sunken)	All crude oils proposed by TMEP fall within USCG Groups 3 & 4; i.e. does not sink on spilling. Weathered oils display similar characteristics as that of heavy crude oils and did not indicate propensity to submerge or sink under test conditions.	N/A	Must have contract with RO that can recover sunken oils and provide sonar, water column sampling, dredges etc.
Group-5 Oils (Lightering)	Vessels of opportunity (large number of oil barges as well as some tankers) exist in the region and can be made readily available if required.	Not an OSRO requirement but planholder must be capable of offloading (lightering) largest tank within 24-hours	N/A
Shoreline response	Treat 3,000m of shoreline per day.	N/A	Must have contracted resources that: 1) can field 100 shoreline workers with a 1:10 supervisory ratio within 24-hours notice for a duration of 14-days; 2) has sufficient equipment to immediately treat 3-miles (4,828 m) of shoreline over 3-tide cycles; 3) must have passive recovery materials (i.e. snare); 4) must have mobile support unit with materials, comms & data.

Table 7-1: Comparison - Canadian Response Organization with US Federal and Washington State (continued)

ITEM	PROPOSED CANADIAN RESPONSE ORGANIZATION TO PROVIDE FOR TMEP (metric units)	US FEDERAL OSRO LEVELS -for WCD3 rating (both metric & imperial units) APPENDIX B	WA STATE REQUIREMENTS FOR COVERED VESSELS -based on highest standard for specified geographic area (both metric & imperial units)
Wildlife Rehabilitation	Under planning and review	N/A	Contract for mobile infrastructure On-scene within 24-hours; trained workers
In-situ Burning (ISB)	Have in-house capability	N/A	Not required - if plan holder intends to seek permission for use must have access to equipment
Use of Dispersants	Under planning and review. Use of dispersants may not be a suitable countermeasure given the heavier crude oils proposed for the project.	Optional Endorsement for WCD OSROs capable of deploying dispersant as far as the 50 nm contour line	Not required - if plan holder intends to seek permission for use must have access to equipment
Aerial Observation – Aerial use of Dispersants	Under planning and review.	Required if deploying dispersants	Not required - if plan holder intends to seek permission for use must have access to equipment
Aerial Observation - General	Under planning and review. Federal and private resources are available.	Must have trained observers according to 33CFR 155.1050 (1) (2) (iii)	For Puget Sound, Straits of Juan de Fuca & Outer Coast…must have 6-hour response with helicopter and fixed wing support including an oil spill spotter trained to federal standards. Remote sensing and infrared-capable aircraft are required within 12-hours.
Tactics Manual	Required and to be developed. Use of simulations for drills, exercises and training purposes.		To be phased in- manual to describe recovery tactics near Neah Bay, San Juan Islands and Columbia River
Equipment Inventory	Voluntary listing on the WRRL database; workgroup ensures accuracy and consistency	federal data base listing equipment	Voluntary listing on the WRRL database; workgroup ensures accuracy and consistency
Firefighting	Shipboard response.	Required for all vessels carrying Groups 1-4 oils	N/A
Salvage	Under planning and review. Not currently required under Federal requirements. Facilities exist in the region, including offices of reputed salvage organizations.	Required for all vessels carrying Groups 1-4 oils	N/A

8. Input to Planning

8.1 Operating Environments

The amount and type of equipment used in any spill response operation is governed by the environmental conditions prevalent in the area of the incident. Most geographic areas of response can be divided into a number of distinct operating environments, based on factors such as: wind, sea state, tides, currents, and bathymetric features.

8.1.1 Unsheltered Waters

Unsheltered waters are those where on-water oil recovery operations are normally affected by environmental conditions. Typically larger vessels or ships are needed to operate safely in these waters. The waters of the Strait of Juan de Fuca, west of Race Rocks, are deemed unsheltered.

8.1.2 Sheltered Waters

Sheltered waters are waters where on-water oil recovery operations can be carried out effectively with minimal disruption from environmental conditions. As an example, this environment is one in which small barges (18 m - 30 m) and small boats (6 m - 12 m) can operate safely.

8.1.3 Shoreline

Shoreline is the intertidal zone between the maximum low tide and maximum high tide, including the back shore area affected by storm conditions. Due to the rise and fall of the tide, spilled oil can migrate across the intertidal zone necessitating some on-water oil recovery capability as part of near-shore treatment.

8.2 Wind Force, Sea States, and Operating Conditions

A brief discussion of wind force and sea state measurement is necessary to define the environmental conditions under which response countermeasures would be most effective. Scaled numerical designations are used to describe wind forces (on the Beaufort Scale) and a range of wave heights (referred to as sea states). Understandably there can be a cause-and-effect relationship between wind and wave height as reflected in Table 8-1 below.

Booming and skimming operations are most effective up to Sea State 2 (maximum wave height of 1 m) and with wind speeds less than 10 knots (Beaufort Scale 3). Wind-driven waves in sheltered harbours, sheltered bays, or in the lee of landforms will have less height than similar waves on the open ocean.

Although WCMRC equipment is capable of operating in sea states greater than 2, the effectiveness of those countermeasures is reduced. For example, at Sea State 3 (Beaufort Scale 4) wave heights exceed 1 m and the wind velocities range from 11 to 16 knots. At this magnitude, containment booming and skimming is difficult to execute and become less effective. Additionally, wave agitation may emulsify water and oil into a thick mousse making oil recovery from the water surface more difficult. Emulsification may also increase the volume of the spill since hydrocarbon-water emulsions can incorporate between 60% and 80% water by volume within two to three hours[8] . It should be noted that regulations only require response organizations and oil handling facilities to plan response operations up to and including Beaufort Scale 4.

[8] *ITOPF, 1986 Technical Information Paper*

Conditions preventing mechanical recovery generally occur at sea states greater than 3 (greater than Beaufort Scale 4). At that intensity, with significant wave heights above 1.5 m and wind velocities greater than about 16 knots, skimming and booming operations would be suspended limiting the response to equipment and personnel mobilization. Control of the spill at its source by transfers and lightering could still potentially occur if deemed safe to do so.

Table 8-1: Definitions of Sea States and Beaufort Scale

Wind speed (knots)	Beaufort Scale	Maximum Wave Height (m)	Sea State	Appearance
1 - 3	1	0.1	0	Calm, small ripples; without foam crests
4 - 6	2	0.3	1	Small wavelets; do not break
7 - 10	3	1.0	2	Large wavelets; beginning to break
11 – 16	4	1.5	3	Small waves; frequent foam crests
17 - 21	5	2.5	4	Large waves; many foam crests
22 - 27	6	4.0	5	Large waves; some spray, foam crests everywhere

8.2.1 Metocean Data Analysis

Studies of metocean (meteorological and oceanographic) data are used to identify mean and extreme environmental conditions. Common metocean conditions studied includes data from waves, tidal surges, currents, salinity and water temperature. Metocean analysis consists of data validation, identification of normal conditions, identification of extreme conditions, and sea state analysis.

Trans Mountain has undertaken a metocean study of the tanker route between the Westridge Terminal and Buoy "J" using hourly data acquired from 29 meteorological stations and six buoys. From this data, observed patterns were analyzed to assist the RO in: 1) planning response times; 2) base locations; weather induced downtimes; and 4) the appropriateness of equipment. Additionally, the analyzed metocean data was applied to risk assessment and scenario development. Table 8-2 below summarizes the extremes of metocean conditions that may be encounter along the shipping route between the Westridge Terminal and Buoy "J".

Table 8-2: Wave and current summary along the shipping corridor - Westridge to Buoy "J"

AREA	TIDAL RANGE Relative to Chart Datum; low to mean to high (metres)	STORM SURGE Relative to Predicted Tide (+/- meters)	CURRENT RANGE[1] Slack to Maximum (metres/second)	WAVE CLIMATE[2] Significant Wave Height Range (metres)
Westridge to 1st Narrows	-0.1 to 3.1 to 5.0	+1.1	max: 3	not significant
1st Narrows to Burrard Inlet Entrance	c.d. to 3.1 to 5.1	+ 5.6 a.c.d.	max: 0.25 to 0.5	0.33 to 2.0
Pt. Grey - Sturgeon Banks - Sand Heads	c.d. to 3.0 to 4.9	-0.6 to +1.1	0.5 to 2.5	0.33 to 2.7
Sand Heads - Roberts Bank - Saturna Island	0.1 to 3.0 to 4.8	-0.6 to +1.1	0.5 to 2.0	> 0.33 to 2.1
Boundary Pass	0.1 to 2.6 to 4.8	unavailable	1.5 to 2.0	not significant
Haro Strait	-0.2 to 2.4 to 3.8	unavailable	2.0 to 3.0	0.21 to 4.0
Rosario Strait (alternate route)	0.8 to 1.6 to 3.1	unavailable	max: 3.6	not significant
Discovery Island - Race Rocks	0.03 to 1.9 to 3.4	unavailable	0.4 to 3.8	0.21 to 4.0
Race Rocks - Neah Bay	-0.6 to 1.3 to 3.3	unavailable	0.75 to 1.3	0.01 to 8.0
Strait of Juan de Fuca Entrance	-0.1 to 2.0 to 4.0	unavailable	0.25 to 1.5	$\leq$ 6.5

NOTES

c.d. = chart datum
a.c.d. = above chart datum
data represented here is summarized, generalized & synthesized across broad geographic area
[1] Current range covers broad geographic area; maximum may occur as localized velocity only
[2] Percentage of occurrence not reflected in this summary

8.3 Operating Environments for Area of Increased Response

Further to the zonal time standards inside the Increased Response Area, specific operating areas exist inside those boundaries that are based on the marine environments. To prevent confusion with the Increased Response Area, such operating environments do not reflect different time standards, but determine the appropriate type and level of equipment to be located nearby. Existing CCG equipment guidelines detail tiered needs for each of the three operating environments: Shoreline, Unsheltered Waters, and Sheltered Waters. In designating these specific geographic regions consideration to make this determination was given to: stakeholder commitments, government regulations, local knowledge, and professional experience . The operating environments in each of these three regions are described below and summarized in Table 8-3. The operating environment classification has a direct impact on the equipment requirements and the efficient placement of equipment for the purpose of cascading throughout the regions

8.3.1 Port of Vancouver to Race Rocks (Eastern Area)

This Eastern Area of Response begins at Race Rocks encompassing the South Salish Sea all the way into the Port of Vancouver. The Designated Port, specifically the Westridge terminal and the greater area beyond the marine terminal, is a sub-set of this area. The operating environment of the Eastern Area of Response, for purposes of this equipment plan, reflects an equal split between sheltered waters and shoreline with a small percentage of area considered to be unsheltered waters. The operating environment stays as previously classified, with the boundaries slightly altered.

