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Geographic Response Plan Development – An Innovative Approach

THEME

Inland Prevention, Preparedness, Response, and Restoration

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of the CSA Z246.2 Emergency preparedness and response for petroleum and natural gas industry systems.

ABSTRACT

The Trans Mountain pipeline system extends from Edmonton, AB to Burnaby, BC, and into Washington State. The pipeline transports a variety of refined and non-refined products to refineries in Canada and the United States, and to the Westridge Marine Terminal in Burnaby, BC for export. The Trans Mountain Expansion Project will twin the existing 1,150 kilometer (714 mile) pipeline between Edmonton, AB, and Burnaby, BC, and increase the systems capacity from 300,000 barrels per day to 890,000 barrels per day.

The Trans Mountain pipeline system has vulnerability to geographic and man-made hazards that could lead, in worst case scenarios, to line ruptures and spill releases. The development of Geographic Response Plans (GRPs) are a vital component of this project because they limit the risk of line ruptures posed by hazards. GRPs provide mitigation for potential spill impacts by enabling timely and effective response with pre-identified control points, response tactics, and other specific geographic details. Trans Mountain's GRPs are designed to expedite the decisions and actions of responders during an incident, as well as minimize impacts to ecologically and culturally sensitive areas by identifying and prioritizing them during a response.

The Trans Mountain pipeline traverses multiple High Consequence Areas (HCAs), including Indigenous communities, urban centers, parks, protected areas, watercourses, and

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sensitive ecosystems. Due to the complex nature of the HCAs, an all-encompassing multi-stage approach to the development of the GRPs was established.

Trans Mountain's GRP development began with simulating and modelling hypothetical spills along the pipeline to determine the largest possible extent of impact. This was followed by an inclusive field program involving a multi-disciplinary team of spill response and environmental specialists, local stakeholders, and Indigenous Peoples that travelled the pipeline and verified proposed control points while documenting environmental, social, and cultural HCAs. The participation of Indigenous communities and local stakeholders was invaluable in providing local knowledge on various aspects of the environment.

As a result, approximately 600 control points were field-verified and corresponding tactical Control Point Data Sheets were developed. The two-page Control Point Data Sheets provide detailed information on waterbody type, site safety, logistics, resources at risk, and spill response tactics which includes a photos and diagrams to visually aid responders in implementing containment and recovery tactics. The GRP and Data Sheets are publicly available at <https://grp.transmountain.com>.

Trans Mountain is committed to conducting business in a safe and environmentally responsible manner. Development of the GRPs has contributed to Trans Mountain being as prepared as possible to mitigate and minimize environmental and socio-economic impacts in the unlikely event of a spill. The GRP development has also enabled First Responders, Indigenous Peoples, communities, and fellow infrastructure operators to augment their response toolbox and enhance their ability to respond.

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INTRODUCTION

The Trans Mountain pipeline system extends from Edmonton, AB to Burnaby, BC, and into Washington State. The pipeline currently transports a variety of refined and non-refined products to refineries in Canada and the United States, and to the Westridge Marine Terminal in Burnaby, BC for export. The Trans Mountain Expansion Project will twin the existing 1,150 kilometer (714 mile) pipeline between Alberta, and Burnaby, BC, and nearly triple the system's capacity from 300,000 barrels per day to 890,000 barrels per day.

Trans Mountain has in place a sophisticated and flexible Emergency Management (EM) Program. The EM Program is a comprehensive set of standards, processes, and procedures designed to support Trans Mountain's commitment to the safety and security of the public, workers, the environment and company property. It provides a continual cycle of improvement as mandated by the *Canada Onshore Pipeline Regulations*.

The EM Program is an emergency management program of mitigation, preparedness, and response, for all-hazards, that evolves continuously with ongoing enhancements and improvements implemented regularly. The EM Program has been developed for the existing pipeline and facility network based on a combination of regulatory compliance, operational needs, industry best practice, consultation sessions, and lessons learned from regular exercises and actual incidents. As technology, regulation, industry standards, operational needs, and partnerships with external partners continue to evolve, so too does Trans Mountain's EM Program.

This paper focuses on one key component of the EM Program, which is referred to as the Geographic Response Plans (or GRPs). GRPs have been defined as "a planning document and

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response tool that is intended to guide local responders in the first 24-48 hours of a major oil spill until additional response assets can be deployed and a Unified Command is established” (McGowan, Algots and Gravenmier, 2017, p.2). GRPs are also “designed to identify high risk areas and develop response strategies for those... locations” (Wirth, Nielsen, Walker, & Gaudiosi, 2017, p.4). Another function of GRPs is to “ensure trustee agencies, industry, contractors, tribes [sic] and communities understand the species and habitat designations, as well as cultural and economic resources at risk from spills and agree on prioritized response tactics” (Pilkey-Jarvis & Irwin, 2017, p.7)

As with the GRPs of other organizations, Trans Mountain’s GRPs serve as a field response tool to expedite the decisions and actions of responders during an incident. The GRPs allow for a timely and effective response to a spill by providing detailed, geographic specific information and tactics to assist spill responders in the containment and recovery of released product.

