

**1<sup>st</sup> Edition**

# **Spill Response Guidelines<sup>©</sup>**

This *guidance document* outlines the industry standards for responding to a spill incident involving an uncontrolled release of *flammable* or *combustible* liquids in Canada.

**May 2021**



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# Spill Response Guidelines

## Guidelines & Training

The 2021 **Spill Response Guidelines** (1<sup>st</sup> Edition) was prepared by NorthWest Response Ltd., Smithers, British Columbia, Canada.

This document outlines the systematic process of how to respond to a spill incident involving TDG Class 3 *Flammable Liquids*.

This guideline was written as a reference document to the *on-line* **Spill Response Training** course available at: [www.fueltraining.ca](http://www.fueltraining.ca)

The *spill response training course* was designed by NorthWest Response Ltd and will issue a **Spill Response Certificate** for participants that achieve an 80% on the five training *Modules* that include:

1. *Spill Prevention & Preparedness*;
2. *Spill Incident Assessment, Safety Assessment and Environmental Impact Assessment*;
3. *Plan & Mobilize* an effective response;
4. Implement an *Action Plan* to contain and recover the spill;
5. Document and prepare an end-of-spill *Closure Report*.

The **Spill Response Guidelines** is not a legal document however, if implemented, it will assist your operation in meeting the test of “*due diligence*”.

## Worker Certification Training

**On-Line Spill Response Training** at: [www.fueltraining.ca](http://www.fueltraining.ca) (now available)

This course complies with the training and awareness requirements outlined in:

**Fire Code** (All Provincial and the National Fire Code):

- **Training.** All employees involved in storage and handling of dangerous goods shall be trained in safe handling and storage procedures and correct responses to an emergency situation. Division B , Part 3 – Section 3.2.7.15 & Section 3.3.4.6

**Occupational Health & Safety** (Provincial and Federal OH&S):

- OH&S - Section 17.5 (1)(b)
  - Every employer shall: prepare emergency procedures if there is a possibility of an accumulation, spill or leak of a hazardous substance in a workplace controlled by the employer, to be implemented in the event of such an accumulation, spill or leak;
- OH&S - Section 17.6 (1)
  - (a) the procedures to be followed: in the event of an emergency; and
  - (b) the use and operation of emergency [spill response] equipment provided by the employer [to control the spill or leak].

**Transport Canada – Dangerous Goods** (Federal Regulation):

- Section 6.2 (k) The reasonable emergency measures the person must take to reduce or eliminate any danger to public safety that results or may reasonably be expected to result from an accidental release of the dangerous goods.

**BC Environmental Management Act** (Provincial):

- Division 2.1 Spill Preparedness, Response and Recovery – Section 91.2 (1) (c) Responsible Persons - Spill Response:
  - Ensures that persons with the skills, experience, resources and equipment necessary to properly deal with the spill.

## Contact Information

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REVENTION & PREPAREDNESS			Section 1
PREVENTION	PREPAREDNESS	LEGAL ISSUES	
<p><b>Spill Prevention</b> includes the <i>action</i> of stopping a spill from happening. This guideline outlines a modified version of the ISO-14001 Environmental Management System for establishing risk.</p> <ol style="list-style-type: none"> <li>Identify the operational activities involving storage, handling and transportation of all products including dangerous goods and hazardous wastes that could spill to: <ol style="list-style-type: none"> <li>The natural environment including land, air and water.</li> <li>The infrastructure environment either by entering, flooding, surrounding or migrating underneath a structure or man-made object.</li> </ol> </li> <li>Conduct a Risk Assessment of the Operational Activities identified in 1a and/or 1b. <ol style="list-style-type: none"> <li>Risk Rank the operational activities to identify the highest risks: <b>Risk = Probability x Consequence</b></li> <li>Develop <i>Procedures</i> to manage or control the highest risk aspects identified.</li> <li>Review the <i>Procedures</i> to ensure they are in compliance with existing <i>Standards</i> and <i>Guidelines</i></li> <li>Implement a training program that provides an educational awareness of the <i>Standards</i> and <i>Guidelines</i> as it relates to the managing risks and implementing procedures.</li> </ol> </li> <li>Using the list of Operational Activities, the Risk Management Procedures and applicable <i>Standards</i> and <i>Guidelines</i> prepare a <u>Spill Prevention Plan</u> that can be used to document and verify the test of <i>due diligence</i>.</li> </ol>	<p><b>Spill Preparedness</b> includes the process of <i>anticipating a credible spill incident</i> and the <i>actions</i> taken to implement countermeasures.</p> <ol style="list-style-type: none"> <li>Establish <i>credible spill scenarios</i> for the site by reviewing the high-risk aspect that involve the storage, handling and transportation of all products including dangerous goods and hazardous wastes. The <i>credible spills</i> should include <i>worst case scenarios</i> entering: <ol style="list-style-type: none"> <li>The natural environment including land, air and water.</li> <li>The infrastructure environment either by entering, flooding, surrounding or migrating underneath a structure or man-made object.</li> </ol> </li> <li>Develop countermeasures for the <i>credible spills</i> including <i>worst case scenarios</i>: <ol style="list-style-type: none"> <li>Prepare &amp; purchase an equipment list to implement the countermeasures</li> <li>Prepare <i>Response Procedures</i> to implement the countermeasures.</li> <li>Implement a training program that provides an opportunity to test and practice the countermeasures.</li> </ol> </li> <li>Develop an Emergency Response Plan (ERP) that reflects the scope of the operation, potential risks and credible spills scenarios. <ol style="list-style-type: none"> <li>The ERP should identify the person(s) who are authorized to implement the plan.</li> <li>The ERP should outline the response procedures required to implement the countermeasures.</li> <li>The ERP should be reviewed annually and tested regularly to ensure response personnel are familiar with the countermeasures.</li> </ol> </li> </ol>	<p><b>Legal Issues &amp; Due Diligence</b></p> <p><b>LEGISLATION</b></p> <ul style="list-style-type: none"> <li>Check Federal, Provincial &amp; Territorial Legislation to ensure that you are following the legal requirements: <ul style="list-style-type: none"> <li>- Spill Reporting Requirements</li> </ul> </li> </ul> <p><b>DUE DILIGENCE</b></p> <ul style="list-style-type: none"> <li>A legal defense that reasonable measures were taken to prevent an incident that could impact the environment.</li> <li>A legal defense that reasonable actions were taken to minimize the impact on the environment.</li> <li>A legal defense that reasonable actions were taken to restore a site to its original condition or provide reasonable compensation when restoration is not possible.</li> </ul> <p><b>REPORTING</b></p> <ul style="list-style-type: none"> <li>Report the volume and the product spilled.</li> <li>Report the adverse effect or potential impact of the spill.</li> <li>Report any spill that has entered or has the potential to enter a water course.</li> </ul> <p><b>NOTES/ PHOTOS</b></p> <ul style="list-style-type: none"> <li>Keep thorough-detailed notes and include timeline-photo-documentation of the incident.</li> </ul> <p><b>DOCUMENTATION</b></p> <ul style="list-style-type: none"> <li>Document the <i>assessments</i>: Spill, Safety &amp; Environment.</li> <li>Document the <i>planning</i> process to justify the response.</li> <li>Document the <i>actions</i> taken to contain the incident.</li> <li>Document the <i>clean-up &amp; restoration</i> measures.</li> </ul> <p><b>PROGRESS REPORTS</b></p> <ul style="list-style-type: none"> <li>Prepare a daily progress report that outlines the overall <i>Objectives</i> and <i>Targets</i> that were achieved within a specified timeframe.</li> <li>Provide justification for any targets not achieved.</li> <li>Communicate with Agencies, First Nations, Stakeholders, Individuals &amp; Communities.</li> </ul>	

INITIAL ASSESSMENT – Complete FORM 2			Section 2
SPILL ASSESSMENT	SAFETY ASSESSMENT	ENVIRONMENTAL ASSESSMENT	
<p><b>Initial Spill Assessment – Complete FORM 2A</b></p> <p>Determine the <b>Product</b> Spilled:</p> <ul style="list-style-type: none"> <li>Check Placards &amp; Labels.</li> <li>TDG Class &amp; Subsidiary Class.</li> <li>Check the Shipping Document.</li> <li>Check Shipping Name.</li> <li>Packing Group.</li> </ul> <p>Understand the characteristics of the product:</p> <ul style="list-style-type: none"> <li>Determine <i>Fate &amp; Effects</i> of the product(s).</li> <li>SDS – WHMIS Information.</li> <li>ER Guidebook (Transport Canada – CANUTEC).</li> <li>Supplier Information and ERAP.</li> </ul> <p>Determine Tank <b>Volume</b>:</p> <ul style="list-style-type: none"> <li>Determine the max potential volume or the total volume of the tank(s) – means of containment.</li> <li>Assess the remaining product in the tank: <ul style="list-style-type: none"> <li>If the tank is not accessible, then assume the tank is full.</li> <li>Assume the worst-case scenario to ensure the response efforts are not under-estimated.</li> </ul> </li> </ul> <p>Assess the Potential <b>Migration Pathways</b></p> <ul style="list-style-type: none"> <li>Assess the topography and determine if product has spread beyond the immediate spill area.</li> <li>Assess the soil characteristics and identify any impermeable or confining layers.</li> <li>Confined Water Courses: <ul style="list-style-type: none"> <li>Can be mechanically contained with spill response equipment.</li> </ul> </li> <li>Unconfined Water Courses: <ul style="list-style-type: none"> <li>Cannot be mechanically contained with spill response equipment.</li> </ul> </li> </ul>	<p><b>Initial Safety Assessment – Complete FORM 2B</b></p> <p><b>Chemical</b> Safety Assessment:</p> <ul style="list-style-type: none"> <li>Chemical Vapors &amp; Flash Point. <ul style="list-style-type: none"> <li>Lower Explosive Limit (LEL).</li> <li>Corrosive (pH).</li> </ul> </li> <li>Chemical Contact: <ul style="list-style-type: none"> <li><u>Routes of Entry</u>: <i>Inhalation</i>; <i>Skin Absorption</i>; <i>Ingestion</i>.</li> <li><u>PPE</u>: HazMat Level A, B, C or D.</li> </ul> </li> </ul> <p><b>Physical</b> Safety Assessment:</p> <ul style="list-style-type: none"> <li>Incident Stability.</li> <li>Tank Integrity.</li> <li>Buried Utilities: Call-Before-You-Dig.</li> <li>Working <i>on</i> or <i>over</i> water.</li> <li>Vehicular Traffic.</li> </ul> <p><b>Environment (Field)</b> Safety Assessment:</p> <ul style="list-style-type: none"> <li>Seasonal Weather &amp; Risks.</li> <li>Terrain Conditions &amp; Access.</li> <li>Water Safety - Creeks &amp; Streams: <ul style="list-style-type: none"> <li>Low to High Energy.</li> <li>Foreshore Access.</li> </ul> </li> </ul> <p><b>Environment (Indoor)</b> Safety Assessment</p> <ul style="list-style-type: none"> <li>Confined Space/ Egress Points.</li> <li>Vapors and Ventilation.</li> <li>Accessibility.</li> </ul> <p><b>Human Health &amp; Safety</b> Assessment:</p> <ul style="list-style-type: none"> <li>Stress &amp; Fatigue.</li> <li>Adequate Resources.</li> <li>Public Access &amp; Safety Perimeter.</li> </ul>	<p><b>Environmental Assessment – Complete FORM 2C</b></p> <p><b>Aquatic Habitat</b> Assessment: <b>Tables 2A &amp; 2B</b></p> <ul style="list-style-type: none"> <li>Confined Water Course – <i>Flowing Water</i>.</li> <li>Confined Water Course – <i>No Water Flow</i>.</li> <li>Unconfined Water Course – <i>Open Water</i>.</li> </ul> <p><b>Terrestrial Habitat</b> Assessment: <b>Table 2C</b></p> <ul style="list-style-type: none"> <li>Unique Features of the Habitat or Region.</li> <li>Soil Characteristics of the Habitat or Region.</li> <li><i>Forested</i> Habitat.</li> <li><i>Mountain</i> Habitat.</li> <li><i>Grassland</i> Habitat.</li> <li><i>Desert</i> Habitat.</li> </ul> <p><b>Flora</b> Assessment: <b>Table 2D</b></p> <ul style="list-style-type: none"> <li>Common Species within Terrestrial Habitat.</li> <li>Endangered or Species-at-Risk.</li> <li>Culturally Significant.</li> <li>Agricultural Harvest – Crop.</li> </ul> <p><b>Fauna</b> Assessment: <b>Table 2E</b></p> <ul style="list-style-type: none"> <li><b>Land</b>: Mammals &amp; Reptiles.</li> <li><b>Water</b>: Fish &amp; Amphibians.</li> <li><b>Air</b>: Migratory &amp; Resident Birds.</li> </ul> <p><b>Land Use &amp; Infrastructure</b> Assessment: <b>Table 2F</b></p> <ul style="list-style-type: none"> <li>Agriculture Infrastructure.</li> <li>Park &amp; Recreational Infrastructure.</li> <li>Residential Infrastructure.</li> <li>Commercial Infrastructure.</li> <li>Industrial Infrastructure.</li> </ul> <p><b>Human Health &amp; Community Impact</b>: <b>Table 2G</b></p> <ul style="list-style-type: none"> <li>Direct Impacts.</li> <li>Indirect Impacts.</li> </ul>	

## PLAN & MOBILIZE – Complete FORM 3

## Section 3

RESPONSE PLAN	SAFETY PLAN	ENVIRONMENTAL PLAN																
<p><b>Response Plan &amp; Mobilize Objective – Complete FORM 3A</b></p> <p>Plan to address the spill containment issues:</p> <p><b>Spill Plan - Land</b> see Table 3A</p> <p>Containment Options:</p> <ul style="list-style-type: none"><li>▪ Diversion Trench.</li><li>▪ Recovery Trench.</li><li>▪ Interceptor Trench.</li><li>▪ Stockpile &amp; Windrow.</li><li>▪ No Migration – contained or minor staining.</li></ul> <p>Recovery, Storage, Disposals:</p> <ul style="list-style-type: none"><li>▪ No recovery possible or too dangerous.</li><li>▪ Surface Absorbents.</li><li>▪ Excavate &amp; Dispose.</li><li>▪ In-Situ Treatment.</li><li>▪ In-Situ Burn.</li><li>▪ Haz-Waste Vac Truck.</li></ul> <p><b>Spill Plan – Confined Water</b> see Table 3B</p> <ul style="list-style-type: none"><li>▪ Tarp Containment.</li><li>▪ Culvert Block or Modified Culvert Block.</li><li>▪ Underflow Containment.</li><li>▪ Water-Gate.</li><li>▪ Storm-Drain Containment.</li><li>▪ Aqua-Dam Containment.</li><li>▪ Sand-Bag Containment.</li><li>▪ Ice Containment.</li><li>▪ Containment &amp; Deflection Booms.</li><li>▪ Absorbent Boom Deflection.</li><li>▪ Groundwater monitoring or recovery wells.</li></ul> <p><b>Spill Plan – Unconfined Open Water</b> see Table 3B</p> <ul style="list-style-type: none"><li>▪ Containment Boom.</li><li>▪ Exclusion Booms.</li><li>▪ Herring-Bone Boom Configuration.</li><li>▪ Foreshore Seal Boom.</li></ul>	<p><b>Safety Plan &amp; Mobilize Objective – Complete FORM 3B</b></p> <p>Plan on how to address the safety issues:</p> <p><b>Chemical Safety Plan</b></p> <ul style="list-style-type: none"><li>▪ Job Hazard Analysis (JHA).</li><li>▪ Site Safety Protocol.</li><li>▪ Vapours, Flash Point &amp; LEL.</li><li>▪ De-Contamination Requirements.</li><li>▪ Evacuation &amp; Public Safety.</li><li>▪ Response PPE &amp; Assess Routes of Entry.</li></ul> <p><b>Physical Hazards Safety Plan</b></p> <ul style="list-style-type: none"><li>▪ Job Hazard Analysis (JHA).</li><li>▪ Incident Stability.</li><li>▪ Equipment used to lift, shift, pull, push and dig.</li><li>▪ Overhead or Buried Utilities: <a href="#">Call-Before-You-Dig</a>.</li></ul> <p><b>Work Environmental Safety Plan</b></p> <ul style="list-style-type: none"><li>▪ Job Hazard Analysis (JHA).</li><li>▪ Working under adverse weather conditions.</li><li>▪ Land: Accessibility &amp; Instabilities.</li><li>▪ Water: Accessibility, Flows, Depth &amp; Foreshore.</li><li>▪ Indoor: Accessibility, Egress, Lock-out, Confined Space, Visibility &amp; Ventilation.</li></ul> <p><b>Human Health &amp; Safety Plan</b></p> <ul style="list-style-type: none"><li>▪ Job Hazard Analysis (JHA).</li><li>▪ Stress, Fatigue &amp; Pressure on Responders.</li><li>▪ Adequate resources to respond.</li><li>▪ Public Security: Restricted Access, Detours &amp; Evacuation</li></ul>	<p><b>Environmental Plan &amp; Mobilize Objective – Complete FORM 3C</b></p> <p>Characterize &amp; Prioritize the Receiving Environmental:</p> <p><b>Aquatic Habitat, Flora &amp; Fauna</b></p> <ul style="list-style-type: none"><li>▪ Confined Water Courses – <i>Flowing</i>.</li><li>▪ Confined Water Courses – <i>Not Flowing</i>.</li><li>▪ Unconfined Water Courses – <i>Open Water</i>.</li></ul> <table><tr><td><b>Flora</b></td><td><ul style="list-style-type: none"><li>- Foreshore Veg.</li><li>- Wetland Plants</li><li>- Emergent Plants</li><li>- Submergent Plants</li><li>- Grasses</li></ul></td><td><b>Fauna</b></td><td><ul style="list-style-type: none"><li>- Fish</li><li>- Amphibians</li><li>- Mammals</li><li>- Reptiles</li></ul></td></tr></table> <p><b>Terrestrial Habitat, Flora &amp; 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<b>Land Use</b>	<ul style="list-style-type: none"><li>- Park</li><li>- Recreational</li><li>- Agricultural</li><li>- Residential</li><li>- Commercial</li><li>- Industrial</li></ul>	<b>Infrastructure</b>	<ul style="list-style-type: none"><li>- Staining Only</li><li>- Within a Containment</li><li>- Surrounding Only</li><li>- Under a Structure</li><li>- Surround &amp; Under</li><li>- Uncontained Structure</li><li>- Migrate In &amp; Through a Structure</li></ul>															
<b>Direct</b>	<ul style="list-style-type: none"><li>- Chemical</li><li>- Physical</li><li>- Environment</li><li>- Stress</li><li>- Access</li></ul>	<b>Indirect</b>	<ul style="list-style-type: none"><li>- Social</li><li>- Economical</li><li>- Recreation</li><li>- Aesthetics</li><li>- Cultural</li><li>- Archeological</li><li>- Spiritual</li></ul>															