8.3.2 Race Rocks to Buoy “J” (Western Area)

The Strait of Juan de Fuca west of Race Rocks all the way to Buoy “J” is considered the Western Area of Response for this equipment plan. It was determined to have a higher amount of unsheltered operating conditions due to the direct exposure to the Pacific Ocean. As such, the IRA can be expected to have higher sea states and stronger wind speeds.

8.3.3 Buoy “J” to the 200-Mile Territorial Limit

Federal regulations require that the Response Organization have the capacity for a Tier 3 and Tier 4 response as far as the 200-mile territorial limit. Incidents outside Buoy “J” would be governed by existing response standards.

Table 8-3: Operating Environments in Identified Geographic Regions of the IRA

Operating Area	Onshore	Sheltered	Unsheltered
South Salish Sea (Eastern area of Response including Designated Port)	40%	40%	20%
Strait of Juan de Fuca to Buoy “J” (Western Area of Response)	40%	20%	40%

9. Aerial Observations

Aerial surveillance is critical in supporting spill assessment, containment and removal operations. During a response, the RO should have the capability to place trained observers aboard chartered helicopters and fixed wing aircraft to obtain relevant information on spill size and movement. Using industry standard assessment techniques, these individuals will interpret, record and communicate spill information to direct on-water strategies, and relay pertinent information to the Incident Command Post (ICP). Additionally, Transport Canada's National Aerial Surveillance Program (NASP) maintains a dedicated Orion aircraft at YVR (Vancouver International Airport) with sophisticated sensors to monitor oil slicks in real time. The data feed and information exchange from the Orion has previously been tested in WCMRC exercises. Ongoing training with Transport Canada and the continued practice of chartering aircraft for exercises will continue. The photograph in Photo 9-1 offers a product sample of the output from an aerial observation platform.

Photo 9-1: Sample Aerial Observation Photo

10. Rescue and Escort Tugs

The Strait of Juan de Fuca shipping lanes are served by a rescue tug stationed at Neah Bay, Washington. This Washington State initiative stipulates that the rescue tug must be of sufficient size with enough bollard pull to control disabled vessels. This includes Aframax sized tankers operating in the western regions of Juan de Fuca including Buoy “J”. Trans Mountain, as part of the TMEP risk assessment carried out by DNV, has concluded that sufficiently sized escort tugs proposed for all outbound laden tankers from Westridge would yield a more significant risk reduction than a rescue tug on-station. For this reason, a Canadian rescue tug program similar to the Washington State model has not been developed as part of this equipment plan. Trans Mountain will require all outbound laden tankers traveling between Westridge Marine Terminal to Buoy “J” to be attended by at least one escort tug at all times. In certain high-risk transit areas, to be determined by pilots and regulatory authorities, the tug/s would be tethered to the ship. Trans Mountain is undertaking a separate review of tug capabilities in the region, which is not referenced in this document.

11. Communications

An effective communications system is critical in the management and control of day-to-day emergency response operations. A communications system is used to direct personnel, vessels, aircraft, automobiles, and receive information regarding the status, surveillance, logistics needs, and/or other emergency requirements.

The primary communications network is capable of total coverage throughout the spill operating area. The CCG provides public VHF capabilities that encompass over 98% coverage on the BC coast. Backup systems comprising single-side band, relays and satellite communications will be necessary to provide a wider range of coverage that may extend beyond the immediate spill operations area.

WCMRC operates its own secure licensed UHF frequencies via a network of fixed and portable receivers. WCMRC operates 5 UHF repeaters. The repeaters are located as follows: South Coast-top of Mount Seymour; Vancouver Island- Mount Helmken; North Coast-Hartley Bay, Gil Island and Mount Hays. Together with repeaters operated by Marine Spill Response Corporation in the United States, this network allows communication with response resources from the upper reaches of Georgia Strait to as far away as Buoy "J" at the mouth of the Strait of Juan de Fuca. As such it is not anticipated that the proposed plan will have much impact on communication equipment requirements.

For small spills, normal vessel communications equipment will be sufficient to direct and coordinate on site cleanup. All response vessels will have both fixed and portable VHF and UHF radio equipment with dedicated channels for routine communication among vessels. Each response base and the larger vessels will also have Iridium satellite phones to ensure coverage through the Strait of Juan de Fuca and up the western side of Vancouver Island.

12. On-Water Recovery Strategy

Federal guidelines for on-water recovery stipulate that resources be identified to meet the rated capability of the response organization over a 10-day operational period. To achieve this goal, the equipment plan recommends strategic base locations, large multi-purpose platforms (response barges) that will support both stationary and self-propelled skimmers, and the containment booms that are fundamental to accepted protection and enhanced recovery methods.

Non-mechanical methods, such as spill-treating agents (i.e., dispersants and shoreline releasing agents) and in-situ burning are viable countermeasure techniques that, under certain circumstances, can be considered on a case-by-case basis through consultation with government agencies. Currently, there is no pre-approval in place for these measures.

Two critical components will be: 1) base locations that improve response times; and 2) purpose-designed barges that enable efficient use of personnel and materials in support of on-water recovery. Historically, responses have been made less efficient due to a lack of early and sufficient storage. Storage will be a key element in the equipment plan. Barges are intended to serve as primary storage for large amounts of recovered product and waste water. Additionally, these mobile barges will be multi-purpose, capable of servicing personnel at various locations, shuttling and/or offloading waste in a cyclical manner while other barges continue to be loaded with recovered material. The barges will also be capable of enhanced skimming operations to allow significantly larger oil encounter rates than presently exist.

High-speed vessels capable of deploying ocean boom are required to meet the aggressive response times proposed. Larger 90-foot vessels will be required given the potential for increased sea states in the Strait of Juan de Fuca. To meet the current federal mandate, larger vessels will likewise be needed to adequately operate in the Pacific Ocean further outside the coastline. Slightly smaller vessels will be needed to address potential issues along the more traffic dense areas of the tanker route.

The commitment to early response drives the need to establish a number of strategically positioned bases along the Trans Mountain tanker route. The bases will house the increased equipment and personnel in addition to bringing vessel operators closer to the fleet additions proposed. Response times are such that personnel must be dispatched immediately from Vancouver Harbour, from the Robert's Bank area (Delta Port ideally), and from other points inside of two hours. Each base will need to be equipped with appropriate types of boom and other shoreline equipment as well as having methods of transporting it to incident locations. High-speed, large-volume landing crafts have been proposed to address the aggressive time standards. Finally, smaller-boom tending and shoreline-capable landing crafts will be needed to address smaller-scale, local operations.

In addition, an offshore supply vessel (OSV) will be required to serve barges and larger vessels, support rapid large scale equipment movements, to shuttle larger crews, and to provide early interim storage capacity. The supply vessel will be moored pre-loaded with Current Buster® 6 packages and mini-barges. The supply vessel will quickly steam to the casualty, discharge first response equipment, and then act as early storage as deemed necessary by the circumstances of the response.

12.1 On-water Recover Equipment

12.1.1 Multi-Purpose Support Platforms / Barges

Given the potential to respond to a spill in remote or infrastructure-poor locations as well as unsheltered water operating environments, large multi-purpose barges have been selected as a key element in the organization's response strategy. These self-sufficient platforms will provide skimming capability, temporary storage of recovered product, logistical support, and field command. Other self-propelled skimming vessels can use these platforms to offload recovered oil while the platforms themselves can act as floating warehouses for portable skimmers awaiting assignment to vessels of opportunity. It is envisioned that these barges will provide housing to a limited number of personnel as well as to supply fuel to the many vessels engaged in a significant response.

12.1.2 Temporary Storage

The planning standards require two types of temporary storage: primary and secondary. Primary storage is defined as the storage volume required for each oil recovery unit to sustain oil/oily water waste recovery operations for 24 hours per day. Secondary storage capacity is essentially double the primary storage capacity. Primary storage must be dedicated to the RO while secondary storage can be contracted from third parties. The logic behind the legislated standard reflects the shuttle nature of managing recovered oil: one unit of storage attends the spill site; one unit of storage is being discharged off-site; and one unit of storage is in-transit back to the spill site.

Temporary storage resources are summarized by location and operating environment in Table 12-1. This storage volume far exceeds the current requirements of accepted guidelines. WCMRC will maintain a variety of storage devices to meet primary and secondary requirements up to the 20,000 tonne TMEP planning standard. This will include three additional response barges with a combined capacity of 20,000 tonnes (one 10,000-tonne barge, two 5,000-tonne barges). The five response barges along with mini-barges, kept onboard the response barges or at base locations, will support recovery operations. Mini-barges (40 tonnes capacity) can be deployed to multiple recovery sites and shuttled back to the response barges to be offloaded. Fast response mobile skimming vessels can also use the mini-barges and floating bladders to complement their onboard storage capacity.

Initially, the fast-response skimming vessels will arrive at the spill site prior to the response barges. In this phase, as illustrated in Figure 12-1, the mobile skimming vessels may rely on their integral storage or floating bladders until a shuttle system of mini-barges can be established. Storage available on the OSV would be extremely beneficial at this stage to enable more efficient response by the on-site skimming vessels.