## Response ACTION – Complete FORM 4

## Section 4

SPILL - ACTION	SAFETY – ACTION	ENVIRONMENTAL - ACTION
<p><b>Spill Response Action Objective - see Table 4</b></p> <p>Stop the spill at the source:</p> <ul style="list-style-type: none"> <li>▪ Patch &amp; plug.</li> <li>▪ Close valves.</li> <li>▪ Move or rotate the tank/ container.</li> </ul> <p>Contain the spill on land:</p> <ul style="list-style-type: none"> <li>▪ Recovery trench/ pits - <a href="#">Ref.#1A</a></li> <li>▪ Interceptor trench - <a href="#">Ref.#1B</a></li> <li>▪ Diversion trench - <a href="#">Ref.#1C</a></li> <li>▪ No Migration – Staining use SOP/BMP.</li> </ul> <p>Contain the spill within a ditch:</p> <ul style="list-style-type: none"> <li>▪ Tarp containment - <a href="#">Ref.#2A</a></li> <li>▪ Culvert Blocks - <a href="#">Ref.#2B</a></li> <li>▪ Modified Culvert Block - <a href="#">Ref.#2C</a></li> <li>▪ Underflow containment - <a href="#">Ref.#2D</a></li> </ul> <p>Contain the spill on small-medium creek:</p> <ul style="list-style-type: none"> <li>▪ Watergate containment - <a href="#">Ref.#2E</a></li> <li>▪ Storm Drain Containment - <a href="#">Ref.#2F</a></li> <li>▪ Aqua-dam Foreshore Protection - <a href="#">Ref.#2G</a></li> <li>▪ Sand-bag Containment - <a href="#">Ref.#2H</a></li> <li>▪ Ice containment - <a href="#">Ref.#2I</a></li> </ul> <p>Contain the spill on a large creek-stream:</p> <ul style="list-style-type: none"> <li>▪ Watergate containment with river boom.</li> </ul> <p>Contain the spill on a river:</p> <ul style="list-style-type: none"> <li>▪ River boom with absorbent booms using a “herring-bone” configuration.</li> </ul> <p>Contain the spill on a lake:</p> <ul style="list-style-type: none"> <li>▪ Containment or log booms.</li> <li>▪ Exclusion &amp; foreshore seal booms.</li> </ul> <p>Recovery on water:</p> <ul style="list-style-type: none"> <li>▪ <a href="#">Use</a>: Sphag Sorb – Peat Moss.</li> <li>▪ <a href="#">Do Not Use</a>: Dispersants, Soaps &amp; Surfactants <ul style="list-style-type: none"> <li>– These are deleterious substances that impact fish &amp; aquatic habitat.</li> </ul> </li> </ul>	<p><b>Safety Action Objectives:</b></p> <ul style="list-style-type: none"> <li>▪ Review the Safety Risks Assessment established for the incident: <ul style="list-style-type: none"> <li>– Chemical Contact Hazards.</li> <li>– Physical Dangers &amp; Stability.</li> <li>– Work Environment Hazards.</li> <li>– Human Health &amp; Safety Hazards.</li> </ul> </li> <li>▪ Review &amp; Implement Safety Plan: <ul style="list-style-type: none"> <li>– JHA's Completed, Reviewed &amp; Documented.</li> </ul> </li> <li>▪ Review the Roles &amp; Responsibilities: <ul style="list-style-type: none"> <li>– On-Scene/ Incident Coordinator.</li> <li>– Response Team &amp; Contractors.</li> <li>– Safety Coordinator.</li> </ul> </li> <li>▪ Site Security: <ul style="list-style-type: none"> <li>– Perimeter security (i.e. public access).</li> <li>– Work Zones/ Safe Zones established.</li> <li>– Traffic Control/ Detours established.</li> </ul> </li> <li>▪ Safety Checklist: <ul style="list-style-type: none"> <li>– Responder Training Certification.</li> <li>– Decontamination (including photos).</li> <li>– Responder Safety &amp; PPE requirements: <ul style="list-style-type: none"> <li>• <a href="#">Level A</a> (hazmat suit with SCBA inside) protects all routes of entry: <i>Inhalation; Skin Absorption; Ingestion.</i></li> <li>• <a href="#">Level B</a> (modified hazmat suit with SCBA outside suit) <i>Inhalation; Skin contact; Ingestion.</i></li> <li>• <a href="#">Level C</a> Chemical splash protection, possible respirator for <i>Inhalation.</i></li> <li>• <a href="#">Level D</a> Work boots, gloves, high-visible-vest, hearing, eye protection &amp; possible respiration for <i>Inhalation.</i></li> </ul> </li> </ul> </li> </ul>	<p><b>Environment Action Objectives:</b></p> <p>Take reasonable measures to minimize the impact of the incident on the environment.</p> <p><a href="#">Environmental Impact Assessments:</a></p> <ul style="list-style-type: none"> <li>▪ Visual Assessments.</li> <li>▪ Testing Pits &amp; Trenches.</li> <li>▪ Surface Water Quality Sampling.</li> <li>▪ Soil &amp; Vapour Sampling.</li> <li>▪ Air Quality Monitoring.</li> <li>▪ Monitoring Wells &amp; Groundwater.</li> <li>▪ Bird Surveys.</li> <li>▪ Fish &amp; Amphibian Survey &amp; Sampling.</li> <li>▪ Mammals &amp; Reptile Surveys &amp; Monitoring.</li> </ul> <p><a href="#">Archeological &amp; Cultural Impacts:</a></p> <ul style="list-style-type: none"> <li>▪ Impacts to wildlands, ecological reserves &amp; protected or conservancy areas should include an archeological assessment.</li> <li>▪ Culturally &amp; Spiritually sensitive areas are often not made public and require consultation with First Nations Governments to obtain access.</li> </ul> <p><a href="#">Restoration Options:</a></p> <ul style="list-style-type: none"> <li>▪ <i>No Restoration</i> is an option if the clean-up or access to the site will cause more damage or if the access to the site is too dangerous. <ul style="list-style-type: none"> <li>– Compensation or restoring another location becomes an option.</li> </ul> </li> <li>▪ Excavate-and-Replace to restore site to its original condition.</li> <li>▪ Aquatic Habitat, Flora &amp; Fauna Restoration: <ul style="list-style-type: none"> <li>– Requires consultation and a QEP.</li> </ul> </li> <li>▪ Terrestrial Habitat, Flora &amp; Fauna Restoration: <ul style="list-style-type: none"> <li>– Site specific habitat, flora &amp; fauna will vary with location. Retain a (QEP) Qualified Env. Professional to develop a restoration plan.</li> </ul> </li> <li>▪ Infrastructure Restoration: <ul style="list-style-type: none"> <li>– Retain QP Engineer for restoration plan.</li> </ul> </li> </ul>



End-of-Spill CLOSURE <span style="float: right;">Section 5</span>		
CLOSURE OBJETIVES	DAILY PROGRESS REPORTS	CLOSURE REPORT
<p><b>Closure Objectives:</b> Define the Closure Objectives: <i>These include the goals and parameters that were established at the outset of the response that, when implemented, will lead to a confirmation of end-of-spill for the incident:</i></p> <p><b>Outline the Goals &amp; Parameters to establish end-of-spill:</b></p> <ul style="list-style-type: none"> <li>▪ Delineation of impact.</li> <li>▪ Excavate to remove source of contamination.</li> <li>▪ Contaminated waste &amp; debris removal.</li> <li>▪ Site clean-up &amp; restoration criteria.</li> <li>▪ <i>Ex-situ</i> or <i>in-situ</i> treatment.</li> <li>▪ Pre-incident condition or negotiated compensation.</li> </ul> <p><b>Spill Response Closure Report:</b></p> <ul style="list-style-type: none"> <li>▪ Documented summary should include: <ul style="list-style-type: none"> <li>– Product, Volume &amp; Cause.</li> <li>– Correlation of spill volume and waste volume.</li> <li>– Response Measures taken to <u>limit</u> or <u>mitigate</u>: <ul style="list-style-type: none"> <li>• Personal Injury – responders.</li> <li>• Property or Infrastructure damage &amp; impacts.</li> <li>• Impact on the environment.</li> <li>• Impacts on individuals or community.</li> </ul> </li> </ul> </li> </ul> <p><b>Disposal vs. Treatment:</b></p> <ul style="list-style-type: none"> <li>▪ Waste Recovery &amp; Storage: <ul style="list-style-type: none"> <li>– Waste volume recovered and methodology of recovery.</li> <li>– Storage methodology.</li> <li>– Sampling protocol to characterize the waste material. <ul style="list-style-type: none"> <li>• Document the waste management options to ensure that both <i>cost effective</i> and <i>practical</i> solutions are considered.</li> <li>• Outline the justification for how waste is managed.</li> </ul> </li> <li>– Document Permits, Approvals and Exemptions associated with waste management.</li> </ul> </li> </ul>	<p><b>Daily Progress Reports:</b> Daily Progress Reports provides a documented timeline of the response. It also outlines the response objectives, targets and implementation timelines.</p> <ul style="list-style-type: none"> <li>• <u>Daily Progress Reports</u> are used to update and communicate with: <ul style="list-style-type: none"> <li>– The Spill Contractor and the Responsible Party.</li> <li>– Government Agencies: Municipal, Provincial &amp; Federal.</li> <li>– First Nations Governments and Stakeholders.</li> <li>– Individuals and Communities including Recreational &amp; Business Organizations.</li> </ul> </li> <li>• <u>Daily Progress Reports</u> will document the response organization and status: <ul style="list-style-type: none"> <li>– Organization Structure: Incident Command System (ICS).</li> <li>– Daily Field Notes &amp; Photo Documentation.</li> <li>– Site Surveys &amp; Updated Site Diagrams.</li> <li>– Summary of equipment, personnel &amp; resources on-site or on-route.</li> <li>– Safety Assessment of the incident: <ul style="list-style-type: none"> <li>• Document the Job-Hazard-Assessment for the response actions.</li> <li>• Document the site security for the responders &amp; public safety.</li> </ul> </li> <li>– Safety Assessment of infrastructure: <ul style="list-style-type: none"> <li>• Document any impacts to infrastructure and include any reports submitted by Qualified Professionals that outline the damage assessment and restoration requirements.</li> </ul> </li> </ul> </li> <li>• <u>Daily Progress Reports</u> will describe and quantify the targets &amp; timelines: <ul style="list-style-type: none"> <li>– Spill Response Actions to be implemented within a specific timeline.</li> <li>– The Action Items are developed to ensure that the Response Objectives are fulfilled: <ul style="list-style-type: none"> <li>• Assess extent of product migration and pathways.</li> <li>• Containment and countermeasures used.</li> <li>• Recovery and waste accumulation.</li> <li>• Clean-up and site disturbance.</li> </ul> </li> <li>– Confirmatory sampling and ongoing monitoring.</li> <li>– Confirmation of site restoration.</li> </ul> </li> </ul>	<p><b>End-of-Spill Closure Report:</b> Review Objectives and Targets that were outlined.</p> <p><b>Closure Report:</b></p> <ul style="list-style-type: none"> <li>▪ Use the <i>Daily Progress Reports</i> to summarize the response: <ul style="list-style-type: none"> <li>– Assessments.</li> <li>– Planning and Mobilization.</li> <li>– Response Actions: <ul style="list-style-type: none"> <li>Containment &amp; Clean-up.</li> <li>Waste Management &amp; Restoration.</li> </ul> </li> </ul> </li> <li>▪ Outline the <i>cause</i> of the spill or the circumstances that lead to the spill.</li> <li>▪ Outline the preventative measures &amp; preparedness measures that emphasize <i>Due Diligence</i>.</li> <li>▪ Outline the “<i>lessons learned</i>” from the incident: <ul style="list-style-type: none"> <li>– Review the risk assessment matrix and what measures are required to manage the risk. <ul style="list-style-type: none"> <li>• Update or improve equipment.</li> <li>• Updated or develop new procedures.</li> <li>• Implement additional awareness or operational training.</li> </ul> </li> </ul> </li> </ul>

# Spill Response Guidelines

APPENDICES

	FORMS	Supporting Tables					
1	<b>Prevention</b> FORM 1 Risk Assessment Matrix						
2	<b>Assessment</b> FORM 2A Spill Assessment FORM 2B Safety Assessment FORM 2C Environmental Assessment*	<b>*Supporting Tables for FORM 2C Environmental Assessment</b> <ul style="list-style-type: none"><li>Table 2A Aquatic Habitat</li><li>Table 2B Aquatic Receptors: Flora &amp; Fauna</li><li>Table 2C Terrestrial Habitat</li><li>Table 2D Terrestrial Receptors: Flora</li><li>Table 2E Terrestrial Receptors: Fauna</li><li>Table 2F Land Use &amp; Infrastructure Risk Priorities</li><li>Table 2G Human Health &amp; Community</li></ul>					
3	<b>Plan &amp; Mobilize</b> FORM 3A Spill Plan* FORM 3B Safety Plan FORM 3C Environmental Plan	<b>*Supporting Tables for FORM 3A Spill Plan</b> <ul style="list-style-type: none"><li>Table 3A - SPILL PLAN: Spill Containment on LAND</li><li>Table 3B - SPILL PLAN: WATER Course Containment</li></ul>					
4	<b>Action</b> FORM 4A Containment Options*	<b>*Supporting Table 4. SUMMARY OF RESPONSE ACTIONS</b> <table><tr><td><b>Reference #1: LAND BASED</b> 1A Recovery Trench 1B Interceptor Trench 1C Diversion Trench 1D SOP/BMP <i>in-situ Treatment</i></td><td><b>Reference #2: CONFINED WATER COURSE</b> 2A Tarp Containment 2B Culvert Block 2C Modified Culvert Block 2D Underflow Containment 2E Water-Gate Containment 2F Storm-Drain Containment 2G Aqua-Dam Containment 2H Sand-Bag Containment 2I Ice Containment</td><td><b>Reference #3: UN-CONFINED OPEN WATER COURSE</b> 3A Containment Boom 3B Exclusion Boom 3C Herring-Bone Boom Configuration</td></tr></table>			<b>Reference #1: LAND BASED</b> 1A Recovery Trench 1B Interceptor Trench 1C Diversion Trench 1D SOP/BMP <i>in-situ Treatment</i>	<b>Reference #2: CONFINED WATER COURSE</b> 2A Tarp Containment 2B Culvert Block 2C Modified Culvert Block 2D Underflow Containment 2E Water-Gate Containment 2F Storm-Drain Containment 2G Aqua-Dam Containment 2H Sand-Bag Containment 2I Ice Containment	<b>Reference #3: UN-CONFINED OPEN WATER COURSE</b> 3A Containment Boom 3B Exclusion Boom 3C Herring-Bone Boom Configuration
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## Spill Response Guidelines

FORM 1:				Risk Assessment Matrix		Appendix 1	
Risk Identification	HIGH	MEDIUM	LOW	Assigned Numerical Value*			
Numerical Value	3	2	1				
<b>Environmental Factors</b>							
Distance to nearest watercourse	< 50m	50m-100m	> 100m				
Soil characteristics around the storage area	Porous or unknown – coble/ gravel	Semi-porous – silt/ sand	Non-porous – clay/ bedrock				
Terrain slope	> 6% slope	2%-6% slope	< 2% slope				
<b>Operational Factors</b>							
Site description	Isolated access: – no road access: <i>fly-in</i> only; – barge only access	Remote access: – 3-5hrs from town/ Hwy access; – no cell phone coverage	Easy access: – within 1hr of town; – cell phone coverage				
Duration of project	> 30 days	10-30 days	< 10 days				
Volumes stored	>1000L	230L-1000L	< 230L				
Daily access	> 12x per day	6-12x per day	< 6x per day				
Personnel access	Everyone has access	Everyone with training has access	Only designated (qualified & trained) personnel have access				
<b>Prevention &amp; Preparedness Factors</b>							
Distance or access to the respond to an incident	Requires helicopter & weather dependent	More than a day to respond with additional equipment	Same day response time with additional equipment				
Additional <i>Spill Control measures implemented</i>	No <i>spill control</i> for the storage area or the dispensing area	<i>Spill control</i> for the dispensing area only	<i>Spill control</i> for the storage & dispensing area with additional <i>Control Measures</i>				
Preparedness and Response Training: <i>Fuel Management &amp; Spill Response</i>	No one trained in <i>Spill Response</i> or <i>Fuel Management</i>	At least one person on-site has a <i>Spill Response &amp; Fuel Management</i> Training Certificate	Everyone who handles fuel has a valid <i>Spill Response &amp; Fuel Management</i> Training Certificate				
<b>Risk Value</b>	<b>*Add the Assigned Numerical Values:</b>						

### CONTROL MEASURE RECOMMENDATIONS

Numerical Value	Risk Ranking	Control Measures
< 12	Low Risk	<ul style="list-style-type: none"> <li>No Additional Control Measures are Considered Necessary</li> </ul>
12-23	Medium Risk	<ul style="list-style-type: none"> <li>Additional Control Measures Should be Considered to Reduce the Risk</li> </ul>
> 23	High Risk	<ul style="list-style-type: none"> <li>Identify &amp; Implement Additional Control Measures for High-Risk Sites</li> </ul>

# Spill Response Guidelines

FORM 2A		Spill Assessment		Appendix 2	
Product Identification	Shipping Name:				
	TDG Information:	TDG Class:	Packing Group:		
	UN #:				
	CANUTEC Emergency Guide #:				
Spill Volume	Max <i>Potential</i> Volume: (Total Capacity of Tank)				
	Estimated Spill Volume: (Tank Volume less Remaining) (Total Volume Recovered)				
Migration Pathways					
Environmental Features	Topography	<u>Terrain slopes &amp; contours</u>	<u>Landscape Features</u>	<u>Infrastructure</u>	
	Soil Characteristics at depth	<u>Soil Characteristics</u>	<u>Porous</u>	<u>Non-Porous</u>	<u>Confining Layer</u>
	Confined Water Courses	<u>High Energy Flow</u> <u>Low Energy Flow</u>	<u>Ditches &amp; Creeks</u>	<u>Ponds &amp; Wetlands</u>	<u>Groundwater</u>
	Unconfined Water Courses	<u>Major Rivers</u>	<u>Open Water</u> <u>Foreshores</u>	<u>Tidal Estuaries</u>	

FORM 2B		Safety Assessment		Appendix 2
Chemical	<b>Understand the chemical properties involved</b>			
	<u>Product Name</u>	<u>PPE Required</u>		
	<u>Flash Point</u>	Level A		
		Level B		
		Level C		
		Level D		
<u>LEL</u>	<u>Evacuation or Safety Distances Required</u>			
<u>Potential Routes of Entry:</u>	<u>Decontamination Required</u>			
Skin Absorption				
Inhalation	<u>Special Handling Required</u>			
Ingestion				
Physical	<b>Be aware of unstable equipment &amp; dangerous work areas</b>			
	<u>Incident Stability</u>	<u>Call-before-you-dig</u> (buried utilities)		
	<u>Tank Integrity</u>	<u>Working on or over water</u>		
	<u>Overhead Utility – Power lines</u>	<u>Working around Vehicular Traffic</u>		
Environment	<b>Consider seasonal weather, access points and exit strategies</b>			
	<b>Outdoor Environment (<i>in-the-field</i>)</b>		<b>Indoor Environment</b>	
	<u>Seasonal Weather Considerations</u>	<u>Vapor Monitoring &amp; Ventilation</u>		
	<u>Surface Water Conditions</u>	<u>Confined Space</u>		
	<u>Terrain Access &amp; Mobility</u>	<u>Collection Sumps &amp; Berms</u>		
	<u>Wildlife</u>	<u>Access &amp; Egress</u>		
Human Impact	<b>Stress, Fatigue &amp; Public Concerns</b>			
	<b>Responder Safety</b>		<b>Public Safety</b>	
	<u>Safe Working Protocols</u>	<u>Perimeter Security Barriers</u>		
	<u>Stress / Fatigue / Pressure</u>	<u>Downstream/ Downwind – Notification</u>		
	<u>Adequate Resources</u>	<u>Evacuation Procedures</u>		