Additional storage support may be contracted in the form of vacuum trucks, waste bins, third party tank barges, and shore tanks. The storage requirements will be tailored to suit the operational needs of the incident, and will be discussed in the waste management plan.

A variety of storage options are available within the two broad categories of portable and integral storage. Storage selection and configuration must consider a number of factors to be effective such as size, portability, and mobilization times.

Table 12-1: Temporary Storage Capacities per Day by Area (tonnes)

Location	Shoreline	Sheltered	Unsheltered	Total
Eastern Area Of Response, 20,000 tonne				
Primary	80	4,000	2,000	6,080
Secondary	160	8,000	4,000	12,160
Total	**240**	**12,000**	**6,000**	**18,240**
Western Area of Response, 20,000 tonne				
Primary	80	2,000	4,000	6,080
Secondary	160	4,000	8,000	12,160
Total	**240**	**6,000**	**12,000**	**18,240**

12.1.3 Portable Storage

Portable storage includes floating bladders which are available in many sizes and can be easily stored and transported on vessel decks. Once deployed, floating bladders can be towed at a speed of 6 knots when full. Floating bladders are sacrificial, used one time when filled with viscous heavy crude oils, and must be taken off-site for disposal.

12.1.3.1 Integral Storage

Integral storage is built into certain response vessels as well as barges, and mini-barges.

Temporary storage is summarized by vessels with integral storage and by portable storage devices below. Only WCMRC assets in Vancouver and Vancouver Island have been identified.

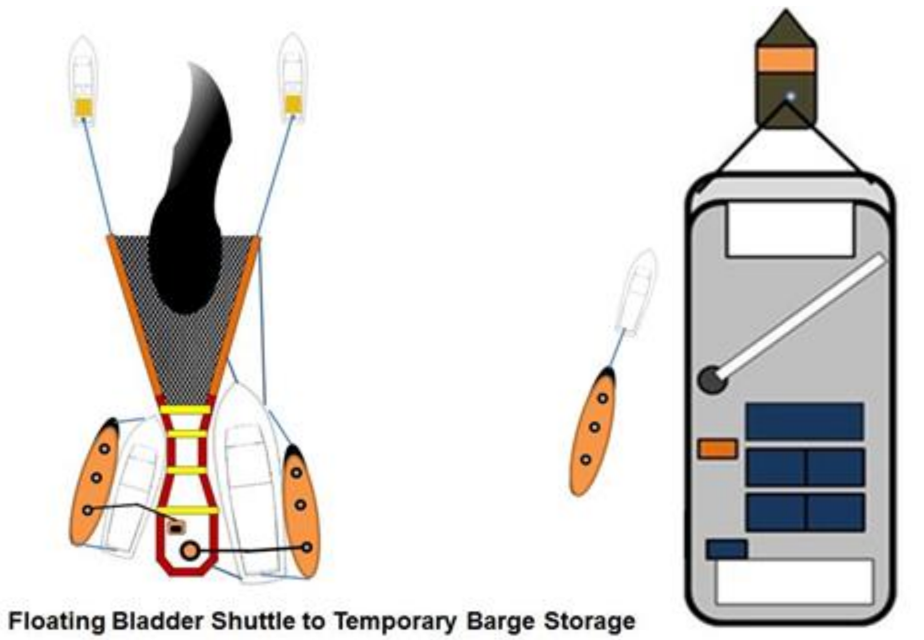
Table 12-2: WCMRC Temporary Storage Resources (tonnes)

Description	Units	Capacity	Type	Total Capacity
RESPONSE BARGES				
Units 1, 2	2	5,000	Integral	10,000
Unit 3	1	10,000	Integral	10,000
Burrard Cleaner No.18	1	4,200	Integral	4,200
Burrard Cleaner No.10	1	2	Integral	2,140
Burrard Cleaner No.17	1	1,000	Integral	1,000
Burrard Cleaner No.12	1	15	Integral	15
MINI-BARGES (4 per new barge + 10 on shore)	22	40	Integral	880
SKIMMING VESSELS				
Skimming vessels, 27.5 m	2	44	Integral	88
Skimming vessels, 20 m	2	34	Integral	68
MJ Green	1	12	Integral	12
Burrard Cleaner No.9	1	80	Integral	80
Burrard Cleaner No.1	1	16	Integral	16
Burrard Cleaner No.2	1	12	Integral	12
Burrard Cleaner No.3	1	4	Integral	4
PORTABLE				
On skimming vessels, 27.5 m (2)	4	10	Floating bladder	40
On skimming vessels, 20 m (2)	4	10	Floating bladder	40
On supply vessel	2	25	Floating bladder	50
Existing in Burnaby and Vancouver Island		175 (SC), 80 (VI)	Floating bladder	255
At proposed remote bases (4)	12	10	Floating bladder	120
OFFSHORE SUPPLY VESSEL				
Onboard tankage	1	2,000	Integral	2,000
Total				31,020

In summary the additions proposed under the equipment response plan:

- Three barges for primary integral storage, 20,000 total tonnes total storage
- 22 mini-barges to be stored on barge decks, the offshore supply vessel, and at response bases
- Four mobile skimming vessels with integral storage tanks
- 22 floating bladders (Sea Slugs), stored on decks of skimming vessels, the offshore supply vessel, and at response bases

Figure 12-1: Typical Shuttle to Temporary Barge Storage



12.1.4 Oil Recovery Devices / Skimmers

Oil recovery devices (commonly referred to as skimmers) remove oil from the surface of the water using different principles. Skimmers can be either part of a self-propelled vessel or be a portable unit assigned to a vessel of opportunity. The proposed skimmer equipment packages will include a mix of units capable of performing across different operating environments and in varying weathered oil conditions. The recovery device inventory will meet the planning standards for on-water recovery of a 20,000-tonne spill in the IRA in ten operating days.

Note: Federal planning standards for on-water recovery require that skimmers:

- Be derated to 20% of nameplate capacity (demonstrated recovery capacities in excess of 20% may be used if validated by actual performance records);
- Have the capability to operate in all three environments. Skimmer equipment calculations, based on derated are in the attached appendix.

To meet the planning standard for a 20,000-tonne spill, the total derated skimming capacity is 83 tonnes per hour as determined by the federal guidelines. In the event 24-hour continuous recovery operations are not possible, there will be sufficient skimming capacity to shorten the duration of the daily on-water recovery period and still meet the planning requirements. For a matrix representation of these thresholds refer below to: 1) Table 12-3 for a summary of derated skimming requirements further broken down by operating environments; and 2) Table 12-4 for a summary of skimming capacity for operational periods less than 24-hours.

Table 12-3: Derated Skimming Capacity (t/h)

Location	Shoreline	Sheltered	Unsheltered	Total
Eastern Area of Response, 20,000 tonne	0.60	33.3	16.6	50.5
Western Area Of Response, 20,000 tonne	0.60	16.6	33.3	50.5

Table 12-4: Skimming Capacity by Operating Period (t/h) for Each Area

Derated Skimmer Capacity Required	On-Water Operating Period
50.5	24 hours
67.3	18 hours
101.0	12 hours
151.5	8 hours

Skimmers must be capable of collecting light to heavy oils and likewise be capable of recovering those products as they weather over the duration of the response. As such, incorporating multi-range skimmers into the equipment package will preclude the need to maintain a series of viscosity-specific units.

Table 12-5: Skimmer Capacity Summaries

Skimmer location	Type	Operating Environment	Number of skimmers Required	Derated Capacity per Skimmer (t/h)	Total Skimming Capacity (t/h)
Response barges (new)	Brush	Unsheltered	6	30	180
Skimming vessel, 27.5m (2)	Brush	Unsheltered	2	32	64
Skimming vessel, 20 m (2)	Brush	Unsheltered	2	32	64
Portable near shore (warehoused)	Brush	Sheltered	4	12	48
Existing Vancouver and Vancouver Island	Various	All			100.5
Total					**456.5**

Current skimming capacities meet the pro-rated legislated requirements, however additional skimmers that are more effective in the proposed operating environments have been recommended. Skimming capacity is increased further with the integrated skimming from the proposed high-speed vessels which will be required to meet the more stringent response time standards. Additionally, new technology high-capacity, fully-contained Aquaguard skimmers suitable for barge deployment have been included to further bolster current capabilities. Each response barge would be capable of enhanced skimming operations and could deploy large size boom sweeps on port and starboard. The Aquaguard skimmers would then be deployed overboard via pump system integrated jib arms, creating large encounter rates. Skimming capacity largely exceeds the planning standard as WCMRC moves to larger multi-purpose equipment.

12.1.5 Submersible Offloading Pumps

Offloading pumps, if not already part of the skimmer, must be acquired to transfer the skimmed product from the recovery device to storage. Submersible pumps are ideally suited to support the transfer of oil from a temporary storage device such as the mini-barges. The pumps are designed to move high volume viscous liquids. The addition of a water injection kit at the pump discharge can also improve transfer rates. Multiple submersible pumps will be stationed on response barges to facilitate the offloading of

recovered product from the skimming vessels and mini-barges. The submersible pumps are versatile and can be used in other response applications.

13. Boom

Transport Canada guidelines for boom resources, which appear in Appendix B of their Final Standards, specifies four potential uses for boom: 1) sweep boom to improve the oil encounter rate for skimmers, 2) protection boom, 3) on-water containment boom, and 4) shoreline cleanup boom. These boom resources must be appropriate for the operating environment in which they will be deployed (i.e., unsheltered waters, sheltered waters, and shoreline). The guidance also notes that 400 m of boom should exist for each oil recovery system operating in the subject waters.

Transport Canada specifies boom requirements in sheltered water operating environments based on projected oil on water and oil in contact with the shoreline. Sheltered water containment boom requirements are calculated as 1.250 times the amountof spilled oil. The amount of boom required for near shore containment is estimated as 0.625 times the volume (in tonnes) of oil in the sheltered waters. Thus, the total boom planning standard for sheltered water containment is 1.875 times the amount of oil spilled or the sum of both the on-water and shoreline figures. Shoreline boom resources are based CCG guidance documents designating a minimum treatment of 500 m of shoreline per day. WCMRC's recommendation is to have resources available to treat 3,000 m of shoreline per day.