FORM 2C Assessing Environment Appendix 2				
Receiving Environment		<b>Habitat</b>	<b>Flora</b>	<b>Fauna</b>
	<b>Aquatic Habitat</b>  See: <b>Tables 2A &amp; 2B</b>	<u><b>Water Courses:</b></u> <ul style="list-style-type: none"> <li>• Confined – <i>flowing</i></li> <li>• Confined – <i>not flowing</i></li> <li>• Unconfined – <i>open water</i></li> </ul>	<ul style="list-style-type: none"> <li>• Foreshore Vegetation</li> <li>• Wetland Plants</li> <li>• Emergent Plants</li> <li>• Submergent Plants</li> <li>• Grasses</li> </ul>	<ul style="list-style-type: none"> <li>• Fish</li> <li>• Amphibians</li> <li>• Reptiles</li> <li>• Mammals</li> </ul>
	<b>Terrestrial Habitat</b>  See: <b>Tables 2C, 2D &amp; 2E</b>	<ul style="list-style-type: none"> <li>• Forested</li> <li>• Mountain</li> <li>• Grassland</li> <li>• Desert</li> </ul>	<ul style="list-style-type: none"> <li>• Coniferous</li> <li>• Temperate Broadleaf</li> <li>• Deciduous</li> <li>• Grasses</li> <li>• Shrubs &amp; Brush</li> </ul>	<ul style="list-style-type: none"> <li>• Mammals:</li> <li>• Herbivores</li> <li>• Carnivores</li> <li>• Omnivores</li> <li>• Reptiles: <ul style="list-style-type: none"> <li>▪ Snakes</li> <li>▪ Lizards</li> <li>▪ Turtles</li> <li>▪ Birds – resident</li> <li>▪ Birds – migratory</li> </ul> </li> </ul>
		<b>Land Use</b>	<b>Infrastructure Impact</b>	
	<b>Land Use &amp; Infrastructure</b>  See: <b>Table 2F</b>	<ul style="list-style-type: none"> <li>• Agricultural</li> <li>• Recreational / Park</li> <li>• Residential</li> <li>• Commercial</li> <li>• Industrial</li> </ul>	<ul style="list-style-type: none"> <li>• Surface stain with no migration beyond stain</li> <li>• Enter or flood a contained structure</li> <li>• Surround but no subsurface migration under structure</li> <li>• Surround and migrate under structure</li> <li>• Enter or flood an uncontained structure or feature</li> <li>• Migrate into and/or through an uncontained structure or feature</li> </ul>	
	<b>Human Impacts</b>  See: <b>Table 2G</b>	<u><b>Direct Impact Caused By:</b></u> <ul style="list-style-type: none"> <li>• Chemical Contact</li> <li>• Physical Instability or Compromised</li> <li>• Environmental Contamination</li> <li>• Mental Health</li> <li>• Access Barrier</li> </ul>	<u><b>Indirect:</b></u> <ul style="list-style-type: none"> <li>• Social Effects on individuals or community</li> <li>• Economical</li> <li>• Recreational</li> <li>• Aesthetic</li> <li>• Cultural</li> <li>• Archeological</li> <li>• Spiritual</li> </ul>	



## Table 2A

## Assessing Aquatic Habitat

(used to complete FORM 2C)

### Water Characteristics:

- Freshwater – *no salt*
- Marine – *saltwater*
- Brackish – *mixture of salt and freshwater*
- Industrial Effluent – *treated or untreated effluent discharge: dilution zone*

	Confined Water Course <i>Flowing</i>	Confined Water Course <i>Not Flowing</i>	Unconfined Water Course <i>Large Water Bodies</i>
Aquatic Habitat	<u>Drainage System/ Ditch</u> <ul style="list-style-type: none"> <li>• Man-made system</li> <li>• Varies in width and depth</li> <li>• May contain aquatic plants</li> <li>• Along roads – impacted by winter gravel build-up and road salt</li> </ul>	<u>Moat/ Collection Ditch</u> <ul style="list-style-type: none"> <li>• Man-made system</li> <li>• Varies in size with no discharge point</li> <li>• Along roads – impacted by winter gravel build-up and road salt</li> </ul>	<u>Large Lakes or Open Water</u> <ul style="list-style-type: none"> <li>• Natural formed large water bodies</li> <li>• Vary in size and depth</li> <li>• Important habitat usually associated where water courses enter the lake</li> <li>• Shallow ledges usually critical habitat</li> </ul>
	<u>Small Creeks / Streams</u> <ul style="list-style-type: none"> <li>• Natural systems - tributaries are critical habitat</li> <li>• Varies in width and depth</li> <li>• Seasonal high-flows &amp; low-flows</li> </ul>	<u>Small Lake / Pond</u> <ul style="list-style-type: none"> <li>• Natural</li> <li>• Varies in size, usually shallow</li> <li>• Contains aquatic plants</li> <li>• Important/ critical habitat</li> </ul>	<u>Major / Large River System</u> <ul style="list-style-type: none"> <li>• Natural geographic surface water drainage systems that vary with seasonal high-water (<i>spring freshet</i>) &amp; low-flows during summer drought</li> <li>• Critical to migration of salmon species</li> </ul>
	<u>Storm Drains &amp; Sumps</u> <ul style="list-style-type: none"> <li>• Man-made system – collection system with a discharge point</li> <li>• Limited aquatic plants</li> <li>• Infrastructure found in urban area</li> </ul>	<u>Groundwater</u> <ul style="list-style-type: none"> <li>• Saturated zone of water located beneath land surface</li> <li>• Groundwater does “flow” towards an open watercourse</li> </ul>	<u>Coastal Foreshore</u> <ul style="list-style-type: none"> <li>• Habitat will vary significantly by level of exposure to wind and waves</li> <li>• Tidal influenced</li> <li>• Naturally protected estuaries and river deltas are critical habitat</li> </ul>
	<u>Puddles or Surface Water</u> <ul style="list-style-type: none"> <li>• Natural usually associated with poor surface water drainage or clay soils</li> <li>• Usually drain into ditches, storm drains or collection system</li> <li>• Not usually associated with aquatic habitat, but can impact other water courses</li> </ul>	<u>Puddles or Surface Water</u> <ul style="list-style-type: none"> <li>• Natural usually associated with poor surface water drainage or clay soils</li> <li>• Can be associated with ephemeral depressions with no discharge point</li> </ul>	<u>Reservoirs</u> <ul style="list-style-type: none"> <li>• Man-made large bodies of water - mostly associated with dams</li> <li>• Seasonal fluctuation of water levels can be significant as a result, perimeter vegetation is sometimes limited</li> </ul>
	<u>Wetlands</u> <i>Confined &amp; Flowing</i>	<u>Wetlands</u> <i>Confined - Not Flowing</i>	<u>Wetlands</u> <i>Not Confined - Open Water</i>
	<u>Shallow Open Water Wetlands</u> <ul style="list-style-type: none"> <li>• Always flooding</li> <li>• Aquatic vegetation species</li> </ul>	<u>Fens</u> (organic wetland) <ul style="list-style-type: none"> <li>• Water table at peat surface</li> <li>• pH &gt;5.0</li> <li>• Sphagnum layer &gt;0.4m</li> </ul>	<u>Saltwater Tidal Marsh</u> <ul style="list-style-type: none"> <li>• Tidal influenced</li> <li>• Marine Environment</li> <li>• Mainly grasses in muddy soil with poor drainage</li> </ul>
	<u>Swamps</u> (mineral wetland) <ul style="list-style-type: none"> <li>• Deeper water table with good drainage</li> <li>• Mainly forested with good mineral soils</li> </ul>	<u>Bogs</u> (organic wetland) <ul style="list-style-type: none"> <li>• Poor drainage as water table is below peat buildup</li> <li>• pH &lt; 5.5</li> <li>• Sphagnum layer &gt;0.4m</li> </ul>	<u>Freshwater Marshes</u> <ul style="list-style-type: none"> <li>• Not tidal but continually flooded near open water</li> <li>• Freshwater</li> <li>• Mainly sedges &amp; grasses in muddy soil with poor drainage</li> </ul>

**Table 2B Assessing Aquatic Receptors  
Flora & Fauna (used to complete FORM 2C)**

Aquatic Flora*		Aquatic Fauna*	
<ul style="list-style-type: none"><li>Aquatic vegetation &amp; Algae</li><li>Hydrophytes &amp; Macrophytes</li></ul>		<ul style="list-style-type: none"><li>Fish</li><li>Amphibians (frogs, toads, salamanders)</li></ul>	
* Common Examples in blue & Endangered species or at risk in red			
Aquatic Flora & Fauna	Confined Water Course Flowing	Confined Water Course Not Flowing	Unconfined Water Course Large Water Bodies
	<u>Drainage System/ Ditch</u> <i>Fish: Usually not applicable</i> <i>Amphibians: Likely</i> <i>Vegetation: Water tolerant grasses and wetland plants</i>	<u>Moat/ Collection Ditch</u> <i>Fish: Usually not applicable-no flow</i> <i>Amphibians: Very likely - abundant</i> <i>Vegetation: Aquatic wetland plants-bulrushes, cattails</i>	<u>Large Lakes or Open Water</u> <i>Fish: Cutthroat Trout, Salmon and many other species</i> <i>Amphibians: Very likely - abundant</i> <i>Vegetation: Aquatic wetland plants</i>
	<u>Small Creeks / Streams</u> <i>Fish: Cutthroat Trout; Salmon</i> <i>Amphibians: Frogs, Toads &amp; Salamanders</i> <i>Vegetation: Will depend on the water course</i>	<u>Small Lake / Pond</u> <i>Fish: Cutthroat Trout; Salmon</i> <i>Amphibians: Critical habitat including Frogs, Spade-foot Toad; Tiger Salamander</i> <i>Vegetation: Duckweed, Mosquito Fern</i>	<u>Major / Large River System</u> <i>Fish: Pacific Salmon, Sturgeon</i> <i>Amphibians: Frogs, Toads &amp; Salamanders</i> <i>Vegetation: Emergent and submergent aquatic plants can be found along sections of river embankments</i>
	<u>Storm Drains &amp; Sumps</u> <i>Surface water that discharges to the receiving environment can have a direct impact on flora or fauna</i>	<u>Groundwater</u> <i>Groundwater that discharges to surface water environment can have a direct impact on flora or fauna</i>	<u>Coastal Foreshore</u> <i>Fish: Pacific Salmon, Rockfish, Tidepool Sculpin</i> <i>Amphibians: Not applicable</i> <i>Vegetation: Eelgrass, Seaweed, Wetland Plants</i>
	<u>Puddles or Surface Water</u> <i>Surface water that flows into the receiving environment can have a direct impact on flora or fauna</i>	<u>Puddles or Surface Water</u> <i>Surface water that discharges to the receiving environment can have a direct impact on flora or fauna</i>	<u>Reservoirs</u> <i>Fish: Cutthroat Trout</i> <i>Amphibians: Frogs, Toads &amp; Salamanders</i> <i>Vegetation: Aquatic vegetation will vary depending on the site and distance to inflowing water courses</i>
	<u>Wetlands</u> <i>Confined &amp; Flowing</i>	<u>Wetlands</u> <i>Confined - Not Flowing</i>	<u>Wetlands</u> <i>Not Confined - Open Water</i>
	<u>Shallow Open Water Wetlands</u> <ul style="list-style-type: none"><li>Always flooding</li><li>Aquatic vegetation species</li></ul>	<u>Fens</u> (organic wetland) <ul style="list-style-type: none"><li>Water table at peat surface</li><li>pH &gt;5.0</li><li>Sphagnum layer &gt;0.4m</li></ul>	<u>Saltwater Tidal Marsh</u> <ul style="list-style-type: none"><li>Tidal influenced</li><li>Marine Environment</li><li>Mainly grasses in muddy soil with poor drainage</li></ul>
	<u>Swamps</u> (mineral wetland) <ul style="list-style-type: none"><li>Deeper water table with good drainage</li><li>Mainly forested with good mineral soils</li></ul>	<u>Bogs</u> (organic wetland) <ul style="list-style-type: none"><li>Poor drainage as water table is below peat buildup</li><li>pH &lt; 5.5</li><li>Sphagnum layer &gt;0.4m</li></ul>	<u>Freshwater Marshes</u> <ul style="list-style-type: none"><li>Not tidal but continually flooded near open water</li><li>Freshwater</li><li>Mainly sedges &amp; grasses in muddy soil with poor drainage</li></ul>

## Table 2C

## Assessing Terrestrial Habitat

(used to complete FORM 2C)

**Defining Terrestrial Habitat:** The *natural environment* on land that supports the survival of animals, plants and organisms. Describe the four distinct terrestrial habitats: forests, mountains, grasslands and deserts.

	Forested	Mountain	Grassland	Desert
	<b>Determining Factors:</b> <ul style="list-style-type: none"> <li>Latitude</li> <li>Forest Floor Decay</li> <li>Soil Characteristics</li> <li>Forest Stage Description</li> <li>Forest Region</li> <li>Dry/ Wet Area</li> </ul>	<b>Determining Factors:</b> <ul style="list-style-type: none"> <li>Elevation</li> <li>Sun Exposure</li> <li>Soil Characteristics</li> <li>Latitude</li> <li>Precipitation</li> <li>Ambient Temp.</li> </ul>	<b>Characteristics:</b> <ul style="list-style-type: none"> <li>Low precipitation</li> <li>Nutrient rich soil</li> <li>Natural - undeveloped</li> <li>Semi-natural - some development</li> <li>Agriculture - developed</li> </ul>	<b>Characteristics:</b> <ul style="list-style-type: none"> <li>Cold semi-arid desert</li> <li>&lt;300mm annual precipitation</li> <li>Temp ranges: +40°C to -5°C</li> </ul>
<b>Terrestrial Habitat</b>	<u>Boreal Forests</u> <ul style="list-style-type: none"> <li>Dominated with coniferous</li> <li>Northern latitude</li> <li>Colder climate</li> <li>Moderate-high precipitation</li> </ul>	<u>Foothill Zone</u> <i>Elevation &lt;400m</i> <ul style="list-style-type: none"> <li>Temperate coniferous</li> <li>Grasslands</li> </ul>	<u>Natural*</u> <ul style="list-style-type: none"> <li>No agriculture or fertilizers</li> <li>Often low productivity</li> </ul>	<u>Dry Shrub</u> <u>Grassland</u> <ul style="list-style-type: none"> <li>Soil is dry, sandy and nutrient poor</li> <li>Open areas dominated by grass</li> </ul>
	<u>Temperate Broadleaf Forest</u> <ul style="list-style-type: none"> <li>Relatively moist soil</li> <li>Broad range of seasonal temperatures</li> <li>Dominated with deciduous</li> </ul>	<u>Montane Zone</u> <i>Elevation Range: 400m-1200m</i> <ul style="list-style-type: none"> <li>Dense coniferous</li> <li>Lower canopy</li> <li>Exposed rock, moss, ferns &amp; lichens evident</li> </ul>	<u>Semi-Natural*</u> <ul style="list-style-type: none"> <li>Agricultural Activity</li> <li>Very little fertilizers used</li> <li>Natural balance between vegetative growth and grazing</li> <li>Very little mechanical disturbance</li> </ul>	
	<u>Montane Forest Region</u> <ul style="list-style-type: none"> <li>Along mountain slopes</li> <li>Mixed ecosystem depending on elevation and latitude</li> <li>Dense coniferous stands</li> <li>Grassland Zones</li> <li>Riparian Woodland Zones</li> <li>Desert Zones</li> </ul>	<u>Subalpine Zone</u> <i>Elevation Range: 1200m-1900m</i> <ul style="list-style-type: none"> <li>Directly below tree-line</li> <li>Stunted plant growth</li> <li>Elevation &amp; sun exposure define climatic zones</li> </ul>	<u>*Nine-Habitats:</u> <ul style="list-style-type: none"> <li><b>Aspen</b> - Moist, cooler environment</li> <li><b>Gully</b> - Moist during the snowmelt then dry out</li> <li><b>Riparian</b> - Adjacent to water courses; critical habitat</li> <li><b>Wetland</b> - Water saturated environment: critical habitat</li> <li><b>Pond/ Lake</b> - Open water bodies with varying depth</li> <li><b>Open Grassland</b> - Open areas dominated by grass</li> <li><b>Rocky Talus/ Rock Outcrop</b> - Fractured rock and caves - important habitat</li> <li><b>Open Coniferous Forest</b> - Grasslands with just enough moisture to support trees</li> <li><b>Closed Coniferous Patch</b> - North-facing slopes with higher moisture in soil</li> </ul>	<u>Cliffs &amp; Rock Outcrops</u> <ul style="list-style-type: none"> <li>Fractured rock and caves - important habitat</li> </ul>
	<u>Coast Forest Region</u> <ul style="list-style-type: none"> <li>Very wet environment</li> <li>Mixed coniferous &amp; broadleaf</li> <li>Understory of mosses, ferns and shrubs</li> </ul>	<u>Alpine Zone</u> <i>Elevation Range: 1900m-2400m</i> <ul style="list-style-type: none"> <li>Above treeline</li> <li>Windy with low ambient temperatures</li> <li>Low precipitation</li> <li>Poor soil nutrient environment</li> </ul>		
	<u>Columbia Forest Region</u> <ul style="list-style-type: none"> <li>Columbia River Valley of South-East BC</li> <li>Mixed deciduous: wet zones</li> <li>Grassland Zones</li> <li>Wetland Zones</li> </ul>			
	<u>Subalpine Forests</u> <ul style="list-style-type: none"> <li>Cooler environment, longer winters &amp; low precipitation</li> <li>Coniferous old growth</li> <li>Wet meadows</li> <li>Fen wetlands</li> </ul>	<u>Snow Zone</u> <i>Elevation &gt;2400m</i> <ul style="list-style-type: none"> <li>Permanent snow &amp; ice</li> </ul>	<u>Agriculture</u> <ul style="list-style-type: none"> <li>Crop Specific</li> <li>Mechanical disturbance</li> <li>Use chemical fertilizers and herbicides</li> </ul>	<u>Open Ponderosa Pine Forests</u> <ul style="list-style-type: none"> <li>Grasslands with just enough moisture to support trees</li> </ul>

## Table 2D Assessing Environmental Receptors – Flora (used to complete FORM 2C)

**Defining Flora:** All *plant life* found in a specific region habitat.

- **Objective:** To provide awareness of the diversity of plant life found in different terrestrial habitats.
- There are too many species to list and regional areas can have a significant variability in diversity.
- Examples of Common plant life in blue & Endangered species or at risk in red