Table 13-1: Boom Requirements by Operating Environment (m)

Location	Shoreline	Sheltered	Unsheltered	Total
Eastern Area of Response	1,000	20,000	1,600	22,600
Western Area of Response	1,000	12,500	1,600	15,100

The following paragraphs highlight some of the boom types anticipated for use in the IRA.

13.1 Boom Types

See appendix for further details.

13.2 Sweep System

While the Current Buster sweep system is not classified as boom for legislated boom requirement it can be considered so for inclusion here. Current Busters, classified as an off-shore recovery system, will be stored on the larger response barge on the West Coast of Vancouver Island, and additional units will be stored on the OSV moored somewhere on the Saanich Peninsula. Storing Current Busters on the OSV will allow for rapid transport and deployment as tug deliveries via the barge would be too slow.

The Current Buster 6 sweep system is a unique product for containing and recovering oil in an offshore environment. The system can be operated in sheltered and unsheltered water and is capable of containing and collecting oil at towing speeds up to 4 knots versus conventional sweep system speeds of approximately 1 knot. The Current Buster sweep system allows higher rates of encounter and more efficient skimming. The 6 series has higher freeboard and a larger sweep than the existing 4 series.

Each system consists of a front sweep which funnels oil into a combined collector/skimming device and then into a separator tank from which the oil is recovered by a simple pump or portable skimmer.

13.2.1 Unsheltered Boom

Each offshore recovery system is required to carry 400 m of unsheltered boom. For the tanker route into Vancouver Harbour, offshore recovery systems will be defined as response barges and vessels large enough to be self-sufficient for an extended period of time. These vessels will carry the Current Buster sweep systems or have integrated skimmers. An air-Inflated boom with a depth of 30 inches plus, stored on reels for rapid deployment, is effective in the unsheltered environment as a containment boom or as protection boom. This type of boom should be included on the response barges as well as on the skimming vessels.

13.2.2 Sheltered Boom

General purpose boom is a versatile curtain style boom designed for use in many different spill response applications. This is the most common type of boom used in the sheltered water environment.

13.2.3 Shore Seal Boom

Shore seal boom is used to prevent oil from spreading further along the shoreline. The boom consists of an air inflated flotation chamber and a water filled skirt chamber. The water filled chamber will seal the shore at the water's edge. The water-filled chambers act as ballasts when the boom is floating; when the tide goes out, the chambers sit on the ground and form a seal.

13.2 Boom Placement

13.2.1 Port of Vancouver

Significant boom resources already exist in the port area in trailers and the Burnaby warehouse. Additional boom will be stored in the proposed Delta Port area response base and on landing crafts.

13.2.2 Eastern Area of Response

Two additional 5,000-tonne barges will each house a 40-foot container with 1,500 m of general purpose boom. The proposed response base will store two additional trailers and a landing craft style vessel will store 500 m on water ready to deploy. Unsheltered water boom will be stored on the new mobile Rozema skimmers, and on containers onboard the barges.

Table 13-2: Boom resources, Existing and Additional - Eastern locations

Host Port	Location	Description of Boom	Operating Environment	Proposed Amount of Boom (m)	Planning Requirement
EXISTING RESOURCES					
Burrard Cleaner No. 18	Port (Vancouver)	NOFI 1,000	Unsheltered	305	
		Kepner (x2)	Unsheltered	915	
		GP, solid flotation, 0.6 m	Sheltered	305	
Burrard Cleaner No. 17	Port (Vancouver)	Kepner	Unsheltered	305	
Burrard Cleaner No. 7	Port (Vancouver)	GP, solid flotation, 0.6 m	Sheltered	305	
Burrard Cleaner No. 8	Port (Vancouver)	GP, solid flotation, 0.6 m	Sheltered	411	
Warehouse/ trailers		Shore seal, 0.6 m	Shoreline	2,039	
Trailers	various	GP, solid flotation, 0.6 m	Sheltered	3,780	
Warehouse	Port (Vancouver)	GP, solid flotation, 0.6 m	Sheltered	3,078	
Trailers		Kepner 41"	Unsheltered	305	
Trailers		GP, solid flotation, 0.6 m	Shoreline	1,163	
Warehouse	Duncan	30" Zoom boom	Unsheltered	427	
Trailers	Vancouver Island	GP, solid flotation, 0.6 m	Sheltered	3,948	
Warehouse	Port (Vancouver)	NOFI 1000/30" air	Unsheltered	412	
TO BE ACQUIRED					
Skimming vessel, 20 m	Port (Delta Port)	Kepner	Unsheltered	400	
Warehouse	Port (Delta Port)	GP, solid flotation, 0.6 m	Sheltered	4,500	
Boom Boat	Port (Delta Port)	GP, solid flotation, 0.6m	Sheltered	500	
Landing craft	Port (Delta Port)	GP, solid flotation, 0.6 m	Sheltered	500	
Skimming vessel, 20 m	Saanich Peninsula	Kepner	Unsheltered	500	
Supply vessel	Saanich Peninsula	Sweep System-NOFI CB, 0.8 m (x2)	Unsheltered	200	
Response Barge Unit 1 (5,000-tonne)		Air inflatable, 1.2 m	Unsheltered	900	
		GP, solid flotation, 0.6 m	Sheltered	1,500	
		Shore seal, 0.6 m	Shoreline	150	
		Fire boom, 150 m/kit	Sheltered	150	
Warehouse	Saanich Peninsula	GP, solid flotation, 0.6 m	Sheltered	3,000	
Landing craft	Saanich Peninsula	GP, solid flotation, 0.6 m	Sheltered	500	
			Total Unsheltered	4,569	1,600
			Total Sheltered	22,977	20,000
			Total Shoreline	3,352	1,000
				29,898	22,600

13.2.3 Western Area of Response

Currently, this area lacks significant inventories of boom and equipment; it will require a larger investment than the other areas. The response plan for the area would centre on a very large storage and work platform (10,000-tonne barge) and a remote base in Ucluelet, Bamfield, or Port Alberni. Secondary-base support could come from Sooke or Becher Bay. The barge would carry four 40-foot containers, each with 1,500 m of boom and related equipment (anchors, trip lines, lights). The warehouse would store three 40-foot containers and/or trailers of the same. Given the unsheltered water exposure, the landing craft proposed for use in the other response bases would be replaced by a boom boat with better sea-

keeping abilities that would also carry 500 m of general purpose boom. Unsheltered boom would also be carried on the larger mobile skimmer (proposed Rozema vessel) and on the response barge which would become the incident working platform and mobile response base.

Table 13-3: Boom resources, Existing and Additional - Western Location

Host	Location	Description of Boom	Operating Environment	Proposed Amount of Boom (m)	Planning Requirement
EXISTING RESOURCES					
Burrard Cleaner No. 10	Esquimalt	30" Zoom Boom	Unsheltered	427	
		Ro Boom 2000	Unsheltered	800	
Burrard Cleaner No. 9	Esquimalt	Kepner 32"	Unsheltered	91	
Burrard Cleaner No. 6	Esquimalt	GP, solid flotation, 0.6 m	Sheltered	305	
Burrard Cleaner No. 11	Esquimalt	GP, solid flotation, 0.6 m	Sheltered	366	
Burrard Cleaner No. 16	Port Alberni	GP, solid flotation, 0.6 m	Sheltered	305	
Canadian Coast Guard warehouse	Ucluelet	GP, solid flotation, 0.6 m	Sheltered	305	
TO BE ACQUIRED					
Response barge Unit 2 (5,000-tonne)	Esquimalt (until location confirmed)	Air inflatable, 1.2 m	Unsheltered	900	
		GP, solid flotation, 0.6 m	Sheltered	1,500	
		Shore seal, 0.6 m	Shoreline	150	
		Fire boom, 150 m/kit	Sheltered	150	
Response barge Unit 3 (10,000-tonne)	Ucluelet area	Sweep System-NOFI CB, 0.8 m	Unsheltered	100	
		Air inflatable, 1.2 m	Unsheltered	900	
		GP, solid flotation, 0.6 m	Sheltered	6,000	
		GP, solid flotation, 0.6 m	Shoreline	1,000	
		Shore seal-24”	Shoreline	150	
		Fire boom	Sheltered	150	
Skimming vessel, 27.5 m	Ucluelet area	Kepner	Unsheltered	450	
Skimming vessel, 27.5 m	Sooke Area	Kepner	Unsheltered	450	
Warehouse	Sooke Area	GP, solid flotation, 0.6 m	Sheltered	3,000	
Landing craft	Sooke Area	GP, solid flotation, 0.6 m	Sheltered	500	
Warehouse	Ucluelet area	GP, solid flotation, 0.6 m	Sheltered	3,000	
Boom boat	Ucluelet area	GP, solid flotation, 0.6 m	Sheltered	500	

Total Unsheltered	5,118	1,600
Total Sheltered	16,081	12,500
Total Shoreline	2,450	1,000
	25,632	15,100

14. Spill Response Vessels

To respond effectively and efficiently to the reduced time frames and larger capacities, a new fleet composed of high-speed skimming vessels (estimated at four), larger landing crafts (estimated at four), additional general response vessels (estimated at three), an offshore supply vessel, and large-volume response barges (estimated at three) will be needed to supplement the existing fleet. The specific

functions of these vessels were also discussed in earlier sections. The Equipment Appendix to this report provides vessels specifications and further information.

14.1 Barges

Barges will be one of the key platforms in this equipment plan. Similar to the existing Burrard Cleaner No.18, the response barges will be fitted with offshore and sheltered water response gear including Current Buster sweep systems, traditional sweep systems and unsheltered boom reels. The barges will also provide temporary storage, logistical support, and some personnel accommodations. There will be three additional barges; one larger platform (10,000 tonnes of storage) in the Western Area of Response, and two secondary barges (5,000 tonnes of storage each) in the Eastern Area of Response. Moorage locations for the secondary barges will likely be in the current Esquimalt facility and the other somewhere on the Saanich Peninsula. The current Burrard Cleaner No. 10 should be moved to Nanaimo area.