	Forested	Mountain	Grassland	Desert
	<u>Determining Factors:</u> <ul style="list-style-type: none"> <li>• Forest Floor Decay</li> <li>• Stand Initiation</li> <li>• Stem Exclusion</li> <li>• Understory Re-initiation</li> <li>• Old Growth</li> </ul>	<u>Determining Factors:</u> <ul style="list-style-type: none"> <li>• Seasonal Temperature</li> <li>• Precipitation</li> <li>• Soil characteristics</li> <li>• Sun Exposure</li> <li>• Latitude</li> </ul>	<u>Characteristics:</u> <ul style="list-style-type: none"> <li>• Low precipitation</li> <li>• Nutrient rich soil</li> <li>• Natural – undeveloped</li> <li>• Semi-natural – developed</li> <li>• Agriculture – developed</li> </ul>	<u>Characteristics:</u> <ul style="list-style-type: none"> <li>• Cold semi-arid</li> <li>• &lt;300mm annual precipitation</li> <li>• Temp ranges: +40°C to -5°C</li> </ul>
Flora – Plant Life	<u>Boreal Forest Region</u> <ol style="list-style-type: none"> <li>1. Northern Region: <u>White Spruce</u>; <u>Black Spruce</u>; <u>Larch</u></li> <li>2. Open Lichen Woodland: <u>Spruce</u>; <u>Balsam Fir</u>; <u>Jack Pine</u>; <u>White Birch</u>; <u>Trembling Aspen</u></li> <li>3. Lower Boreal Region: <u>Trembling Aspen</u>; <u>Willow</u>; <u>Pinegrass</u></li> </ol>	<u>Foothill Zone</u> <u>Elevation &lt;400m</u> <u>Lodgepole Pine</u> ; <u>Trembling Aspen</u> ; <u>Balsam Poplar</u> ; <u>Paper Birch</u> ; <u>Balsam Fir</u> ; <u>Blue-Bunch Wheatgrass</u> ; <u>Rough Fescue</u>	<u>Natural*</u> <ul style="list-style-type: none"> <li>• No agriculture or fertilizers</li> <li>• Often low productivity</li> </ul> <u>Semi-Natural*</u> <ul style="list-style-type: none"> <li>• Agricultural Activity</li> <li>• Very little fertilizers used</li> <li>• Natural balance between vegetative growth and grazing</li> <li>• Very little mechanical disturbance</li> </ul>	<u>Dry Shrub Grassland</u> <u>Antelope-brush</u> ; <u>Big Sagebrush</u> ; <u>Grass</u> ; <u>Hard fescue</u> ; <u>Cacti</u> : <u>Little Prickly Pear Cactus</u>
	<u>Temperate Broadleaf Forest</u> <u>Oak</u> ; <u>Maple</u> ; <u>Birch</u> ; <u>Pine</u> ; <u>Firs</u> ; <u>Spruce</u>	<u>Montane Zone</u> <u>Elevation Range 400m-1200m</u> <u>Douglas Fir</u> ; <u>Forage Grass</u> ; <u>White Spruce</u> ; <u>Lodgepole Pine</u> ; <u>Ponderosa Pine</u> ; <u>Bunchgrass</u> ; <u>Sedges</u>	<u>*Nine-Habitats:</u> <ul style="list-style-type: none"> <li>• <u>Aspen</u> - <u>Trembling Aspen</u>; <u>Snowberry</u>; <u>Snowberry</u>; <u>Blue Wheatgrass</u>; <u>Timber Oat Grass</u>; <u>Prairie Rose</u></li> <li>• <u>Gully</u> – <u>Douglas Maple</u>; <u>Saskatoon</u>; <u>Common Snowberry</u></li> <li>• <u>Riparian</u> – <u>Red-Osier Dogwood</u></li> <li>• <u>Wetland</u> – <u>Bulrush</u>, <u>Cattails</u>; <u>Willows</u>; <u>Aspen</u></li> <li>• <u>Pond/ Lake</u> <u>Cattail</u>; <u>Bulrush</u></li> <li>• <u>Open Grassland</u> – <u>Prairie Rose</u>; <u>Sagebrush</u>; <u>Choke Cherry</u></li> <li>• <u>Rocky Talus/ Rock Outcrop</u> - <u>Horse-brush</u>; <u>Common Juniper</u></li> <li>• <u>Open Coniferous Forest</u> - <u>White Current</u>; <u>Black gooseberry</u>; <u>Common Juniper</u>; <u>Rocky Mountain Juniper</u></li> <li>• <u>Closed Coniferous Patch</u> - <u>Red Elderberry</u></li> </ul>	<u>Cliffs &amp; Rock Outcrops</u> <u>Common Juniper Shrub</u> ; <u>Saskatoon</u> ; <u>Sagebrush</u>
	<u>Montane Forest Region</u> <u>Pine</u> ; <u>Spruce</u> ; <u>Fir</u> ; <u>Rhododendron</u> ; <u>Ferns</u> ; <u>Pinegrass</u> ; <u>Blue-bunch Wheatgrass</u>	<u>Subalpine Zone</u> <u>Elevation Range 1200m-1900m</u> <u>Alpine Fir</u> ; <u>Engelmann Spruce</u> ; <u>Ponderosa Pine</u> in drier areas; <u>Rough Fescue</u> ; <u>Pinegrass</u>		
	<u>Coast Forest Region</u> <u>Western Hemlock</u> ; <u>Western Red Cedar</u> ; <u>Sitka Spruce</u> ; <u>Douglas Fir</u> ; <u>Understory of Mosses, Ferns and Shrubs</u>	<u>Alpine Zone</u> <u>Elevation Range 1900m-2400m</u> <u>Alpine Grasses</u> , <u>Sedges</u> , <u>Forbs</u> ; <u>Mosses</u> ; <u>Lichens</u> and <u>alpine flowers</u> ; <u>Rough Fescue</u>		
	<u>Columbia Forest Region</u> <u>Sitka Spruce</u> ; <u>Douglas Fir</u> ; <u>Lodgepole Pine</u> ; <u>White-bark Pine</u>			
	<u>Subalpine Forest Region</u> <u>Pine</u> ; <u>Spruce</u> ; <u>Fir</u> ; <u>Rhododendron</u> ; <u>Ferns</u>	<u>Snow Zone</u> <u>Elevation &gt;2400m</u> <u>Lichens and mosses</u> on exposed rock surfaces	<u>Agriculture</u> <ul style="list-style-type: none"> <li>• Crop Specific</li> <li>• Mechanical disturbance</li> <li>• Use chemical fertilizers &amp; herbicides</li> </ul>	<u>Open Ponderosa Pine Forests</u> <u>Ponderosa Pine</u> ; <u>Blue-bunch Wheatgrass</u> ; <u>Snowbrush</u> ; <u>Rough Fescue</u> ; <u>June-grass</u> ; <u>Prairie Lupine</u>

## Table 2E Assessing Environmental Receptors – Fauna (used to complete FORM 2C)

**Defining Fauna:** All *animal life* found in a specific region habitat.

- **Objective:** To provide awareness of the diversity of species found in different terrestrial habitats.
- There are too many species to list and regional areas can have significant variability in diversity.
- Examples of Common Species in blue; Endangered or Species-at-risk in red

	Forest	Mountain	Grassland	Desert
	<b>Factors Include:</b> <ul style="list-style-type: none"> <li>• Forest Floor Decay</li> <li>• Stand Initiation</li> <li>• Stem Exclusion</li> <li>• Understory Re-initiation</li> <li>• Old Growth</li> </ul>	<b>Factors Include:</b> <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Humidity</li> <li>• Soil</li> <li>• Sun Exposure</li> </ul>	<b>Characteristics:</b> <ul style="list-style-type: none"> <li>• Low precipitation</li> <li>• Nutrient rich soil</li> <li>• Natural - undeveloped</li> <li>• Semi-natural – developed</li> <li>• Agriculture - developed</li> </ul>	<b>Characteristics:</b> <ul style="list-style-type: none"> <li>• Cold semi-arid desert</li> <li>• &lt;300mm annual precipitation</li> <li>• Temp ranges: +40°C to -5°C</li> </ul>
<b>Fauna – Animal Life</b>	<u>Boreal Forest Region</u> Moose; Elk; Woodland Caribou; Mule Deer; Black Bear; Grizzly Bear; Beaver; Grey Wolf; Snowshoe Hare; Lynx; Squirrels	<u>Foothill Zone</u> Elevation <400m Moose; Elk, Deer; Snowshoe Hare; Beaver; Muskrat; Lynx; Wolf; Black Bear; Goat Sandhill Cranes; Grouse; Warblers	<u>Natural*</u> <ul style="list-style-type: none"> <li>• No agriculture or fertilizers</li> <li>• Often low productivity</li> </ul> <u>Semi-Natural*</u> <ul style="list-style-type: none"> <li>• Agricultural</li> <li>• Very little fertilizers used</li> <li>• Natural balance between vegetative growth and grazing</li> <li>• Very little mechanical disturbance</li> </ul> <u>*Nine-Habitats:</u> <ul style="list-style-type: none"> <li>• <b>Aspen</b> – Beaver, Moose, Elk Deer; Reptiles: snakes; Grouse</li> <li>• <b>Gully</b> – Bighorn Sheep; Grouse; <b>Behr's Hairstreak Butterfly</b></li> <li>• <b>Riparian</b> - Beaver; River Otters; Moose; Mule Deer</li> <li>• <b>Wetland</b> – Moose; Amphibians &amp; Reptiles: <b>Painted Turtles &amp; Rubber Boa</b>; Ducks; Geese; Shore Birds</li> <li>• <b>Pond/ Lake</b> - Reptiles: <b>Painted Turtle</b>; Amphibians: <b>Spade-foot Toad</b>; Birds: Loons;</li> <li>• <b>Open Grassland</b> - <b>Badger</b>; <b>Coyote</b>; Birds: <b>Sage Thresher</b>; <b>Common Nighthawk</b>; <b>Short-Eared Owl</b>; Reptiles: <b>Lizards &amp; Snakes</b></li> <li>• <b>Rocky Talus/ Rock Outcrop</b> -<b>Western Rattle Snake</b></li> <li>• <b>Open Coniferous Forest</b> – <b>Deer</b>; <b>Bears</b>;</li> <li>• <b>Closed Coniferous Patch</b> -<b>Black Bear</b>; <b>White-Tailed Deer</b></li> </ul>	<u>Dry Shrub Grassland</u> Bald Eagle; Sage Thresher; Burrowing Owl; Western Harvest Mouse; Garter Snake; Marmot; Ground Squirrels; Mice; Voles; Shrews and Coyotes
	<u>Temperate Broadleaf Forest</u> Peregrine Falcon; Grey Wolf; Black Bear; Grizzly Bear; Beaver; White-tailed Deer; Raccoons; Porcupines and Red Fox	<u>Montane Zone</u> Elevation Range 400m-1200m Rocky Mountain Elk; Mule Deer; White-Tailed Deer; Moose; Snowshoe Hare; Black Bear; Sandhill Crane; Grouse; Warbler		
	<u>Montane Forest Region</u> Bald Eagle; Moose; Elk; Black-Tailed & Mule Deer; Squirrels; Beavers Woodland Caribou; Red Fox; Grouse; Black & Grizzly Bears; Wolf	<u>Subalpine Zone</u> Elevation Range 1200m-1900m Collard Pika; Mountain Goat; Bighorn Sheep		
	<u>Coast Forest Region</u> Bald Eagle; Pacific Salamander; Tree Frog; Raccoon; Black Bear; Black-Tailed Deer; Wolf	<u>Alpine Zone</u> Elevation Range 1900m-2400m Collard Pika; White Tail Ptarmigan; Mountain Goat; Bighorn Sheep		
	<u>Columbia Forest Region</u> Lewis's Woodpecker			
	<u>Subalpine Forest Region</u> Mountain Goat; Bighorn Sheep	<u>Snow Zone</u> Elevation >2400m	<u>Agriculture</u> <ul style="list-style-type: none"> <li>• Crop Specific</li> <li>• Mechanical disturbance</li> <li>• Use chemical fertilizers and herbicides</li> </ul>	<u>Open Ponderosa Pine Forests</u> Owls; Sparrows, White-Breasted Nuthatch

**Table 2F Assessing *Risk* Priorities of a Spill**  
(used to complete FORM 2C)

**Defining Land Use & Infrastructure:**

- All man-made structures or non-natural features within specific land use.

		Surface stain of an area or feature with no migration beyond the stain	Enter or flood a contained structure or feature	Surround but <i>not</i> migrate under a structure or feature	Surround and migrate under a structure or feature	Enter or flood an uncontained structure or feature	Migrate into and through an uncontained area or feature
<b>Land Use</b>	<b>Industrial</b>	<b>LOW Risk Rank 1</b>	<b>Risk Rank 2</b>	<b>Risk Rank 3</b>	<b>Risk Rank 4</b>	<b>Risk Rank 5</b>	<b>Risk Rank 6</b>
	<b>Commercial</b>	<b>Risk Rank 2</b>	<b>Risk Rank 3</b>	<b>Risk Rank 4</b>	<b>Risk Rank 5</b>	<b>Risk Rank 6</b>	<b>Risk Rank 7</b>
	<b>Residential</b>	<b>Risk Rank 3</b>	<b>Risk Rank 4</b>	<b>Risk Rank 5</b>	<b>Risk Rank 6</b>	<b>Risk Rank 7</b>	<b>Risk Rank 8</b>
	<b>Recreational</b>	<b>Risk Rank 4</b>	<b>Risk Rank 5</b>	<b>Risk Rank 6</b>	<b>Risk Rank 7</b>	<b>Risk Rank 8</b>	<b>Risk Rank 9</b>
	<b>Agricultural</b>	<b>Risk Rank 5</b>	<b>Risk Rank 6</b>	<b>Risk Rank 7</b>	<b>Risk Rank 8</b>	<b>Risk Rank 9</b>	<b>HIGH Risk Rank 10</b>



## Table 2G Human Health & Community

(used to complete FORM 2C)

### Defining Human Health and Communities:

- Awareness of individual and community impacts resulting from direct and indirect impacts of the spill incident.

### Human Health & Communities

#### Direct Impacts

##### Chemical & Physical Impacts

- Chemical
- Physical
- Mental health of victims Involved in the spill incident or the community response to an incident

##### Contamination Impact

- Property or resources

##### Access

- Delays and detours or restricted access to property

#### Indirect Impacts

##### Social Impacts:

- The effect on people & communities that can happen as a result of *action* or *inaction*

##### Economic Impacts:

- Financial or employment impacts due to the response efforts, impacts, the clean-up, disposal, monitoring or site restoration; and possible fines

##### Recreational Impacts:

- Impacts have restricted access a recreational site

##### Aesthetic Impacts:

- The beauty or unique feature of a site has been permanently altered or destroyed

##### Cultural Impacts:

- Significant activities including food gathering, fishing or hunting

##### Archeological & Spiritual Impacts:

- Traditional sites are protected & anonymity is respected

FORM 3A

Spill Plan

Appendix 3

Migration Pathways

		<b>Land</b> - Topography - Soil Type <ul style="list-style-type: none"> <li>▪ Porous</li> <li>▪ Impermeable</li> <li>▪ Organic</li> </ul>	<b>Inland Water</b> - Land-to-Water - Confined Water Courses <ul style="list-style-type: none"> <li>▪ Flowing Water</li> <li>▪ No Flow</li> </ul>	<b>Open Water</b> - Unconfined Foreshore	
<b>Spill Response Plan</b>	<b>Containment Options</b>  <b>USE SPILL PLAN MATRIX:</b> <b>TABLE 3A – Land Containment</b> <b>TABLE 3B – Water Containment</b>	Topography Features:	Near Water Features:	Open Water Features:	
		Land Features:	Into Water Feature Confined - <i>Flowing</i>	Containment Option	
			Confined – <i>Not Flowing</i>		
		Containment Option	Containment Option		
		Objectives & Targets:			
	<b>Recovery Options</b> Circle Applicable Options  *Agency Approval, Permit or Exemption Required	No Recovery	No Recovery	No Recovery	
		Surface Absorbents	Surface Absorbents	Surface Absorbents	
		Excavation	Sphag-Sorb	Sphag-Sorb	
		In-Situ Treatment	Skimmers	Skimmers	
		In-Situ Burn*	Haz-Waste Hydro-Vac	Haz-Waste Hydro-Vac	
Haz-Waste Hydro-Vac		Haz-Waste Vac Truck	Haz-Waste Vac Truck		
Haz-Waste Vac Truck					
<b>Storage Options</b> Circle Applicable Options	No Storage	No Storage	No Storage		
	Stockpile	Open Mobile Berms	Open Mobile Berms		
	Windrow	Containment Cell	Containment Cell		
	Containment Cell	Super-Sacs - solids	Super-Sacs - solids		
	Super-Sacs				
<b>Disposal/Treatment</b> Circle Applicable Options	Permitted Landfill	Permitted Landfill	Permitted Landfill		
	Industrial Waste Facility	Industrial Waste Facility	Industrial Waste Facility		
	Commercial Treatment	Commercial Treatment	Commercial Treatment		
	On-Site <i>Ex-Situ</i> Treat	On-Site <i>Ex-Situ</i> Treat	On-Site <i>Ex-Situ</i> Treat		
	On-Site <i>In-Situ</i> Treat	On-Site <i>In-Situ</i> Treat	On-Site <i>In-Situ</i> Treat		

# Spill Response Guidelines

FORM 3B			Safety Plan		Appendix 3	
Chemical Hazards	Job Hazard Analysis	Site Safety Protocol	Vapours	DE-CON Unit (Decontamination)	Evacuation	PPE & Routes of Entry
	Assess the Task & Risk Develop an Objective	Low Risk: Barriers, Pylons, Barrier Tape	No Vapours associated with spilled product	No DE-CON Unit Required	No Risk of Evacuation or Public Notification	Level D Splash Protection Inhalation Risk Potential
	Outline the interaction between: Worker, Task, Risks Tools, Environment & Develop a Procedure	Medium-High Risk: Detours or Road Closure	Potential Vapours within the spill but no LEL	Contaminated Work Boots, Gloves & Respirators	No Risk of Evacuation Agency Notification	Level C Inhalation
		Very High Risk: Restricted Access Zones: Green=Safe Yellow=Caution Red=Danger	Strong Vapours No LEL Respiration Protection Required	DE-CON Unit on Standby	Possible Evacuation Required Public Notification Required and Agency Consultation	Level B Inhalation Ingestion
	Document, Implement, Review & Monitor		Strong Vapours and LEL are present and dangerous	Full DE-CON Unit Required		Level A Inhalation Ingestion Skin Absorption
Physical Hazards	Job Hazard Analysis	Incident - On Scene			Working with Response Equipment	
	Assess the Task & Risk Develop an Objective	Incident Stability: The stability of the incident has been assessed and there is no risk of physical danger from unstable equipment to responders or public Tank or Means of Containment is Not Leaking or Compromised			Hand Tools & Power Tools	
	Outline interactions between: Worker, Task, Risk, Tools, Environment & Develop a Safe Work Procedure				Pumps & Vac Trucks	
		Power Lines: Permits are required when working under high-voltage Power Lines Spotter is required Safety Plan is required			Excavator & Trucks	
	Document, Implement, Review & Monitor	Buried Utilities: Public Sites - Call Before You Dig Private Sites – Call a Qualified Utility Locator Contractor			Boats, Booms & Skimmers	
Hazard Work Environment	Job Hazard Analysis	Field Incident			Indoor Infrastructure	
	Assess the Task & Risk Develop an Objective	Easy Access – Low Risk: Flat Terrain Shallow Water Course with Low Flow  Moderate Access - Medium Risk: Equipment required to build Site Access Terrain has gradient Water Course Low-Medium Energy with Shallow-Deep Water			Damaged Infrastructure: Structural Instability Issues Access & Egress Options	
	Outline interactions between: Worker, Task, Risk, Tools, Environment & Develop a Safe Work Procedure					
	Document, Implement, Review & Monitor	No Access - High Risk: Difficult Terrain Steep Gradient/ Cliffs High Energy Water Course with Fast Flowing Water  Working Overtop of Water or Underwater Requires: Specialized Training with Support Team & Equipment Adverse Weather Conditions May Restrict, Alter or Prevent Response Activities			Restricted Access Locations: Confined Space Procedures Lock-Out Procedures Egress Procedures	
Human Health & Safety Hazards	Job Hazard Analysis	Responder Safety			Public Safety	
	Assess the Task & Risk Develop an Objective	Low Risk: Low Stress / Minor Incident No Exposure Time Limitation within Incident			Low-Medium Risk: Traffic Control with full access	
	Outline interactions between: Worker, Task, Risk, Tools, Environment & Develop a Safe Work Procedure	Medium Risk: Stress Levels May Vary on Response Team PPE with Respirators Required Risk Management is based on Responder Comfort Fresh Air / Rest Breaks are Provided on Regular Intervals			High Risk: Police enforced restricted access	
	Document, Implement, Review & Monitor	High Risk: High Stress & Pressure on Response Team Monitor Responder Exposure within Incident Back-up Response Crew with Decontamination Unit on Standby			Extreme Risk: Evacuation Air Space Restriction	