14.2 Offshore Supply Vessel

A dedicated OSV is proposed to play a significant logistical role in providing time-critical delivery of advance skimming systems and rapid temporary storage across the response area. It is envisioned that this vessel will be patterned after Gulf of Mexico OSVs that serve the dual function of shuttling personnel in a protected cabin and transporting cargo on a spacious afterdeck.

During an incident the supply vessel can be tasked in a variety of functions that may include:

- Waste support – in the early stages waste support is important. This vessel may provide support for liquid storage with onboard capacity or by placing waste bins or supersacks on deck for solid waste.
- Equipment and personnel transport – pick up and transport of equipment and personnel from onshore staging to the engaged GAR.
- Fuel supply – these vessels typically have fuel storage in integral tanks and could also be fitted with additional on-deck fuel storage and dispensing capability to support response vessels.
- Service/exchange equipment – provide support for equipment with mechanical failure or damage during the response. The focus would be to minimize down times for any gear. Note, this concept was extensively used during the BP Gulf oil spill in 2010.
- Boom tender – The vessel would be of appropriate size to support the open water/unsheltered response activities by becoming a boom tender for sweep systems deployed from the response barges.

The supply vessel would be moored in the Saanich peninsula area and would be considered a major enhancement to WCMRC responses and operations. Housed on board would be four Current Busters, and four mini-barges for quick deployment.

14.3 Skimming Vessels

During the initial response the skimming vessel will be tasked with free skimming in areas of high-oil concentration. When other vessels are available, an enhanced sweep system can be added to concentrate oil for collection by the skimming vessel. The open-deck and high-speed features make this a multi-functional vessel. High speed mobile skimmers are required to meet the much quicker proposed time

standards and will be equipped with boom sufficient to start containment of the casualty in unsheltered waters.

Additionally, larger mobile skimmers will be capable of tending the lead sweep boom from the response barges operating in either open or sheltered waters. These vessels will be able to transit in Beaufort Scale 6 conditions and will have accommodations that allow for extended time at sea in open water conditions.

It is recommended that two 27.5 m versions be constructed. One vessel will be based on the west side of Vancouver Island, in either Bamfield or Ucluelet, while the second vessel will be based in either Sooke or Becher Bay. Both vessels will be designed for quick responses to unsheltered areas and have the ability to stay at sea longer given the extended distances between safe harbours. To address both the two-hour response time in designated port boundaries and the high-risk vessel convergence zones there, two smaller, 20 m versions will be based respectively in the Saanich peninsula and within the port boundaries, (ideally at Delta Port).

14.4 Landing Craft

Capable of high speeds and shore landings, landing crafts will be tasked with boom deployment along shallow shorelines, transporting response equipment and participating in sheltered water response activities.

Landing craft will be used to deliver shoreline crews and equipment to the beaches as well as being responsible for the collection of solid and liquid waste. Typically, solid waste collected from the shorelines will be bagged and transferred to super sacks onboard the landing craft. A crane onboard the waste barge will lift the super sacks off the landing craft for deposition into onboard bins.

Preliminary specs include twin engines, enclosed cabin, bow strengthened doors to offload vehicles and a hydraulic crane. Several used vessels of this type are generally available.

It is envisioned that these vessels will be located in Becher Bay/Sooke, the Saanich Peninsula, and in the Delta Port areas. The waters off Ucluelet area would be better served by a closed-bow boom vessel similar to the Burrard Cleaner No. 11.

14.5 Work Boat

The workboat is a general purpose vessel that can tend boom, assist in recovery operations, and support shoreline operations. Depending on the anticipated tasking a larger vessel may be specified. Due to the need to tend boom, and land equipment on shorelines, each base will have at least one work boat.

14.6 Mini-Barge

The mini-barge is a dual function vessel that can store and shuttle up to 40 tonnes of recovered oil and supply general purpose boom in the field. Mini-barges serve as the link between skimming operations and storage/disposal and would play an integral part in operations continuing efficiently. Mini-barges will be stored on barges and at base locations.

14.7 Summary of Spill Response Vessels (WCMRC current and proposed)

Table 14-1: Vessel location summary

Name	Location	Function	Estimated Speed (knots)	Sea State (vessel operation) Beaufort
SKIMMING VESSELS				
Skimming vessel, 27.5 m	Sooke or Becher Bay	Fast response, initial booming, skimming operations, extended range, unsheltered waters	20	5
Skimming vessel, 27.5 m	Ucluelet or Bamfield	Fast response, initial booming, skimming operations, extended range, unsheltered waters	20	5
Skimming vessel, 20 m	Delta Port	Fast response, initial booming, skimming operations	26	4
Skimming vessel, 20 m	Sidney or Chemainus	Fast response, initial booming, skimming operations	26	4
BARGES				
Response barge Unit 1	Ucluelet area	response platform, accommodation, storage	6	3
Response barge Unit 2	Esquimalt area	response platform, accommodation, storage	6	3
Response barge Unit 3	Saanich Peninsula	response platform, accommodation, storage	6	3
BOOM BOATS				
Boom boat No. 1	Delta Port area	boom and crew transport, boom tending and towing	20	4
Boom boat No. 2	Ucluelet area	boom and crew transport, boom tending and towing	20	4
LANDING CRAFTS				
Landing craft No. 1	Sooke area	boom and crew transport, boom tending and towing, shoreline	20	3
Landing craft No. 2	Delta Port area	boom and crew transport, boom tending and towing, shoreline	20	3
Landing craft No. 3	Saanich Peninsula	boom and crew transport, boom tending and towing, shoreline	20	3
WORK BOATS				
Work boat No. 1	Ucluelet area	boom and crew transport, boom tending and towing, shoreline	25	2
Work boat No. 2	Delta Port area	boom and crew transport, boom tending and towing, shoreline	25	2
Work boat No. 3	Saanich Peninsula	boom and crew transport, boom tending and towing, shoreline	25	2
Work boat No. 4	Sooke/Becher Bay	boom and crew transport, boom tending and towing, shoreline	25	2
SUPPLY VESSELS				
Supply vessel, 40 m	Saanich Peninsula	multi-purpose, resupply, transport	15	5

15. Shoreline Cleanup

While federal RO standards require that sufficient equipment and personnel are available to treat a minimum of 500 m of shoreline per day, an increased plan for the treatment of 3,000 m of non-contiguous shoreline per day, to reflect the finding from spill modelling, which highlighted extensive shoreline oiling in case of an oil spill along the tanker route. Such an increase in shoreline response capacity would also bring it in close alignment with what is currently Washington State standards. Shoreline treatment operations will largely depend upon the physical characteristics of the affected shoreline, the area's environmental sensitivities, degree of oiling, and character of stranded oil. As with all shoreline operations, logistics will play a critical role in the success of the activity.

Shoreline treatment teams are expected to come from third-party resources either contractors or community-based organizations. The RO will provide material support for shoreline cleanup teams performing treatment operations. The RO will also be prepared, if required, to provide logistical support to shoreline treatment teams. Logistical support may include but not be limited to the management of staging areas, supply chains, waste streams and personnel shuttle. It should be recognized that many of the IRA shorelines may only be accessible by helicopter and, as such, will require teams with a high level of safety training. Assumptions are that the RO should stock supplies in unitized increments capable of treating 3,000 m of shoreline daily. Additional equipment to support shoreline cleanup can be available from contracted resources. Note that chemical and biological treatment techniques are not preapproved for use.

Table 15-1: Total shoreline treatment equipment- 3,000 m/day

Shoreline Type	Item	Quantity
All	Port-a-Tanks	30
	Personal protective equipment	300 sets
	Barrier tape	20 boxes
	Do Not Enter signs	30
	Sorbent boom	366 m
	Sorbent rolls	90 rolls
	Sorbent pads	300 bundles
	Oleophilic strips (pom-poms or mops)	150 boxes
	Roll 10’ x 100’ of 6 ml plastic bags/ties/tape	6
	Water deluge systems	12
Pebble and cobble	Low-pressure wash systems	12
	Boom	6,000 m
	Shallow-water skimmers c/w pumps (e.g., WCMRC Manta Rays)	12
	4.5 ml open-top tanks	12
Sand	Rakes, shovels (round and square), 5 gallon buckets	180 each
	Sand/gravel bags	6,000
	High-pressure washer systems	6
Bedrock and manmade solids	Low-pressure wash systems (see Pebble and Cobble)	6
	Boom (see Pebble and Cobble)	6,000 m
	Shallow-water skimmers (see Pebble and Cobble)	12
	Scrapers and long-handled squeegees	60 each
	Water deluge systems (see Pebble and Cobble)	12
Marsh and mudflats	Low-pressure wash systems (see Pebble and Cobble)	12
	Boom (see Pebble and Cobble)	6,000 m
	Shallow-water skimmers (see Pebble and Cobble)	12
	4.5 ml open-top tanks	12
	Skiffs	6
	Weed eaters	24
	Mat for pathways and access	200 m

Notes:

- Specific boom and skimmers are listed in other tables. Manta Ray skimmers and vacuum trucks can provide shoreline recovery in addition to recovery resources identified for on-water.
- There will be a minimum of two water deluge/low pressure washing systems for shoreline flushing at each of the response bases.
- Low pressure/deluge components: one 8hp gasoline trash pump (396 gpm, 96’ head), 33 m rigid 3” suction hose c/w strainer, 200’ lay-flat 3” discharge, two holes every foot
- The above table lists total equipment to treat 3,000 m of shoreline, therefore each kit would contain 1/6 of the above noted equipment

By way of comparison, US regulations stipulate that 100 workers need to be mobilized in 24 hours and have a 1:10 supervisor to worker ratio for a 14-day duration. Additionally, there must be a plan and equipment to treat 3 miles of shoreline over a three tide cycle period. RO will need to create a shoreline task force plan to address the personnel side of shoreline cleanup which will involve volunteer management, supervision, training, and mobilization. An important aspect of the plan will involve community and First Nation participation in training, and notification protocols.

16. Other Equipment

It will be necessary to outfit each of the response bases with miscellaneous equipment. Miscellaneous equipment will cover many categories including response equipment, support equipment, and tools. Listed below in Table 16-1 are pieces of equipment that are essential to a successful response operation.

Table 16-1: Miscellaneous Equipment Required

Description	Examples
Special purpose trailers or containers	Boom Trailer, Decontamination Trailer , Small Spill Trailer, Stores (PPE) Trailer, Wildlife, flat beds (for containers and forklifts)
Forklifts	For moving containers
Shoreline treatment equipment	Deluge Kits, Hand Flushing Kits
Miscellaneous equipment	Vacuum unit, Heavy oil transfer pump, Generator, Portable Lighting
Miscellaneous tools	Hand Tools, Power Tools, etc.
Sorbents	Pads, Boom, snare and related supplies

In addition to equipment discussed above, each response base will need 2 heavy duty trucks for towing and hauling equipment, as well as a commuter car for staff transport and community meetings.

17. Decontamination

Decontamination is an important part of worker health and safety. Basic decontamination supplies, sufficient until more structured services can be established, are provided on all the RO vessels and equipment packages. Decontamination supplies will be stationed at transition points from hot zone to cold zone so that personnel or equipment do not cross contaminate clean areas.

Decontamination services will be available early in the response, so that when the equipment is no longer needed in the field it is moved through the cleaning process and returned to response ready. When establishing decontamination sites, consideration will need to be given to how much equipment will require cleaning, how to transport equipment to the sites without cross contamination and the infrastructure required supporting a decontamination facility.

Table 17-1: Sample Decontamination Package

Delineator posts	Sorbent rolls	Decontamination berms
Hand cleaner	Personal protective equipment	Tarps rolls

APPENDIX A. EQUIPMENT

This appendix has details on each of the key equipment categories. Manufacturer's specifications are available upon request.

BOOMS:

BOOM – SWEEP (CURRENT BUSTER OFFSHORE RECOVERY SYSTEM)

Function: The Current Buster® sweep system is a unique product for containing and recovering oil. The system can be operated in sheltered and unsheltered water and is capable of containing and collecting oil at towing speeds up to 4 knots versus conventional sweep system speeds of approximately 1 knot. The Current Buster® allows higher rates of encounter and more efficient skimming.

The system consists of a front sweep which guides/herds oil into a combined collector/skimming device and then into a separator tank from which the oil is recovered by a simple pump or conventional skimmer.

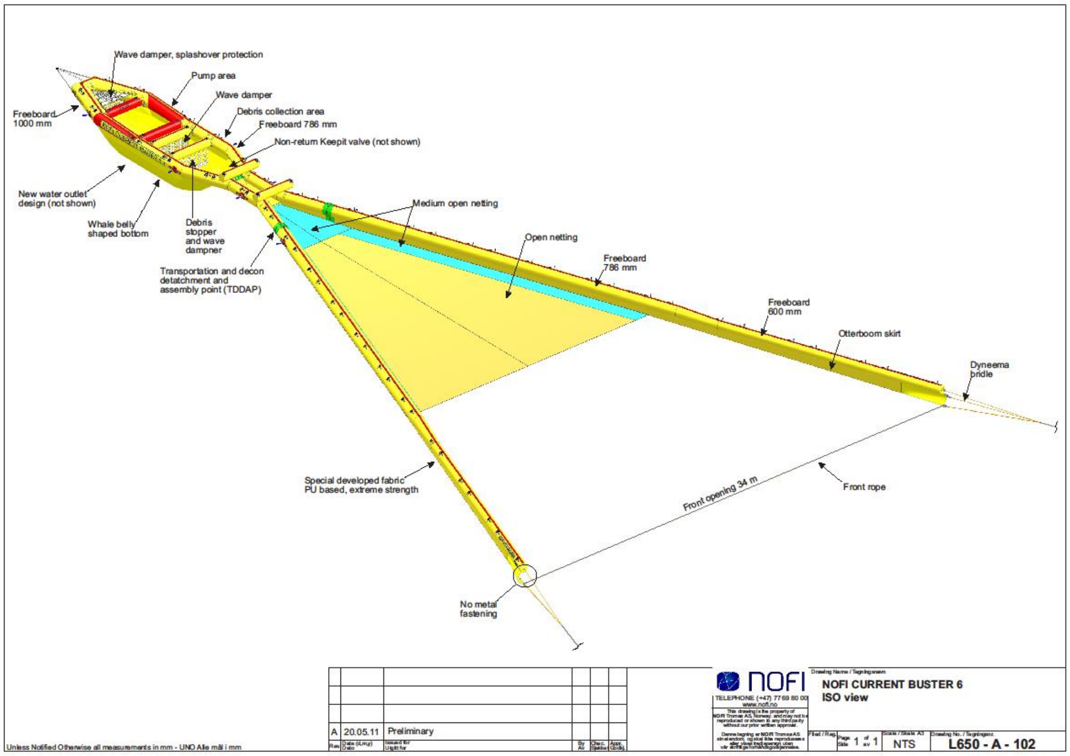
Supplier: Fitzwright Survival, Inc.)

Trade Name: Current Buster® Boom 600 series

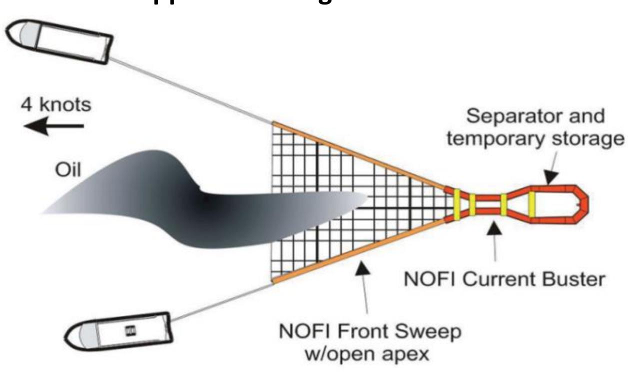
Dimensions:

100 m length + 300 m of unsheltered boom

Appendix A - Figure 1: Current Buster Sweep System



Appendix A - Figure 2: Current Buster



Appendix A - Photo 1: Current Buster in Action

BOOM - FIRE

Function: In-situ burning

Supplier: Desmi-AFTI (Applied Fabric Technologies, Inc.)

Trade Name: PyroBoom™

Dimensions:

- 150 m/kit
- 10 @ 15 m section lengths
- Overall height: 76.2 cm. (30”)

Construction: Fireproof section consists of silicone coated, high-temperature metallic wires interwoven with similar wires and refractory materials. For strength and flexibility below the water line PVC coated Polyester fabric is used. Flotation is steel hemispheres filled with high-temperature foam material.

Other: no auxiliary pumps required; deployment/use is a four-step process: deploy, collect product, burn, and retrieve.

Appendix A - Photo 2: Fire boom in Action and in Storage

BOOM - UNSHELTERED

Function: Booming from mobile skimming vessels and barges in unsheltered and sheltered waters

Supplier: Desmi, Vikoma, Kepner, Norlese

Trade Name: Kepner-SeaCurtain ReelPak™ boom system; Norlese NO-800-R Offshore Boom; Vikoma Hi-Sprint 1200; Desmi-Ro-Boom

Dimensions:

- 1.1 m (43")
- 450 m length

Other: Can be deployed directly from the winder by one console control operator and a work boat. Automatic inflation and self-filling give you maximum speed during deployment. 400 m can be deployed in five minutes.

Appendix A - Photo 3: Unsheltered Boom Being Deployed

BOOM - SHELTERED

Function: Booming sheltered or unsheltered waters

Supplier: Canadyne, Richmond, B.C.

Trade Name: ContractorBoom – or General Purpose boom

Dimensions:

- 6 m (22-24")
- 6,000 m (20 m sections joined with ASTM International connectors)

Appendix A - Photo 4: Sheltered Boom - Deployed

BOOM – SHORE SEAL

Function: Used for making the transition between a conventional floating boom and the shoreline to prevent oil from spreading further laterally along the shoreline. Shore seal boom consists of an air inflated flotation chamber and one or more water-filled skirt chambers. The water-filled chambers act as ballast to seal the shore at the water's edge.

Supplier: Vikoma International Limited, Isle of Wight, England

Trade Name: Shoreguardian

Dimensions:

- 150 m/kit

Appendix A - Photo 5: Shore Seal - Deployed

VESSELS:

BARGES

Function: Storage/secondary bases on the West Coast of Vancouver Island, the Strait of Juan de Fuca, and the Saanich Peninsula.