FORM 3C		Environmental Plan		Appendix 3
Actual & Potential Environmental Impacts		Impact Summary	Site Restoration Objectives	
	Aquatic Habitat Flora & Fauna	Actual	<b>Environmental Impact Assessments:</b> <ul style="list-style-type: none"> <li>• Visual Assessments</li> <li>• Testing Pits &amp; Trenches</li> <li>• Surface Water Quality Sampling</li> <li>• Soil &amp; Vapour Sampling</li> <li>• Air Quality Monitoring</li> <li>• Monitoring Wells &amp; Groundwater</li> <li>• Bird Surveys</li> <li>• Fish &amp; Amphibian Survey &amp; Sampling</li> <li>• Mammals &amp; Reptile Surveys &amp; Monitoring</li> </ul> <b>Archeological &amp; Cultural Impacts:</b> <ul style="list-style-type: none"> <li>• Impacts to wildlands, ecological reserves, protected areas and conservancy areas and other natural or undisturbed sites should include an archeological assessment</li> <li>• Culturally &amp; Spiritually sensitive areas are often not made public and require consultation with First Nations Governments to obtain access to these protected areas</li> </ul> <b>Restoration Options:</b> <ul style="list-style-type: none"> <li>• <i>Excavate-and-Replace</i> is the most common restoration method as it removes the source of contamination and restores <i>as much as practical</i> the site to its original condition</li> <li>• <i>Aquatic Habitat, Flora &amp; Fauna Restoration</i> <ul style="list-style-type: none"> <li>- Foreshore &amp; in-stream restoration requires Agency Approvals, Permits and the involvement of Stakeholders including First Nations</li> </ul> </li> <li>• <i>Terrestrial Habitat, Flora &amp; Fauna Restoration</i> <ul style="list-style-type: none"> <li>- Site specific habitat, flora &amp; fauna will vary with location. Ensure that you retain the expertise of a qualified professional when developing a restoration plan.</li> </ul> </li> <li>• <i>Infrastructure Restoration</i> <ul style="list-style-type: none"> <li>- As a general rule, the integrity of any infrastructure including foundations are protected. Ensure that you retain the expertise of a qualified professional when developing a restoration plan in or around infrastructures.</li> </ul> </li> <li>• <i>No Restoration</i> is an option if the clean-up or access to the site will cause more damage or if the access to the site is too dangerous. Compensation or restoring another location becomes an option.</li> </ul>	
		Potential		
		Objectives & Targets		
	Terrestrial Habitat Flora & Fauna	Actual		
		Potential		
		Objectives & Targets		
	Land Use & Infrastructure	Actual		
		Potential		
		Objectives & Targets		
	Human Impact	Actual		
		Potential		
		Objectives & Targets		

**Table 3A** **Spill Containment on *LAND***  
(Used for Complete FORM 3A)

Containment Options		Impermeable							Porous			Organic Layer		
1A	Recovery Trench													
1B	Interceptor Trench	Infrastructure			Natural Features				Ground			Natural Features		
1C	Diversion Trench	Paved Road	Unpaved Road	Cement	Bedrock	Hardpan	Clay	Silt	Sand & Gravel	Cobble & Rock	Mixed Fill	Peat (Fen/ Bog)	Humus (Forest Duff)	Grass Area (Dense Fescue)
1D	In-Situ & Ex-Situ Treatment													
1E	Excavate & Dispose													
1F	Absorbents													
1G	In-Situ Burn													
Receiving Environment	Flat 0%-5%	1F	1F	1F	1G	1G	1 A-C	1 A-C	1 A-C	1A 1D	1 A-C	1D	1A	1A
	Minor Gradient 5%-10%	1F	1F	1F	1D 1G	1D 1G	1 A-C	1 A-C	1 A-C	1A 1D	1 A-C		1A	1A
	Steep Gradient 10%-50%	1F	1F	1F	1D	1D	1E	1E	1D 1E	1A 1D	1E		1A	1A
	Embankment 50%-100%				1D	1D	1E	1E	1D 1E	1A 1D	1E		1A	1A
	Ditches				1D	1D	1E	1E	1D 1E	1A 1D	1E		1A	1A
	Non-Classified Drainages				1D	1D	1 A-C	1 A-C	1 A-C	1A 1D	1 A-C		1A	1A
	Dry Gully/ Ravine				1D 1G	1D 1G	1A 1E	1A 1E		1A 1D	1E		1A	1A
	Exposed Ridge/ Cliff				1D	1D								
	Sub-Surface Migration	1F	1F	1F			1B 1D	1B 1D	1B 1D	1B 1D	1A		1A	1A
	Below Roads, Buildings, etc.	1F	1F	1F			1B 1D	1B 1D	1B 1D	1B 1D	1B 1D			
COLOR CODE:		1° (High Priority)			2°			3°			4° (Lower Priority)			

**Table 3B**

# **Water Course Containment**

(used for complete FORM 3A)

			Distance to a Water Courses				Into a Water Courses										
							Confined Water Courses							Unconfined Open Water			
	Reference	Features	>100m	50m-100m	Within 50m	Adjacent to Water	Ditch	Stream or Creek	Small Lake or Pond	Ground-water	Wetland or Marsh	Puddles or surface water	Storm Drains & Sumps	Large Lakes	Major River Systems	Coastal Foreshore	Tidal Estuaries
CONTAINMENT NEAR WATER	1A	Recovery Trench	X	X	X	X				X							
	1B	Interceptor Trench	X	X	X	X				X							
	1C	Diversion Trench	X	X	X	X				X							
	1D	In-Situ & Ex-Situ Treatment	X	X	X	X						X					
	1E	Excavate, Stockpile & Dispose	X	X	X	X						X					
	1F	Absorbents	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CONTAINMENT FOR INLAND WATER	2A	Tarp Containment					X	X									
	2B & 2C	Culvert Block & Modified Block					X						X				
	2D	Underflow Containment					X						X				
	2E & 2J	Watergate Containment						X	X				X				
	2F	Strom Drain Block											X				
	2G	Aqua-Dam Shore Containment						X	X					X	X	X	X
	2H	Sandbag Containment					X	X									
	2I	Ice Containment					X	X	X		X	X		X			
	2K & 1F	Surface Water Absorbents					X	X	X	X	X	X	X	X	X	X	X
	2L	Borehole Wells								X							
OPEN WATER CONTAINMENT	3A	Containment & Deflection Booms												X	X	X	X
	3B	Exclusion Boom												X	X	X	X
	3C	Herring-Bone Configuration												X	X	X	X
	3D	Foreshore Seal Boom												X	X	X	X



<b>FORM 4</b>		<b>Response Actions</b>	<b>Appendix 4</b>
<b>Spill Response</b>			
	Reference #		
Containment Objectives & Targets			
Timeline			
<b>Safety</b>			
	Reference #		
Priority Risks			
Job-Hazard-Analysis JHA			
<b>Environmental</b>			
	Reference #		
Impact Assessment			
Clean-up & Restoration Objectives & Targets			

## Spill Response Guidelines

<b>Table 4. Summary of Response Actions</b> (used to complete FORM 4)					
Containment Options					
Ref. 1	Land Based	Ref. 2	Confined Water Course	Ref. 3	Un-Confined Water Course
1A	Recovery Trench	2A	Tarp Containment <i>(for high-flow and low-flow water courses)</i>	3A	Containment Boom
1B	Interceptor Trench	2B	Culvert Block <i>(for products that float)</i>	3B	Exclusion Booms
1C	Diversion Trench	2C	Modified Culvert Block <i>(for products that sink)</i>	3C	Herring-Bone Boom Configuration
1D	<i>In-Situ &amp; Ex-Situ</i> Treatment	2D	Underflow Containment	3D	Foreshore Seal Boom
1E	Excavate & Dispose	2E	Water-Gate™ Containment		
1F	Absorbents/ Patch & Plug	2F	Storm-Drain Containment		
1G	<i>In-Situ</i> Burn	2G	Aqua-Dam™ Containment		
1H	Super-Sacs for Ice & Snow	2H	Sand-Bag Containment		
1I	Modified Recovery Trench	2I	Ice Containment		
1J	Infrastructure Containment	2J	Water-Gate™ with Herring-Bone Diversion		
1K	Infrastructure & <i>In-Situ</i> Treatment	2K	Containment & Absorbent Booms		
1L	Hydro-Vac & Vac Trucks	2L	Groundwater Monitoring Well		
<b>Color Code:</b>		The <i>on-line</i> Spill Response Training Course provides diagrams & photo documentation of <i>all</i> Containment Options.		This Spill Response Guidelines provides only CAD diagrams of these specific Containment Options.	

## Reference #1A-C Recovery-Interceptor-Diversion Trenches™

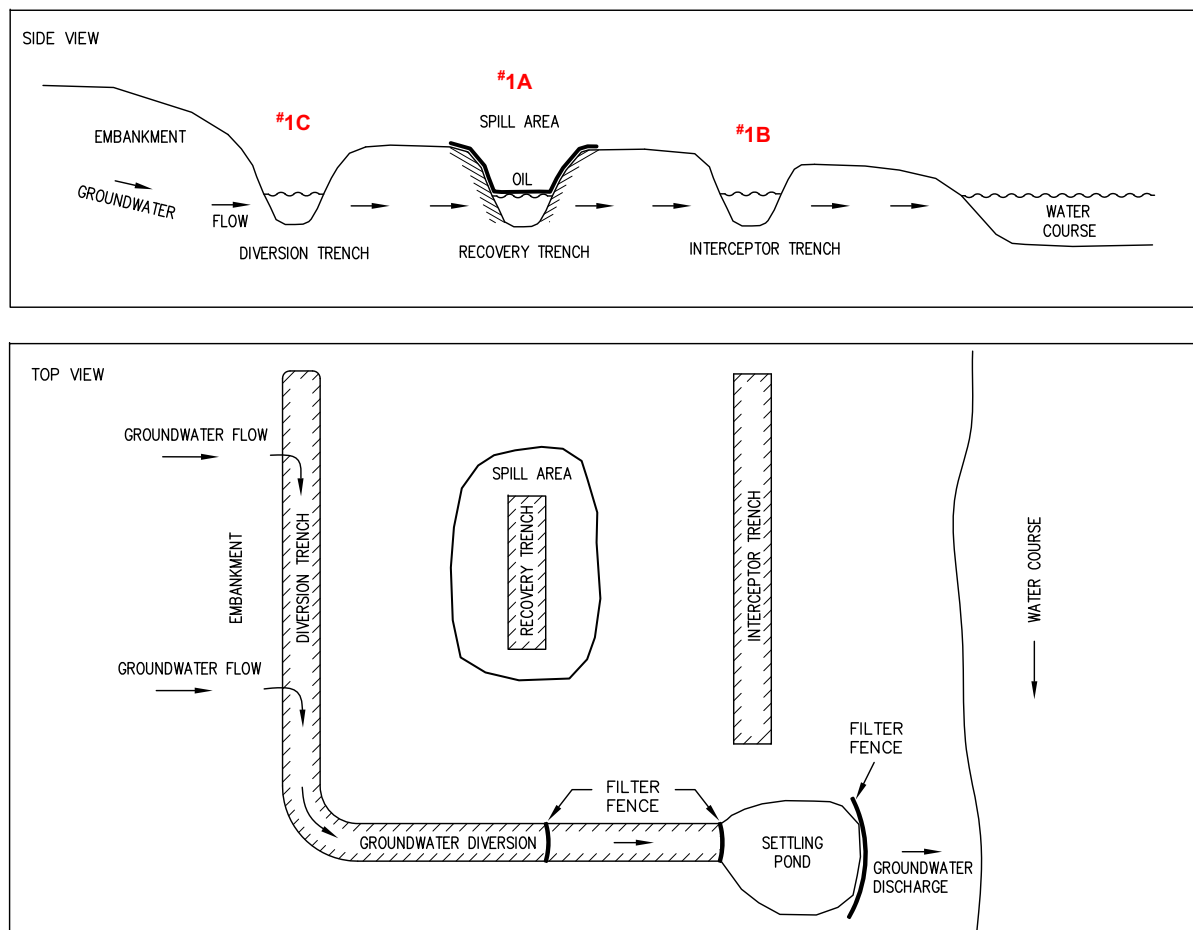
**Objective:** Containment of a spill on land.

**Materials:** An excavator required to dig trenches. Consider using a vac-truck to continually pump the product and contaminated groundwater from the recovery trench. This will remove the contamination but also lower the water table within the trench and mitigate any further migration.

**Method:** **#1A.** Begin at the spill area. Dig a recovery trench or pit through the centre of the spill and allow product to accumulate within the excavation.

**#1B.** To ensure that the spill does not migrate into a water course, dig an interceptor trench downgradient of the recovery trench or spill area. This will be your monitoring point to confirm that product has not migrating beyond the spill area.

**#1C.** If groundwater movement is evident and product is found in the interceptor trench, consider digging a diversion trench to divert clean groundwater around the spill area.



## Reference #1D

## SOP: *In-Situ* & *Ex-Situ* Treatment

**Best Management Practices (BMP):** This SOP will ensure that BMP are implemented when treating small volumes of hydrocarbon waste material.

### Specifications for this SOP:

- The contamination is petroleum hydrocarbon based (synthetic oil will not bio-remediate)
- The source of the petroleum hydrocarbon contamination is from:
  1. Non-reportable spills to land, including: Class 3 *Spills* less than (<)100L / Leaks / Drips / Hydrocarbon Stains; That have no adverse effects on the environment.
  2. On-site facilities, including: Wash-Pad Sumps / Oil-Water Separator Sumps / Sediment & Storm Drain Sumps / Shop Sweepings
- On-going treatment is a long-term maintenance plan to reduce potential site contamination from increased accumulation of petroleum hydrocarbons;
- Criteria for identifying contamination follow these general guidelines:
  1. The depth of contamination does not exceed 0.5m below surface grade;
  2. The surface staining is less than 3m in diameter;
  3. The volume of contaminated media is less than (<) 5m<sup>3</sup>.

### ***In-situ* Treatment** (see Table 1)

The visible suspect/ contaminated material will not be excavated or removed. All treatment will be performed within the boundaries of the stained/ contaminated area.

### **Spill Assessment:**

- Contain and remove any free product:
  - Use petroleum absorbent pads or equivalent absorption product(s) to remove free product prior to treatment

### **Environmental Assessment:**

- Identify the characteristics of the contaminated media:
  - Clay, Silt and Mud mixtures
  - Sand and Gravel mixtures
  - Pebbles and Cobble mixtures
  - Gravel and mixed fragments
  - Fibric, Silt and Sand mixture
  - Humic, Silt and Sand mixture

### **Bioremediation *in-situ* Treatment:**

- Add treatment product to contaminated area (see Table 1)
  - Dry or liquid product, depending on the media
    - Dry treatment product: 1 bag/ 1m<sup>3</sup> or as recommended
    - Liquid product: 1L concentrate to 50L water or as prescribed
- Mix treatment product with contaminated media
  - Use excavator, grader or equivalent to ensure a good mix
  - On hard surfaces (i.e. asphalt or cement pads) spread product to absorb, sweep and remove
- Assess the treated area:
  - Check for petroleum hydrocarbon odors & visible staining
- Repeat *in-situ* treatment if staining or odors persists

### ***Ex-situ* Treatment** (see Table 1)

- Stockpile contaminated media in a mini-biocell for treatment;
  - A small cell lined with 20mil poly and 1m soil cover, a cement pad or equivalent
- Mix treatment product with contaminated media
  - Dry product: 1 bag/ 1m<sup>3</sup> of contaminated media (see Table 1);
  - Use excavator or equivalent to ensure a good mix
  - Aerate with excavator every two weeks
  - Leave uncovered if no precipitation is in the forecast
- Assess the treated area:
  - Check for petroleum hydrocarbon odors & visible staining
- Repeat treatment within *biocell* if petroleum hydrocarbon odors or staining persist

### **Disposal Options:**

- Landfill intermediate cover and/or final cover material (Check with *Permit* requirements)
- On-site restoration (no *off-site* media relocation permitted):
  - Construct berms, ditches & use to backfill around the site
  - On-site road surface improvements

Table 1. Remedial Options for Media Characteristics.

Remedial Options for Media Characteristics	<i>In-situ</i> Bioremediation Dry Product <sup>1</sup>	<i>In-situ</i> Bioremediation Liquid Product <sup>2</sup>	<i>Ex-situ</i> Bioremediation Cell Dry-Product
Clay/ Silt/ Mud	YES		YES
Sand/ Gravel	YES		YES
Pebbles/ Cobble		YES	YES
Gravel/ Mixed Fragments		YES	YES
Fibric/ Silt/ Sand	YES		YES
Humic/ Silt/ Sand	YES		YES
Cement Pad/ Asphalt Road	YES	YES	
Large Rocks & Boulders		YES	

<sup>1</sup>Oil Gator® or equivalent

<sup>2</sup>Microblaze® or equivalent

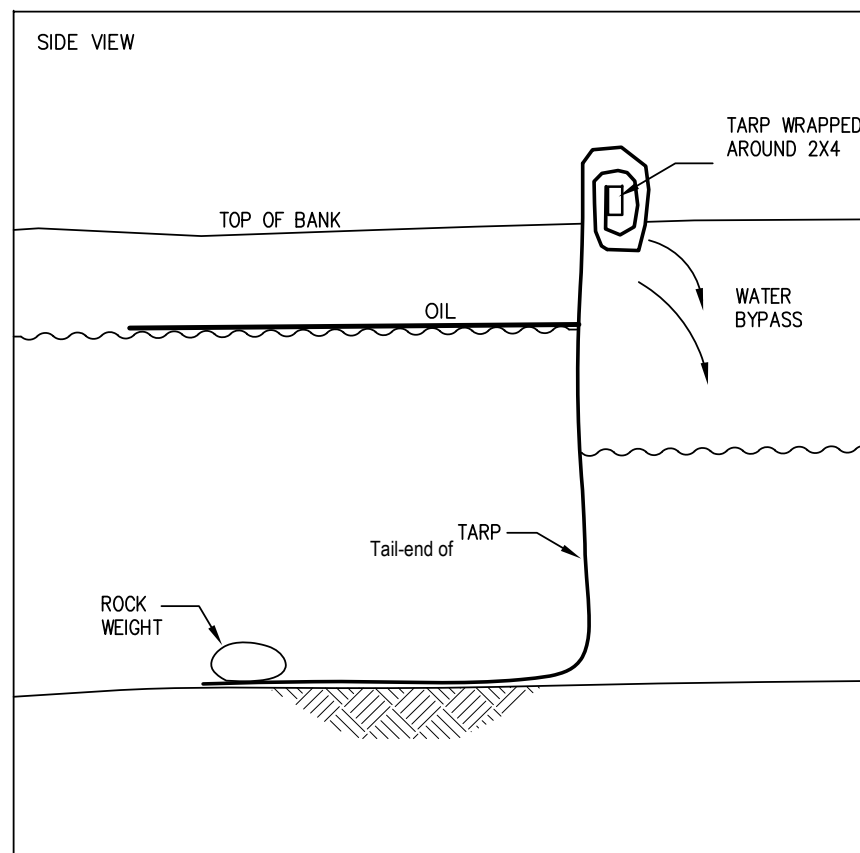
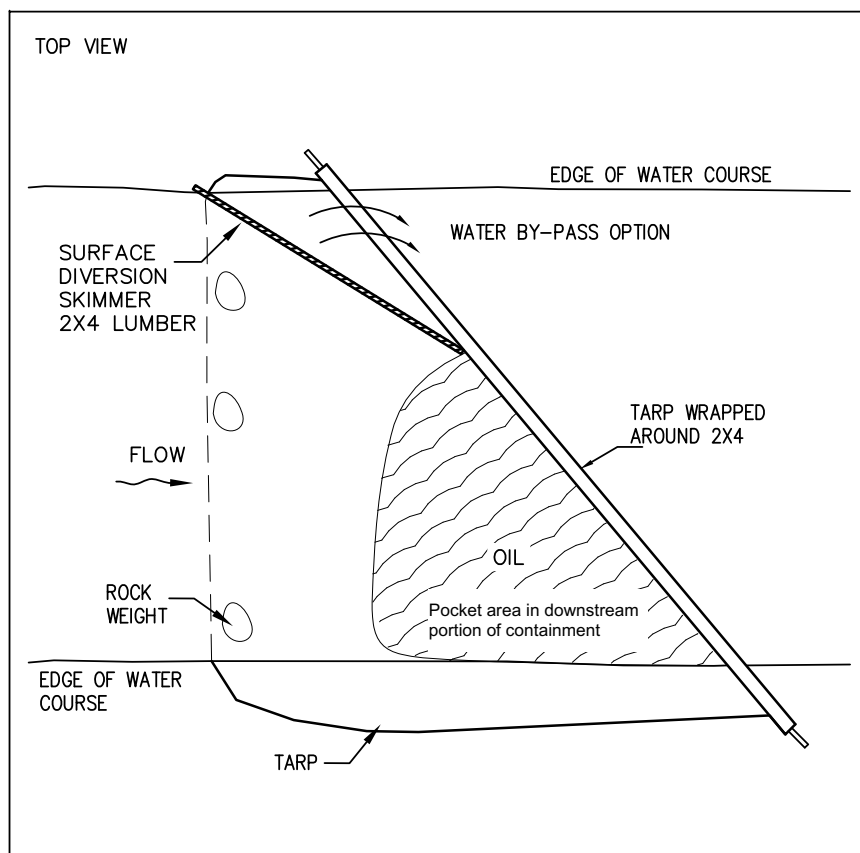
**Acknowledgement:** NWR thanks the BC Ministry of Environment for providing continual feedback on the legislative interpretation and confirming this SOP as a *Best Management Practice*. NWR also thanks West Fraser Mills Ltd. Co. for financial support in developing this SOP.

## Reference #2A Tarp Containment™ – high energy flow water course

**Objective:** Surface water control within a confined water course with high flows.

**Materials:** A tarp that is large enough to span the width of the water course. A crossbeam that is long enough to span water course (i.e. 2x4 lumber). Surface skimmer will be required to allow surface water to by-pass the tarp along the upstream side.

**Method:** Lay the tarp out and wrap it around the crossbeam (i.e. 2x4 lumber). Place the crossbeam and tarp across the water course. Keep the tail-end of tarp above the water to keep it from filling and sinking. Angle the crossbeam to approximately 45° angle to create a pocket area within the downstream portion of the containment. Now place the crossbeam and tarp high enough up the embankment so that the oil cannot by-pass the containment. On the upstream side, place the end of the crossbeam low enough so that water will by-pass the containment. Sink the tarp and place a few rocks along the leading edge. Place a 2x4 lumber across the water to deflect the oil into the pocket of the containment. Monitor and recover product within the pocket of the containment.



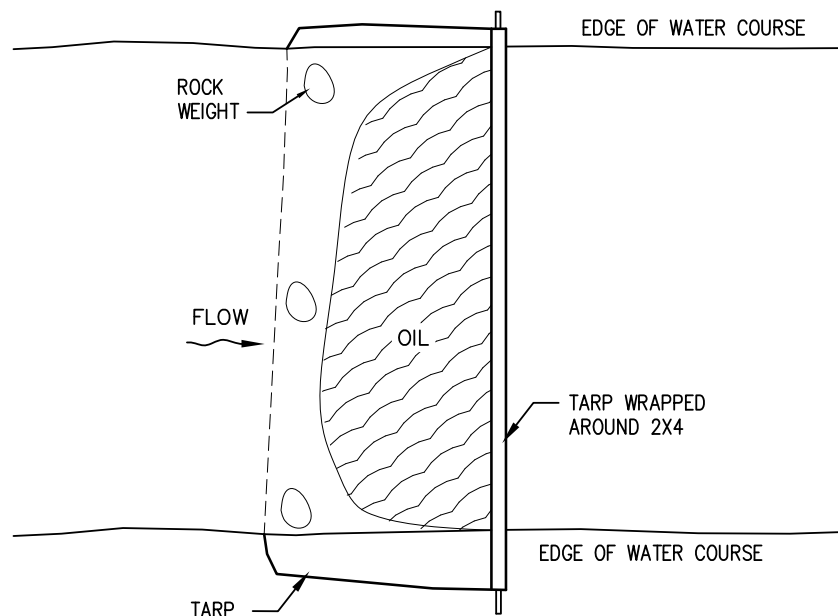
## Reference #2A **Tarp Containment™** – low energy flow water course

**Objective:** Surface water control within a confined water course with low flows.

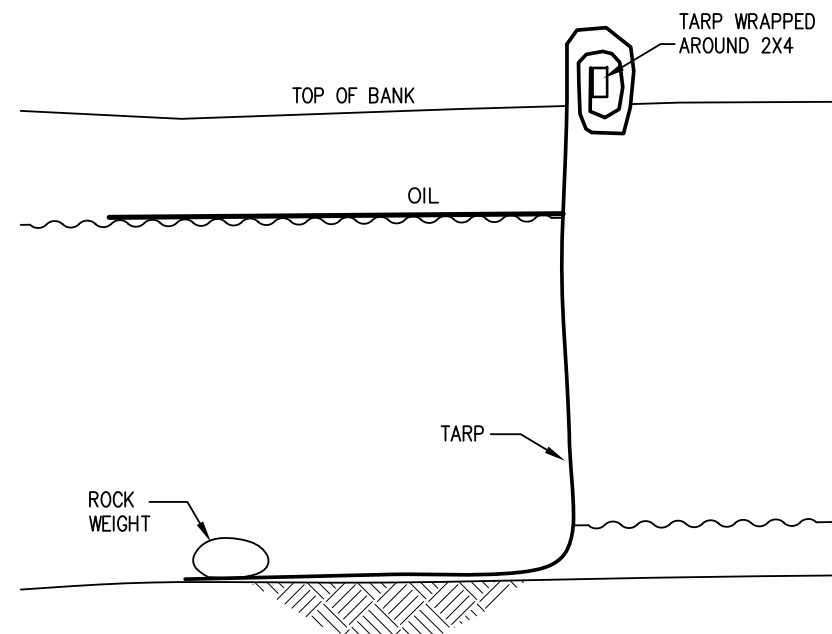
**Materials:** A tarp that is large enough to span the width of the water course. A crossbeam that is long enough to span water course (i.e. 2x4 lumber). Have enough tarps and lumber to install at least three tarp-containments in series.

**Method:** Lay the tarp out and wrap it around the crossbeam (i.e. 2x4 lumber). Place the crossbeam and tarp across the water course. Keep the tail-end of tarp above the water to keep it from filling and sinking. Place the crossbeam at 90° to the water course and high enough up the embankment so water cannot overflow the crossbeam (at least 2'). Sink the tarp and place a few rocks along the leading edge. Monitor and recover product within the containment. As surface water control is achieved, the surface product will disperse upstream. Use an absorbent boom to sweep and corral the spill within the containment.

TOP VIEW



SIDE VIEW





## Reference #2B

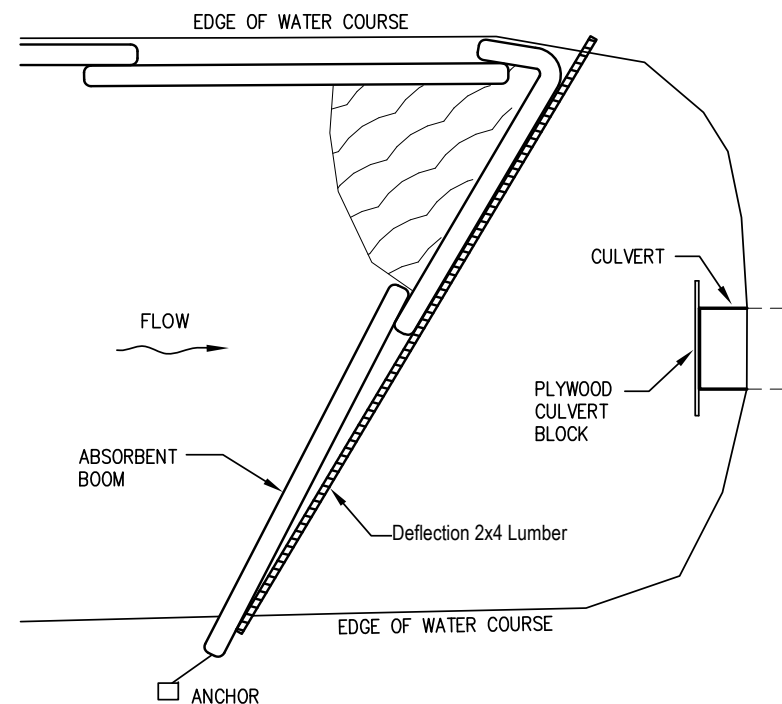
## Culvert Block™

**Objective:** Containment & recover a spill before it goes through the culvert. Surface water control on the upstream side of the culvert. This containment will also prevent the culvert from getting contaminated with hydrocarbons.

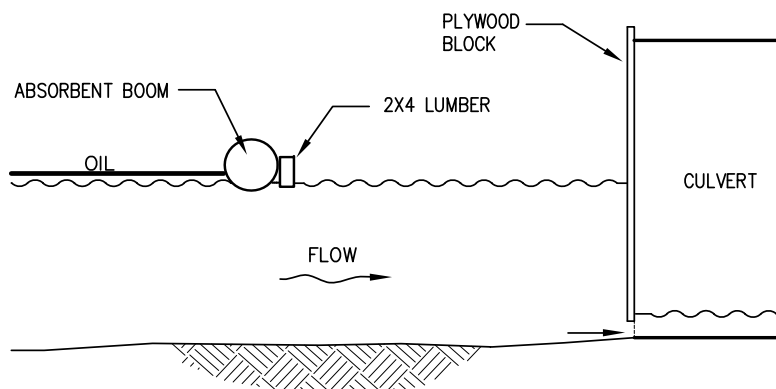
**Materials:** A piece of plywood large enough to cover the front of the culvert. The larger the culvert diameter (typically 1' to 3'), the thicker the plywood (typically 1/2" to 1"). Use a tarp or poly to help seal the plywood & culvert (not always required).

**Method:** **Attention: In high-flow waters culverts can be extremely dangerous. Always assess the risk before attempting to block a culvert!** Remove any large rocks that might prevent the plywood from being flush with the culvert. Place the plywood in front of the culvert so that it seals the entire culvert, then place the tarp over the front of the plywood to seal any gaps. Once surface water control is obtained use a sandbag to hold the plywood in place. If water level rises too high, adjust the tarp and plywood to allow subsurface water to enter the culvert. Place a deflection (2x4 lumber) across the water course and line with absorbent booms. Use additional absorbent booms to sweep the oil towards the containment.

TOP VIEW



SIDE VIEW



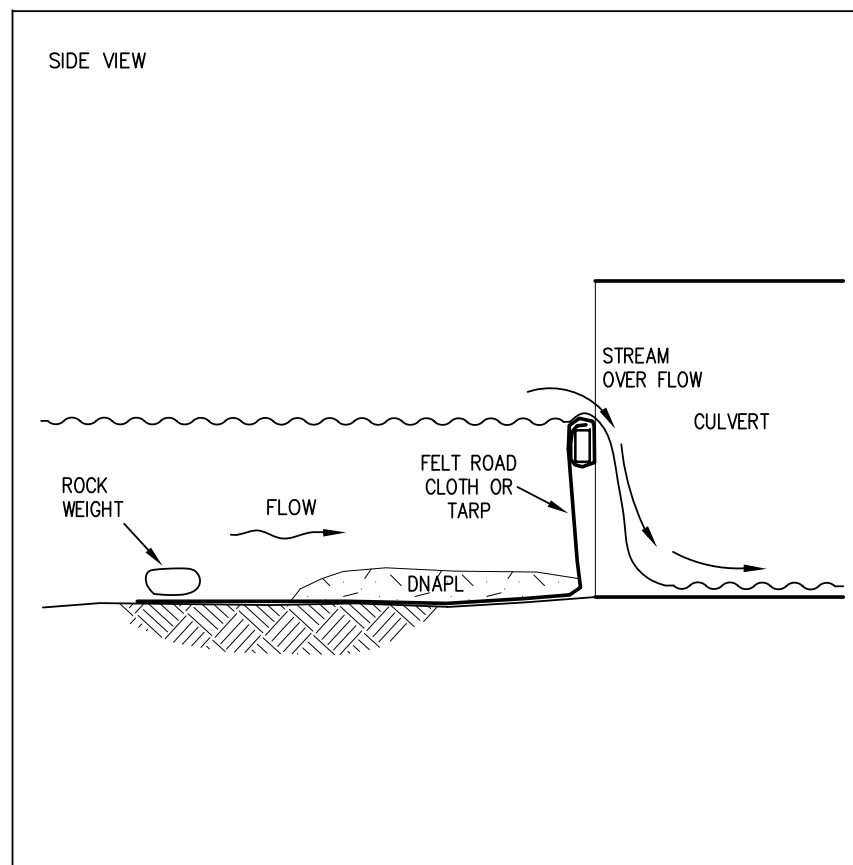
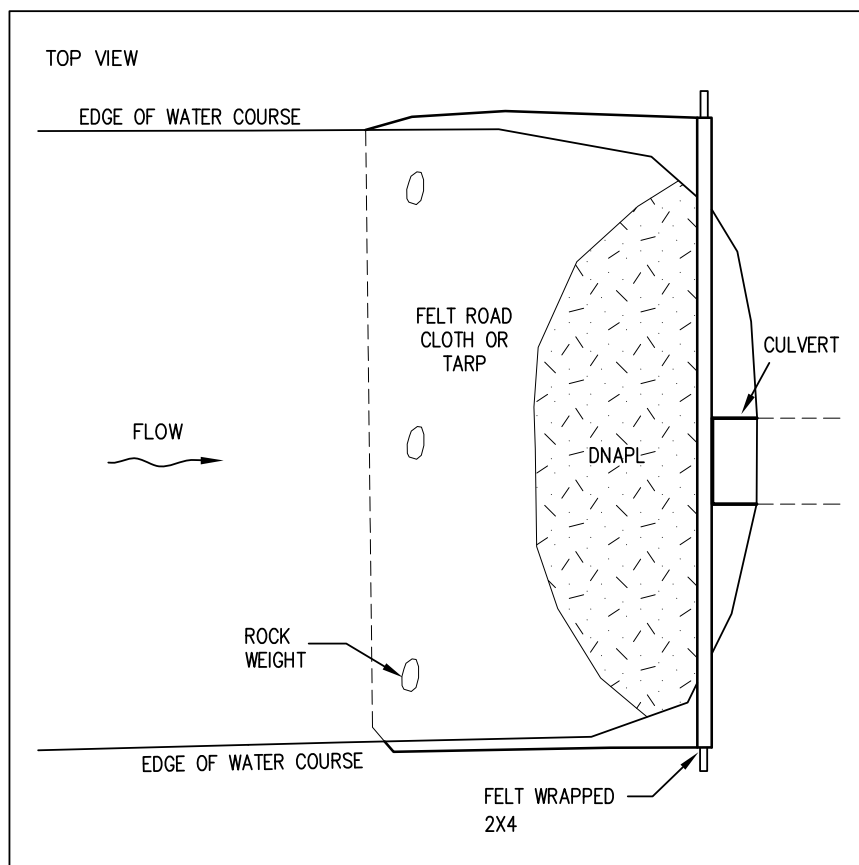
## Reference #2C

## Modified Culvert Block™

**Objective:** Control the sub-surface water flow while allowing the surface water to flow over the containment system. This will allow a dense-non-aqueous-phase-liquid (DNAPL) or solid to collect at the base of the containment.

**Materials:** A tarp that is large enough to span the width of the water course. A crossbeam that is long enough to span water course (i.e. 2x4 lumber) and the culvert.

**Method:** Lay the tarp out and wrap it around the crossbeam (i.e. 2x4 lumber). Place the crossbeam and tarp across the water course in front of the culvert. Keep the tail-end of tarp above the water to keep it from filling and sinking. Place the crossbeam approximately halfway up the culvert. Sink the tarp and place a few rocks along the leading edge. Allow water to build-up and overflow the containment. Monitor the build-up of DNAPL or solid at the base of the containment. Consider a vac-truck to recover product within the containment.



## Reference #2D

## Underflow Containment™

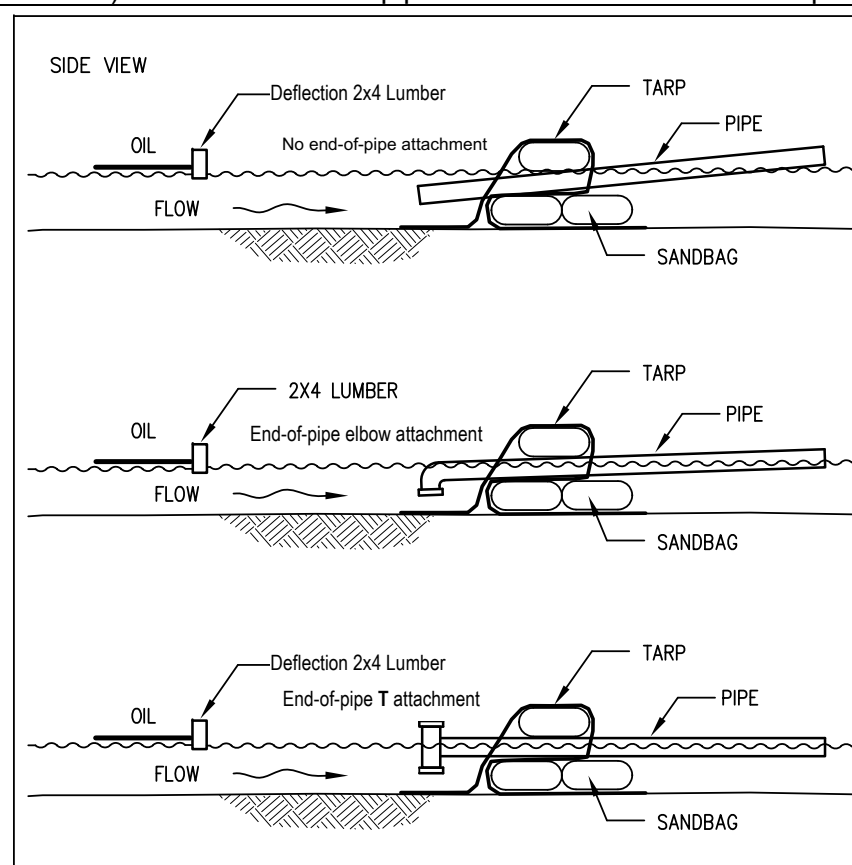
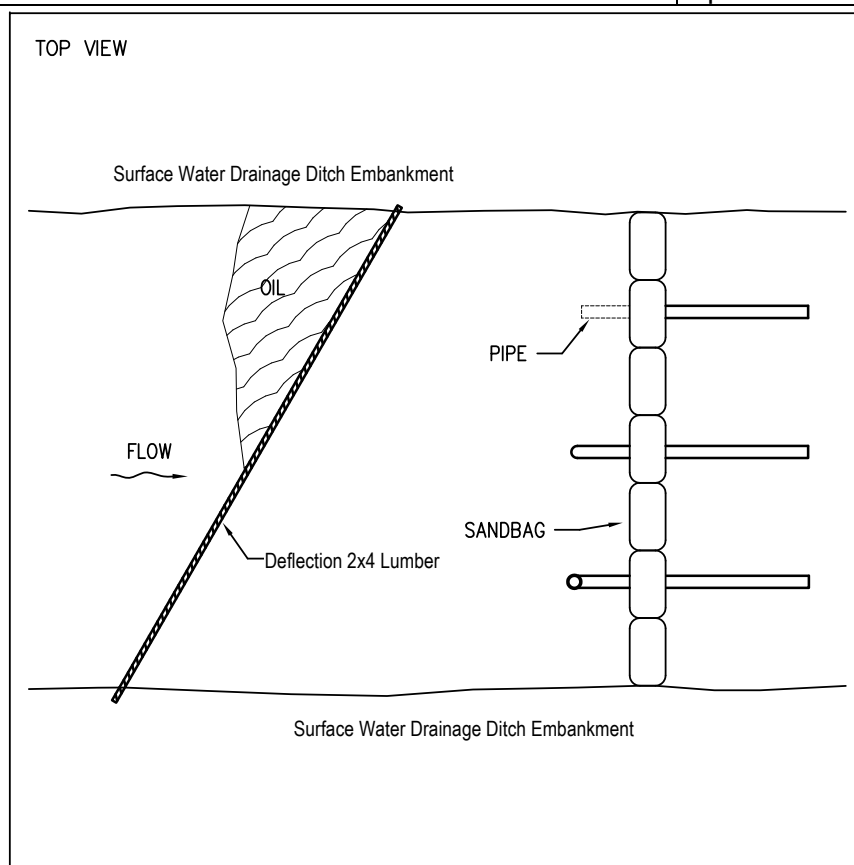
**Objective:** To control the surface water flow while allowing subsurface flow through a series of PVC pipes. Primarily used in surface water drainage ditches along roads, that are not fish-bearing.