Supplier: TBD

Dimensions: 90-115 m

Size: 5,000 and 10,000 tonnes

Carry 20 passengers minimum

Appendix A - Figure 3: Barge Detail - 90 to 115 m

SUPPLY VESSEL

Function: Supply/Equipment delivery

Supplier: TBD

Dimensions: 67 m (approximately)

Speed: 12- 16 knots loaded

Carry: 10-15 passengers

Appendix A - Photo 6: Typical Supply Vessel – LOA 67 m:

SKIMMING VESSELS

SKIMMING VESSEL – 27.5 M

Function: Oil spill response (skims oil, deploy boom and spill-treating agents)

Supplier: TBD (Example - Rozema Boat Works, Mount Vernon, Washington)

Dimensions: 27.5 m

Speed: Cruise 20 knots; top speed 26 knots; skim speed 1.5 knots

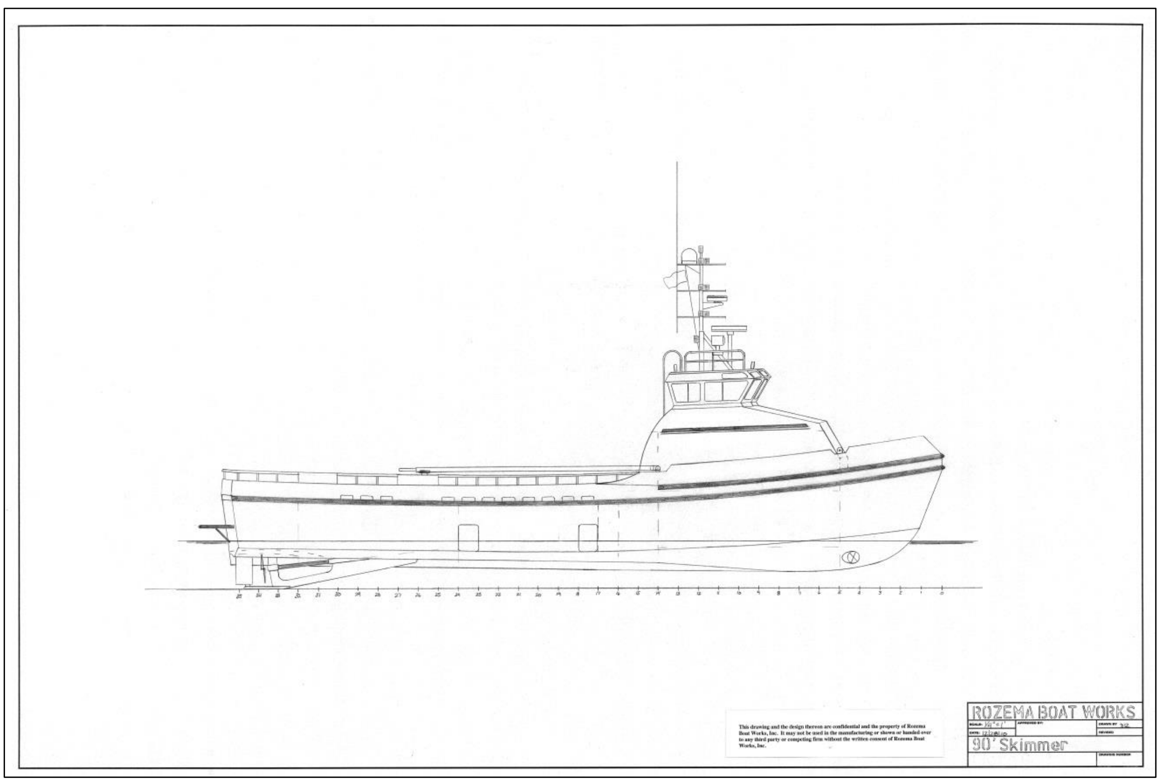
Crew: 4

Accommodations: 4

Spill Response Systems:

- Recover oil via built-in three-brush LAMOR skimming system.
- Hydraulic boom reel
- 625 m of Kepner SeaCurtain ReelPack boom system 1 m Reelpak™ Ocean Boom
- Storage 50 tonnes

Appendix A - Figure 4: Skimming Vessel - 27.5 m



SKIMMING VESSEL – 20 M

Function: Oil spill response (Oil skimming)

Supplier: TBD (Example - Rozema Boat Works, Mount Vernon, Washington)

Dimensions: 20 m

Speed: Cruise-20 knots; top speed - 26 knots; skim speed 1.5 knots

Crew: 3

Accommodations: 3

Spill Response Systems:

- Recover oil via built-in three-brush LAMOR skimming system.
- Hydraulic boom reel
- 34-tonne storage
- 460 m of Kepner SeaCurtain ReelPack™ boom system

Appendix A - Photo 7: Mobile Skimming Vessel - 20 m

LANDING CRAFT RESPONSE VESSEL

Function: Logistics / Response

Supplier: TBD (Example - Daigle Welding & Marine Ltd., 2177 Island Hwy., Campbell River, B.C)

Trade Name: Eaglecraft – Landing craft

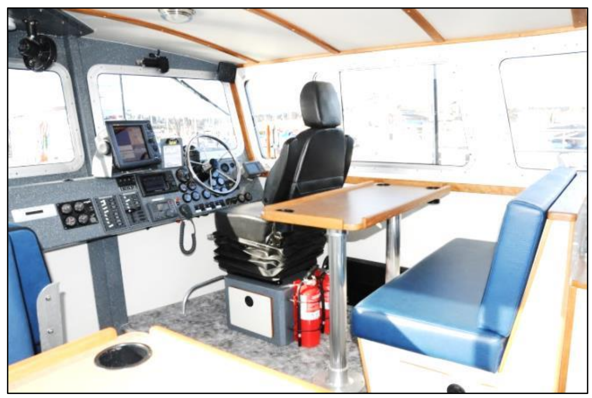
Dimensions: 14 m

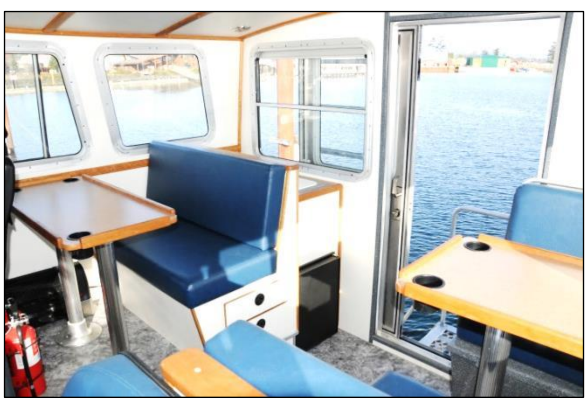
Speed: 15-25 knots

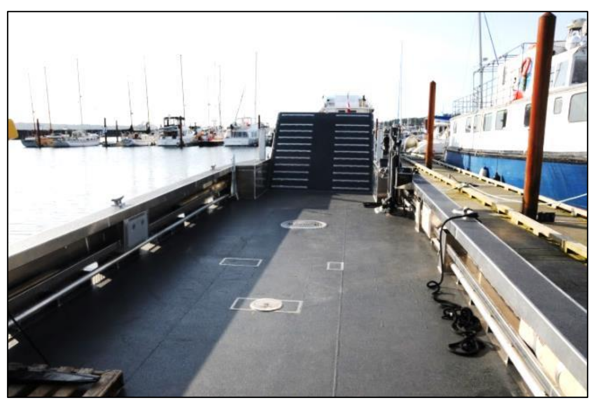
Boom Capacity: 305-450 m

Crew: 3

Appendix A - Photo 8: Landing Craft - 14 m







BOOM BOATS

Function: Transport boom to response areas, unsheltered

Supplier: TBD

Dimensions: 14 m

Speed: 20 knots

Crew: 2

Accommodations: N/A

Spill Response Systems:

- As required

Appendix A - Photo 9: Boom Boat - 14 m

WORK BOAT

Function: Work boat

Supplier: TBD (Example - Broadwater Industries Ltd., Prince Rupert, B.C).

Dimensions: 8 m

Speed: 25 knots

Crew: 2

Accommodations: N/A

Spill Response Systems:

- As required

Appendix A - Photo 10: Work Boat - 8 m

MINI-BARGE

Supplier: TBD (Example - Rozema, Mount Vernon, Washington)

Trade name: 249 Barrel barge

Dimensions: 13.0 m

Capacity: 249 barrels (37.4 tonnes)

Speed: Towed-8/10 knots

Spill Response Systems: N/A

Appendix A - Photo 11: Mini-barge - 12 m

SKIMMERS:

Large Capacity / Small Capacity

Function: Oil skimming vessels – large and small capacity for use in open and protected water environments and are able to recover 300 m³/h (derated 60 m³/h) and 150 m³/h (derated 30 m³/h) respectively

Supplier: TBD (Example - Aqua-Guard, Vancouver, B.C.)

Trade name: RBS Triton 300 OS and Triton 15 OS

Components: The RBS TRITON™ 300 OS and 150 OS systems consist of three major components: the RBS TRITON™ 300 150 oil skimmer heads, a hydraulic power pack, and hydraulic and oil transfer hose sets.

Other:

Its modular design makes for easy transport by truck from a warehouse to a Vessel of Opportunity.

Once loaded and secured on a vessel or jetty, the system can be deployed by one operator, either over the side or stern of the vessel.

Twin thrusters enable the operator to maneuver and position the skimmer head to the most advantageous location to ensure efficient oil recovery.

The robust design with protective tubular cage ensures optimal protection of the skimmer head from foreign objects or encounters with the deployment vessel in high wind and sea conditions.

Appendix A - Photo 12: RBS Triton 300-OS Skimmer

Appendix A - Photo 13: RBS Triton 150-OS Skimmer

STORAGE:

FLOATING BLADDER

Function: Temporary storage to support skimming operations

Supplier: TBD (Example – Canflex)

Trade name: Sea Slug

Dimensions: 13 m

Tonnage: 10 tonnes

Speed: Towed-6 knots

Crew: N/A

Accommodations: N/A

Spill Response Systems: N/A

Appendix A - Photo 14: Floating Bladder - deployed

APPENDIX B. USCG STANDARDS

This appendix has details of the USCG oil recovery standards.

The requirements are categorized as the MMPD (Maximum Most Probable Discharge) and WCD (Worse Case Discharge) WCD is divided into Tiers 1, 2, and 3.

MMPD and WCD are based on a calculation using a facility's largest foreseeable oil discharge or a tank vessel's cargo volume.