**Materials:** 4" PVC pipes with elbows or T attachments; Sandbags filled with pea-gravel and a roll of poly or a tarp.

**Method:** Place the sandbags end-to-end the width of the drainage ditch. Place PVC pipes and cover with another row of sandbags. Place elbows or T attachments onto end-of-pipe (upstream end) to ensure that the subsurface water enters the pipe and not the oil. If more than two layers of sandbags are required, consider a base with two side-by-side sandbags.

**Long-Term Use:** Consider placing a tarp or poly down and folding it over each layer to seal the sandbags and minimize the leakage. Use Gorilla Tape to seal the tarp to the PVC pipe.

If the ditch is shallow with little or no gradient, consider digging a sump on the upstream side (not shown). This will allow the pipe to extend down into the sump.



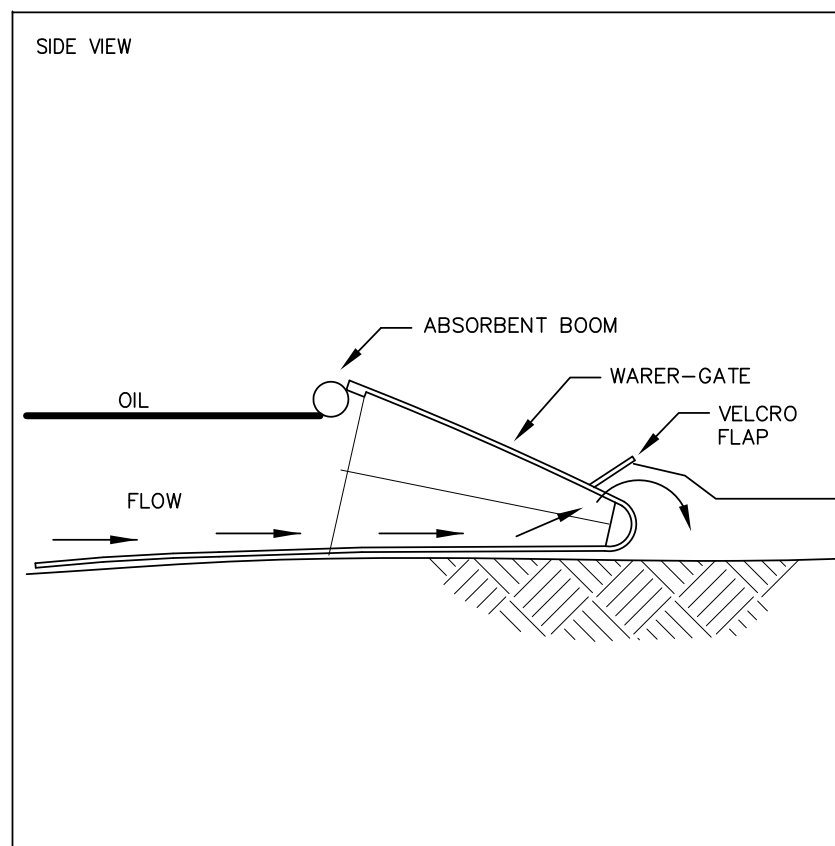
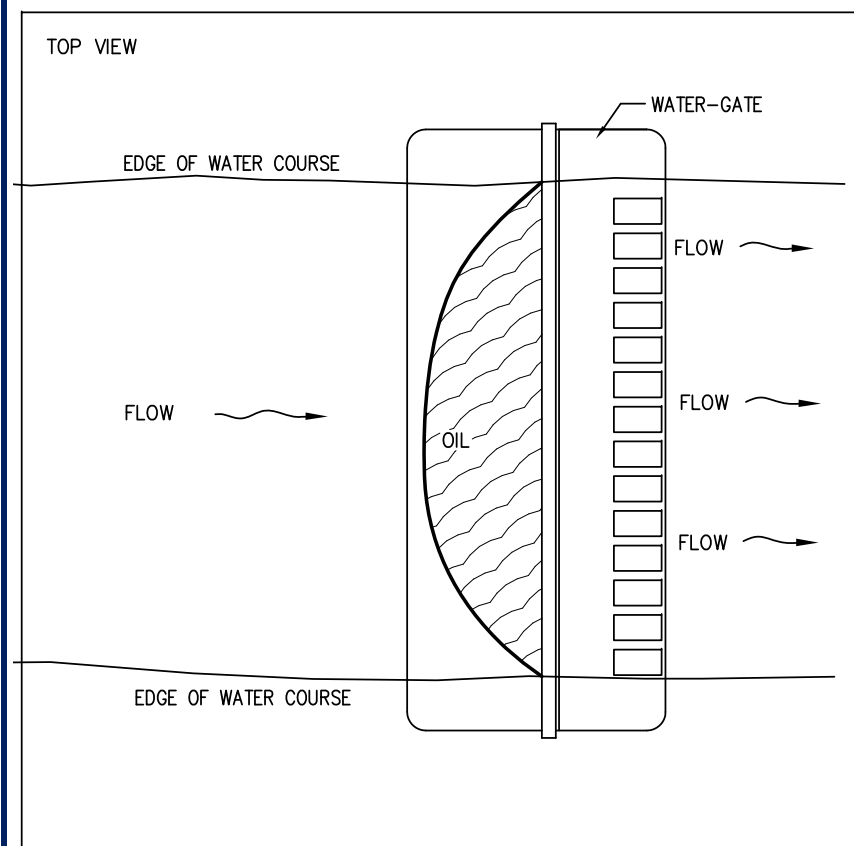
## Reference #2E

## Water-Gate™ Containment

**Objective:** Used in water courses that are typically too wide for a Tarp Containment. Control the surface water flow while allowing subsurface flow to continue.

**Materials:** This is an engineered 30' Tarp Containment that does not require a crossbeam as it has a built-in baffle system. There are four sizes available for different depths: small (15"); medium (21" & 28"); & large (39"). A Velcro tongue-and-groove at each end allows the Water-Gate to extend by 30' at a time.

**Method:** Position the Water-Gate the correct way (as indicated on unit) and roll across the water course. Attach additional units until the Water-Gate spans the width of the water course. Unfold and allow water to enter and fill the baffle system. Once the water level reaches 2/3 up the baffles open several Velcro Flap Valves and allow subsurface water to escape. Monitor the water level so that it remains near the top edge of the Water-Gate. Use an absorbent boom along the top edge of the Water-Gate. Recover the surface water and recovering with Sphag Sorb, additional absorbents or a vac truck.



## Reference #2F

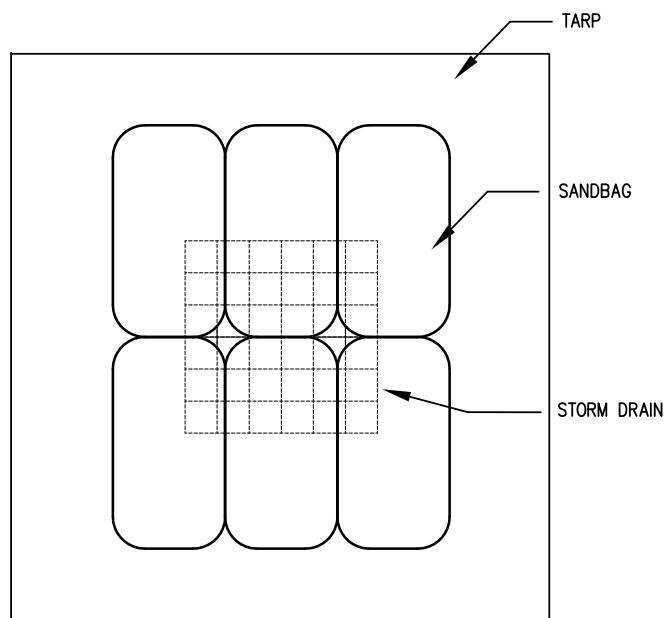
## Storm-Drain Containment™

**Objective:** Prevent a spill from entering a storm drain.

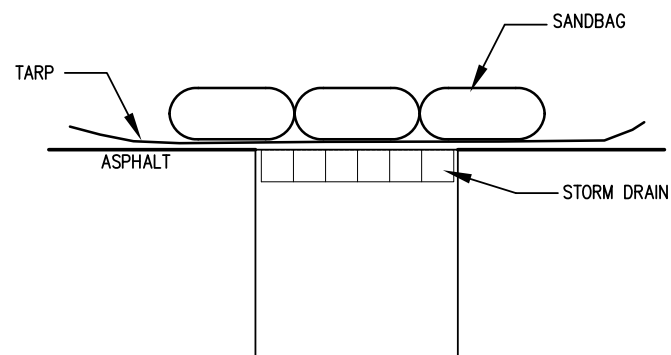
**Materials:** A small tarp and several sandbags.

**Method:** If time allows, sweep to remove gravel and rocks around the perimeter of the storm drain. Place the tarp over the storm drain and cover the perimeter of the storm drain with sandbags. Step or stomp on the sandbags to help seal the tarp to the ground around the storm drain. Fold the tarp up over the sandbags to protect them from surface contamination. Monitor and apply pressure or redistribute the sandbags to ensure the entire perimeter is sealed. Add more sandbags if required.

TOP VIEW



SIDE VIEW



## Reference #2G

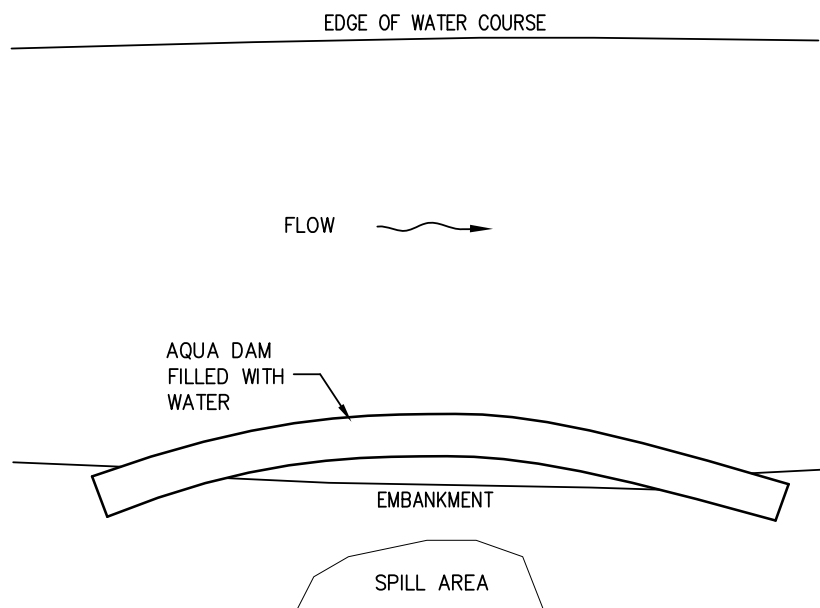
## Aqua-Dam™ Foreshore Installation

**Objective:** Prior to removing or digging along a foreshore, separate the water course from the foreshore by placing a protective barrier or Aqua-Dam along the foreshore.

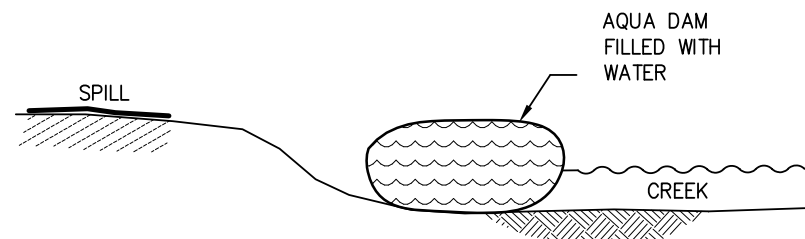
**Materials:** An Aqua-Dam comes in many sizes. For small to medium size creeks, consider a 30m long unit by 2m wide. Water pump with attachments.

**Method:** Attention! Make sure all applicable Permits, Approvals or Exemptions have been obtained prior to doing any in-stream work, including foreshore removal of contamination. Open the Aqua-Dam and place along the length of the foreshore that requires excavation. Close the downstream end and secure to foreshore. Pull the upstream end up the embankment and secure. Fill the Aqua-Dam with water from the stream and allow the weight of the unit to seal to the substrate. Begin excavation from the furthest point of the spill and work towards the foreshore embankment. Use a vac truck to remove contaminated surface water from the excavation. The last bit of excavation should be the remaining berm along the Aqua-Dam.

TOP VIEW



SIDE VIEW



## Reference #2H

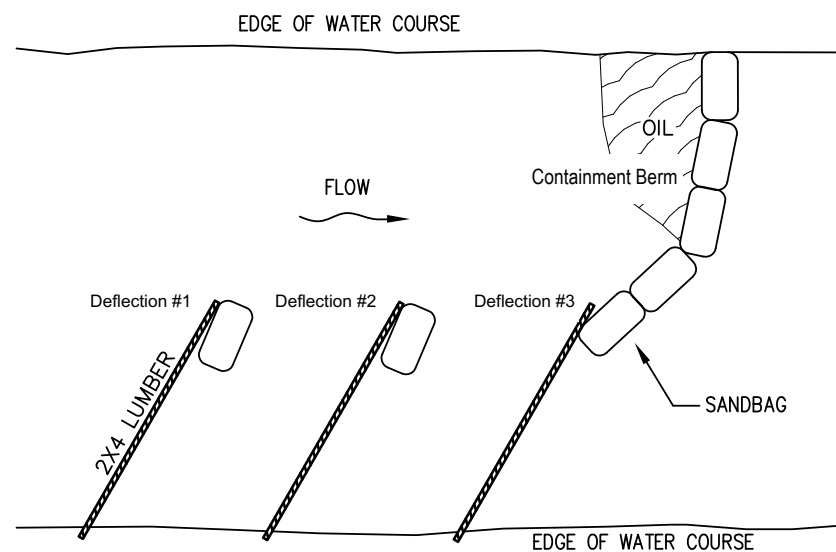
## Sandbag Containment™

**Objective:** Surface water deflection into a sandbag containment berm.

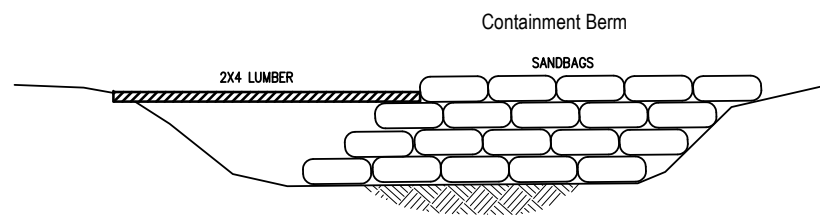
**Materials:** Sandbags (20x) to build the in-stream containment berm. A roll of poly or a tarp to place over the sandbags and make it more functional for containment. Several 2x4 lumber to deflect the surface water into the berm.

**Method:** Place the sandbags in the stream, moving at an approximate 45° angle from the foreshore upstream. This will create a “pocket” for the oil to collect in. Place the tarp or poly overtop of the berm to help seal the gaps between the sandbags. This will also protect them from contamination. Position several upstream deflection units (2x4 lumber) to force surface water into the sandbag containment system.

TOP VIEW



SIDE VIEW





## Reference #21

## Ice Containment™

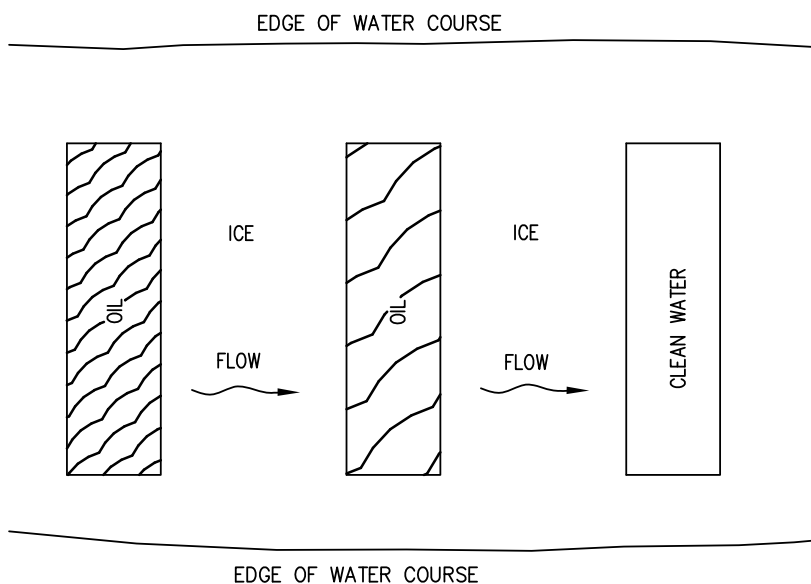
**Objective:** Contain and recover oil that is under the ice within a moving stream.

**Materials:** A chainsaw, ice hooks or an excavator.

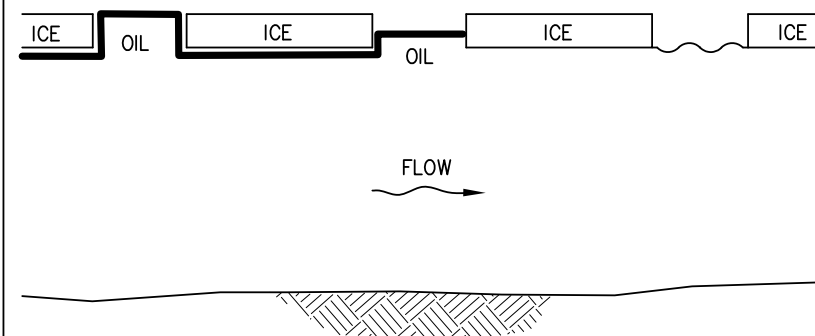
**Method:** Attention! Assess the ice thickness, depth of water and the flows prior to working on the ice.

Use a chainsaw to cut the ice into large blocks approximate 1m by the approximate width of the stream. Remove the ice with an excavator or by hand using ice-hooks. The oil will corral within the open water of the ice containment. Cut several more downstream. The last downstream containment should be used to confirm that no hydrocarbons have migrated beyond the upstream containments. Recover using a vac truck or by hand using absorbents followed by Sphag Sorb.