Category	Facility	Tank Vessel
MMPD	1,200 bbls or 10% of WCD	2,500 bbls or 10% of WCD
WCD	Largest foreseeable oil discharge	Entire loss of oil cargo

Requirements	Most Probable	Worse Case III
	Nearshore	
Protective Boom (feet)	8,000	30,000
Containment Boom (feet)	1,000'+300' per skimming system	1,000'+300' per skimming system
bbl./day recovery rate	171	7,143
Storage capacity in bbls	343	14,286
Response time in hours	12 high volume ports/24 other	60 high volume ports/72 other
	Offshore	
Protective Boom (feet)	8,000	15,000
Containment Boom (feet)	1,000'+300' per skimming system	1,000'+300' per skimming system
bbl./day recovery rate	171	7,143
Storage capacity in bbls	343	14,286
Response time in hours	12 high volume ports/24 other	60 high volume ports/72 other
	Open Ocean	
Protective Boom (feet)	-	-
Containment Boom (feet)	1,000'+300' per skimming system	1,000'+300' per skimming system
bbl./day recovery rate	171	7,143
Storage capacity in bbls	343	14,286
Response time in hours	12 high volume ports/24 other	60 high volume ports/72 other

APPENDIX C. EQUIPMENT PACKAGE

As described throughout this report the plan allows a great deal of flexibility in how equipment may be moved to a location depending on the need. Therefore it is considered a flexible plan, subject to adjustments depending on the circumstances.

There are essentially two packages of equipment, one located at bases east of Race Rocks and the other located at bases west of Race Rocks. Each package has been tailored to meet the nature of challenges that will be faced in the area, be it weather, strong current, remote location, logistics, etc.

This has led to creation of equipment lists that typically appear to have excess capacity necessary for achieving a goal of 20,000 m3 (21,277 tonnes) certified capacity anywhere in the IRA.

This appendix has details of the oil-spill equipment package needs summaries, based on operating environments.

EQUIPMENT PACKAGE – 20,000-TONNE (EAST)

Area: Port to Race Rocks

Planning Volume 20,000 tonne

Operating Environment

Shoreline	Sheltered	Unsheltered
40%	40%	20%

Derated factor 20%

Number of offshore recovery systems 4

Appendix C - Table 1: Oil Skimming Requirements – 20,000-tonne (East)

Operating Environments	Planning Volume	Oil to be Skimmed	
Shoreline	8,000	10%	800
Sheltered	8,000	100%	8,000
Unsheltered	4,000	100%	4,000
	20,000		12,800

Appendix C - Table 2: Primary and Secondary Storage Requirements - 20,000-tonne (East)

Area	Planning Volume	Derated 20%	Total Volume skimmed	Number of Days to Recover	Required Volume to be Recovered per day (includes oil and water)
Shoreline	800	20%	4,000	50	80
Sheltered	8,000	20%	40,000	10	4,000
Unsheltered	4,000	20%	20,000	10	2,000
				Primary	6,080
				Secondary (x2)	12,160
				Total	18,240

Appendix C - Table 3: Summary – 20,000-tonne (East)

	Shoreline	Sheltered	Unsheltered	Total
Volume of oil per operating area	800	8,000	4,000	12,800
SKIMMERS				
Volume to be recovered per day (oil and water)	80	4,000	2,000	6,080
Skimmers- derated capacity (t/h)	0.60	33.3	16.6	50.5
STORAGE				
Primary	80	4,000	2,000	6,080
Secondary	160	8,000	4,000	12,160
Total	240	12,000	6,000	18,240
BOOM (m)				
Sweep **(1)**			1,600	1,600
Containment **(2)**		15,000		15,000
Protection **(3)**		5,000		5,000
Shoreline cleanup **(4)**	1,000			1,000
	1,000	20,000	1,600	22,600

Notes:

1. Sweep assumes one sweep (400 m of boom) per off-shore recovery system; follows CCG guidance documents, Appendix B
2. Boom resources for on-water containment and protection in sheltered waters are calculated as 1.875 times the volume (tonnes) of oil in the sheltered environment
3. Protection boom assumes a maximum of 5,000 m according to CCG guidance documents, Appendix B
4. Follow CCG guidance documents, Appendix B. The amount of boom required for containment near the shoreline is twice the daily distance for shoreline treatment or 2 x 500 m = 1,000 m

EQUIPMENT PACKAGE – 20,000-TONNE (WEST)

Area: West of Race Rocks

Total Volume 20,000 tonne

Operating Environment

Shoreline	Sheltered	Unsheltered
40%	20%	40%

Derated factor 20%

Number of offshore recovery systems 4

Appendix C - Table 4: Oil Skimming Requirements – 20,000-tonne (West)

Operating Environments	Volume	Oil to be Skimmed	
Shoreline	8,000	10%	800
Sheltered	4,000	100%	4,000
Unsheltered	8,000	100%	8,000
	20,000		12,800

Appendix C - Table 5: Primary and Secondary Storage Requirements – 20,000-tonne (West)

	Volume	derated 20%	Total Volume skimmed	Number of Days to Recover	Required Volume to be Recovered per day (includes oil and water)
Shoreline	800	20%	4,000	50	80
Sheltered	4,000	20%	20,000	10	2,000
Unsheltered	8,000	20%	40,000	10	4,000
				Primary	6,080
				secondary (x2)	12,160
				Total	18,240

Appendix C - Table 6: Summary – 20,000-tonne (West)

	Shoreline	Sheltered	Unsheltered	Total
Volume of oil per operating area	800	4,000	8,000	12,800
SKIMMERS				
Volume to be recovered per day (oil and water)	80	2,000	4,000	6,080
Skimmers- derated capacity (t/h)	0.60	16.6	33.3	50.5
STORAGE				
Primary	80	2,000	4,000	6,080
Secondary	160	4,000	8,000	12,160
Total	240	6,000	12,000	18,240
BOOM (m)				
Sweep **(1)**			1,600	1,600
Containment **(2)**		7,500		7,500
Protection **(3)**		5,000		5,000
Shoreline cleanup **(4)**	1,000			1,000
	1,000	12,500	1,600	15,100

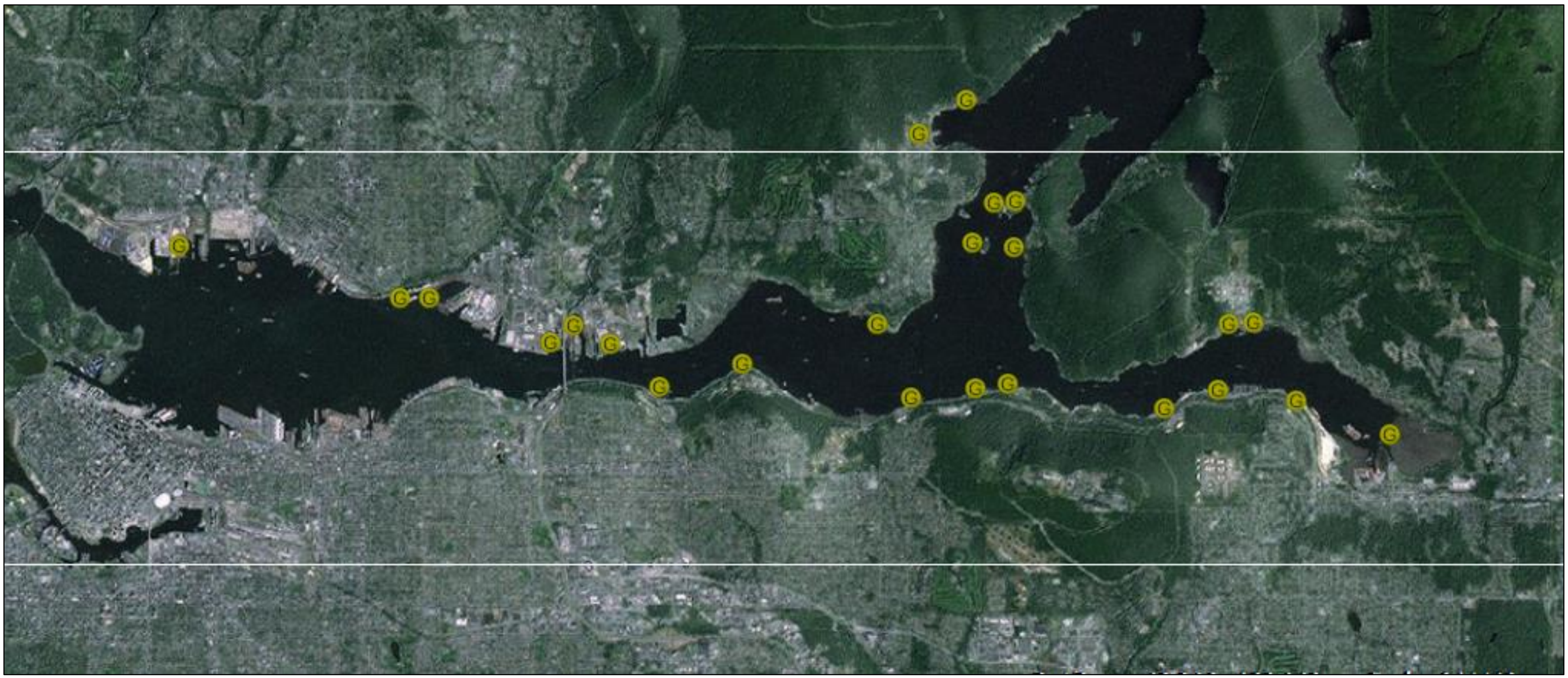
Notes:

1. Sweep assumes one sweep per off-shore recovery system; follows CCG guidance documents, Appendix B
2. Boom resources for on-water containment and protection in sheltered waters are calculated as 1.875 times the volume (tonnes) of oil in the sheltered environment
3. Protection boom assumes a maximum of 5,000 m according to CCG guidance documents, Appendix B
4. Follow CCG guidance documents, Appendix B. The amount of boom required for containment near the shoreline is twice the daily distance for shoreline treatment or 2 x 500 m = 1,000 m

APPENDIX D. GEOGRAPHIC RESPONSE PLAN (GRP) MAPPING EXAMPLES

Appendix D - Map 1: Boom Placement

Appendix D - Map 2: GRS Locations



Bibliography

Fisheries and Oceans – Sailing Directions: British Columbia Coast (South Portion) 17th Edition, Volume 1, 2004

Fisheries and Oceans – Sailing Directions: British Columbia Coast (South Portion) 15th Edition, Volume 1, 1990