TOP VIEW



SIDE VIEW



## Reference #3A

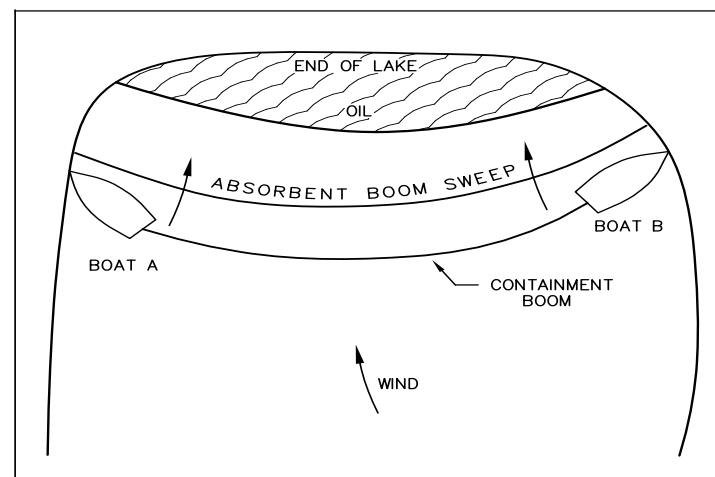
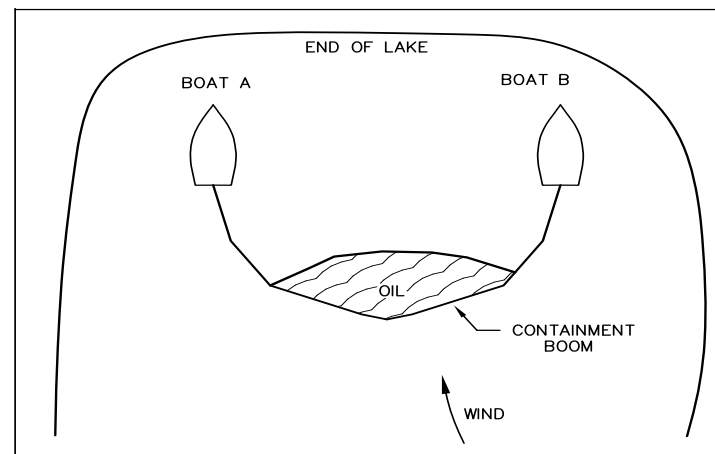
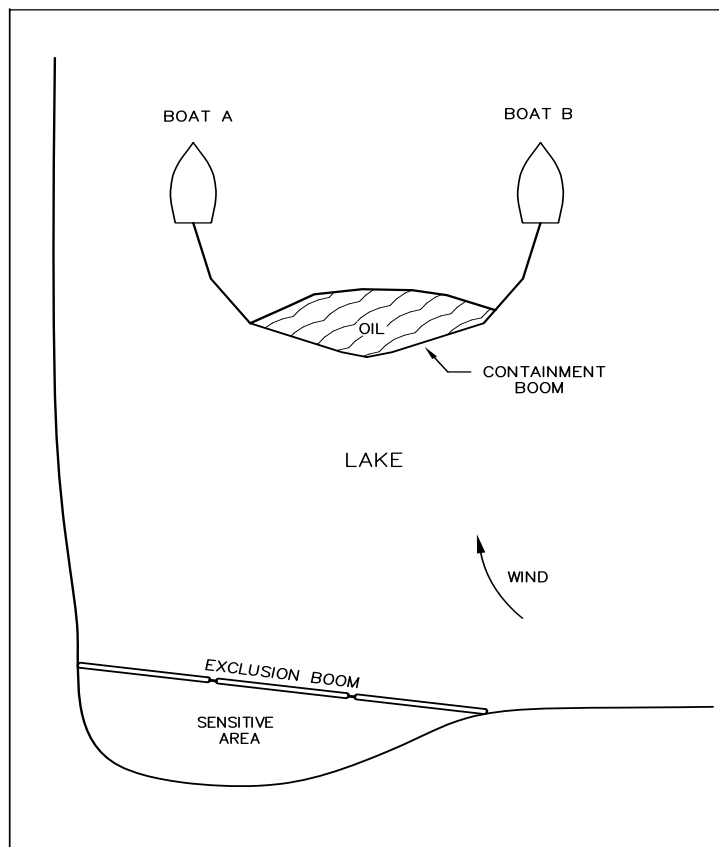
## Containment Boom – OPEN Water

**Objective:** Corral an oil slick on open water using containment booms on inland lakes or large rivers

**Materials:** At least two displacement boats and several 100 feet of 6" (or deeper) river containment boom.

**Method:** Corral the surface oil slick using the containment boom stretched between two boats. Move with the wind towards the shoreline where oil has accumulated. Place an absorbent boom inside the length of the containment boom and sweep to oil towards shore to corral and recover the oil. In remote locations, there are multiple recovery options including portable vacuum systems, skimmers and manual recovery with absorbents.

3A CONTAINMENT BOOM



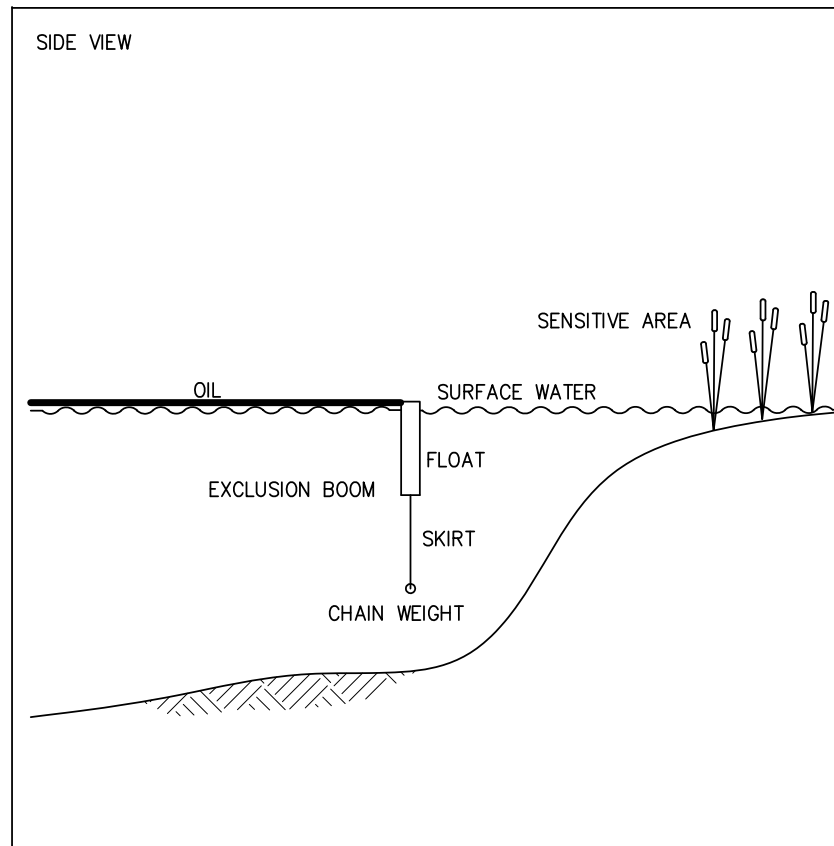
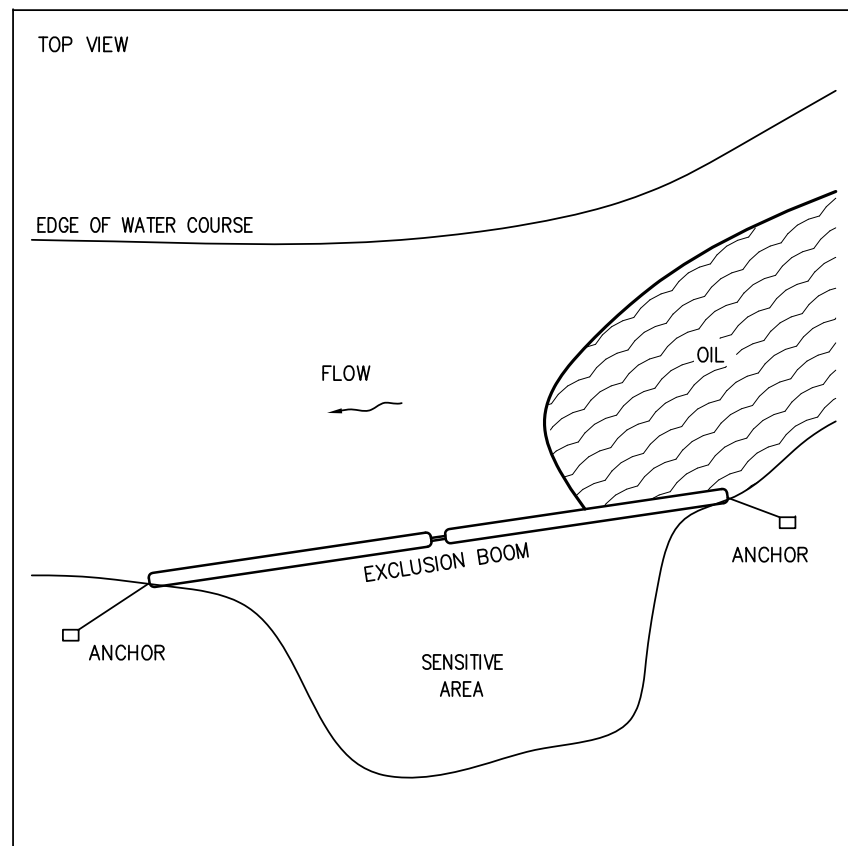
## Reference #3B

## Exclusion Boom

**Objective:** Deflect an oil slick from impacting a sensitive area using containment booms on inland lakes or large rivers. The containment boom should be stretched along a section of foreshore that requires protection.

**Materials:** Enough lengths of river containment booms to reach across a sensitive area. If possible, deploy the river containment boom manually. Alternatively, a boat will be required to pull the boom into position. Shore anchors, anchor line and boom harnesses.

**Method:** Ideally, this section of foreshore would have been identified during the risk assessment period when developing Prevention & Preparedness. The length, depth and deployment method would have been established. Alternatively, assess the sensitive area, conditions of the water course, safety considerations and options for environmental protection. To be effective, deployment of an exclusion boom should be done as soon as possible. Monitor the sensitive area to determine the effectiveness of the exclusion boom. Make *in-situ* adjustments to ensure the sensitive area is protected as much as reasonably possible.

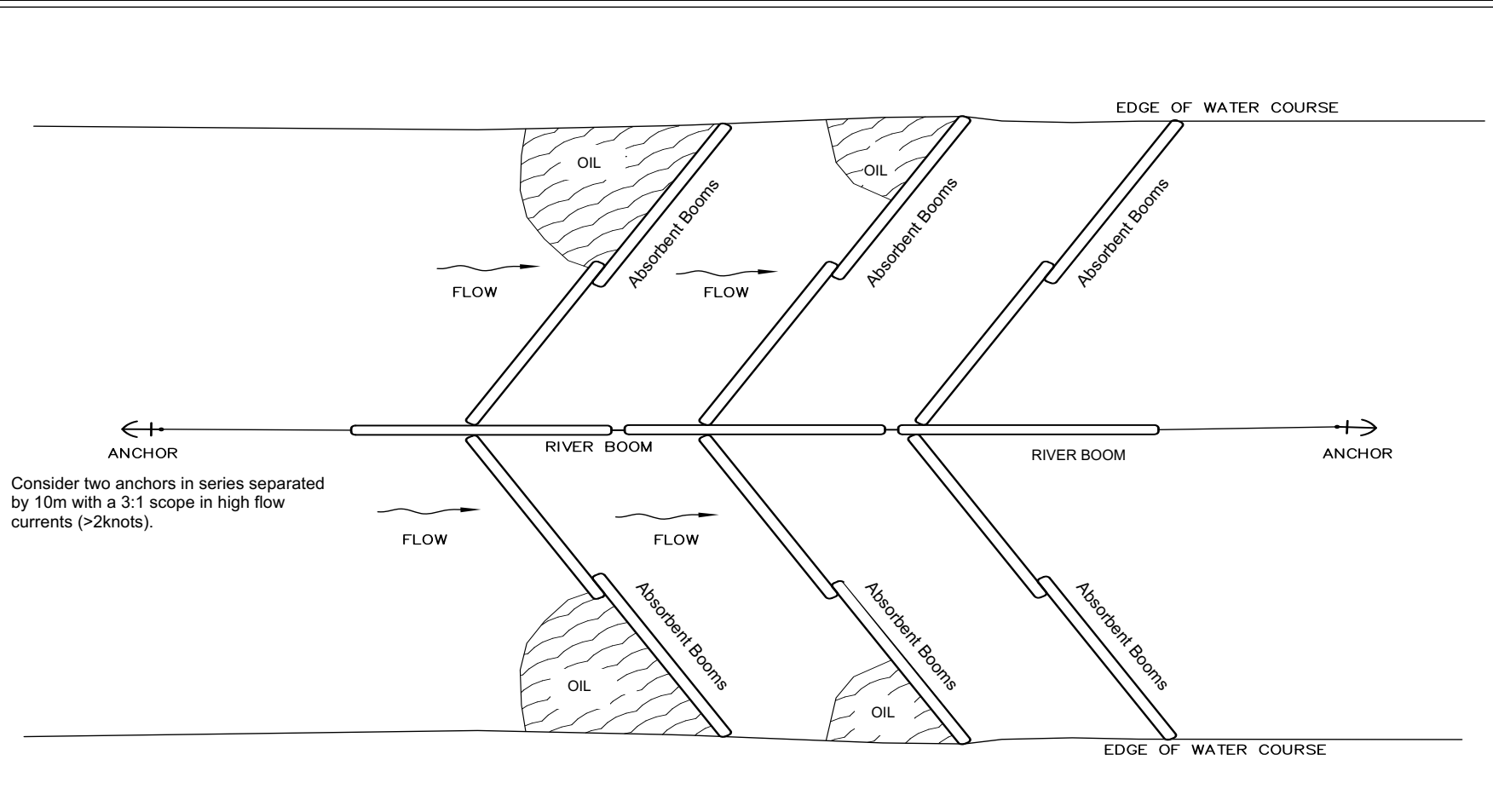


## Reference #3C Herring-Bone Configuration™ Confined Water Course

**Objective:** Deflect surface contamination towards the shoreline for recovery.

**Materials:** A length of river boom, anchors, anchor lines and boom harness. Absorbent booms with poly rope to pull the boom towards the foreshore.

**Method:** In shallow water courses, deployment may be done manually. In larger water courses a river boat is required. Deploy river boom and then attach absorbent booms. Once attached, pull the absorbent booms to the foreshore to deflect and contain the surface oil slick. The angle will require adjusting so keep monitoring the effectiveness. At a minimum, use three deflection booms, more if possible.

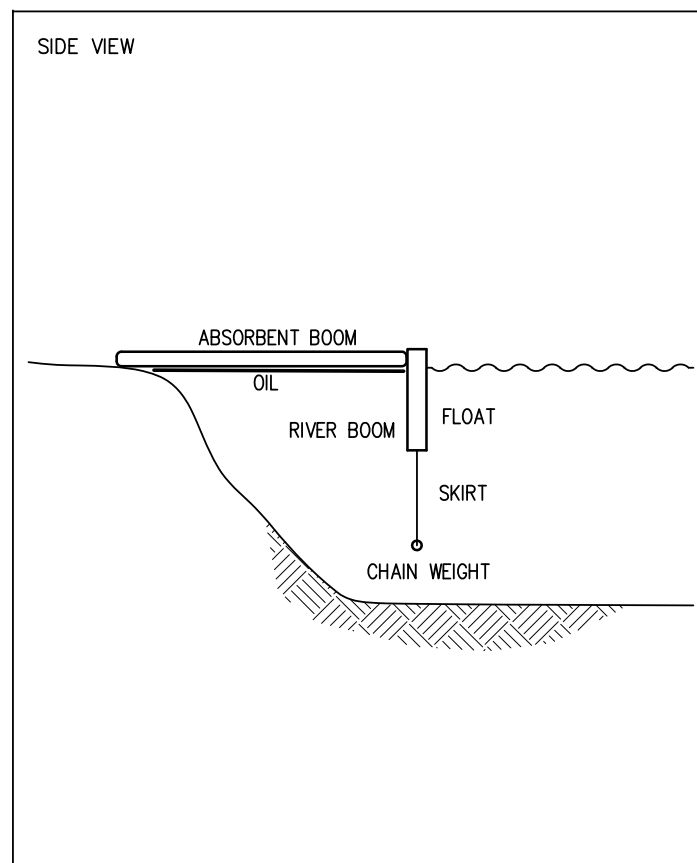
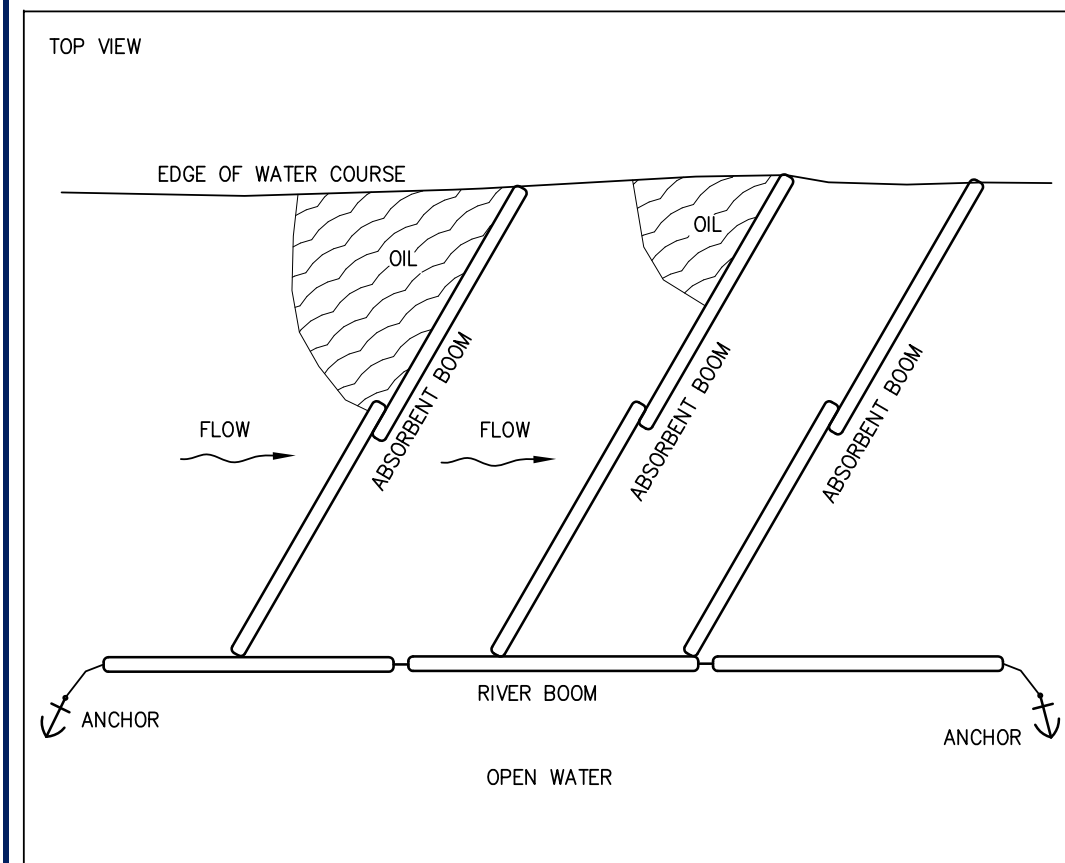


## Reference #3C Herring-Bone Configuration™ Open Water Course

**Objective:** Deflect surface contamination towards the shoreline for recovery. In large, open water rivers, consider deploying the river boom only towards one shoreline.

**Materials:** A length of river boom, anchors, anchor lines and boom harness. Absorbent booms with poly rope to pull the boom towards the foreshore.

**Method:** In large, open water rivers, a river boat is required. Deploy river boom with the current flow and then attach absorbent booms. Once attached, pull the absorbent booms to the foreshore to deflect and contain the surface oil slick. The angle will require adjusting so keep monitoring the effectiveness. At a minimum, use three deflection booms, more if possible. Work with the river current to capture the natural deflection zone and deep pools where water current is slower, and booms are more effective.



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