Conditions vary significantly along the length of the Trans Mountain Pipeline in terms of terrain, accessibility, population centres, and local natural, cultural, and economic resources. Additionally, a number of High Consequence Areas (HCAs), i.e. areas where a spill would have a significant negative impact, are found along the route of the pipeline. HCAs include, but are not limited to:

- Aquifers
- Drinking water
- Ecological Areas
- High Populated Areas

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- Low Populated Areas
- Navigable waterways
- Cultural, archeological or historical sites
- Critical infrastructure sites

The GRPs were designed to minimize impacts to these ecologically, culturally and economic sensitive areas by prioritizing the protection of them during a response.

The development of the GRPs utilized an innovative and inclusive consultation approach that involved local Indigenous community members, municipalities, and other interested stakeholders to fully incorporate traditional and local knowledge, as well as on-the-ground experience.

Four GRPs resulted from these consultation and development efforts – one for each of Trans Mountain’s operational districts. Each GRP contains district-specific information, internal notification protocols, initial assessment and response procedures, and actions to guide tactical response, including decontamination. Of greatest significance is the resulting Data Sheets, which were generated for each of the 600+ Control Points. Control Points are locations where responders can set up equipment to intercept, contain, and recover spilled product. The two-page Data Sheets provide the specific containment and recovery tactics appropriate for the associated Control Point, with an implementation diagram to visually aid responders. The Data Sheet also includes details on the waterbody, safety information, logistical considerations, and a summary of resources at risk in the vicinity. All the Data Sheets are stored in a GIS platform with web interface and, together with their parent GRPs, have been made publicly available by Trans Mountain at <https://grp.transmountain.com>. In 2018, this was the first time a pipeline company in

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North America had publicly disclosed this data to the wider response community in an open and transparent manner, with the goal of enabling communities and agencies to benefit from the work Trans Mountain had performed.

METHODS

Due to the complex nature of the High Consequence Areas along the pipeline right-of-way, a comprehensive, multi-stage approach to developing Trans Mountain's GRPs was established. The approach is unique, generated by Trans Mountain to meet the needs of the project and particularly, the stakeholders with whom engagement was being conducted with. The first step in the development of the GRP was the simulation and modelling of hypothetical spills along the pipeline to identify the largest possible area impacted by a spill and potential Control Points. Through the EM Consultation Program, input for consideration on the EM Program, including the GRPs, was then gathered from various stakeholders, Indigenous communities, and landowners. A variety of methods were used for soliciting input including both workshops and one-on-one meetings. These efforts were complemented by an extensive field component involving a multi-disciplinary team of spill response and environmental specialists, local stakeholders, and Indigenous Peoples who travelled along the pipeline corridor to verify proposed Control Points while documenting environmental, social, and cultural HCAs. The participation of Indigenous communities and local stakeholders was invaluable in providing local input and knowledge on various aspects of the environment and the practicality of the Control Point.

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Oil Spill Modelling

Trans Mountain's development of the GRPs began with simulating and modelling hypothetical spills along the pipeline to determine the largest possible geographic extent of impact. Over 70,000 pathways were modelled, simulating outflow locations at 30-meter intervals along the pipeline and at every water crossing, assuming the product flowed, *unmitigated*, for 24 hours. Trans Mountain is the only known pipeline company in British Columbia using a combination of oil spill plume modelling and field assessments to predict oil movement, which provides for more predictive precision, and an overall quicker response time.

Desktop Review

Once the oil spill modelling was completed, a thorough desktop review was conducted where the theoretical model outputs were compared to what could be expected to occur in a real spill event. The desktop review allowed for the evaluation of the model outputs against various Geographic Information System (GIS) data, such as land elevation data and surface water features, and the incorporation of known environmental assessments. Approximately 5 to 7 control points and 2 to 4 boat launches were identified for every 50-70 km (31.2 – 43.8 miles) stretch of river downstream from the pipeline.

Consultation & Engagement

Consultation and engagement with stakeholder and Indigenous communities continue to be of key importance in the development and enhancement of the GRPs. It is Trans Mountain's belief that Indigenous communities and local stakeholders are in the best position to identify the resources that are most important to them, and they typically have experience and ideas for how best to protect those resources. By developing relationships locally Trans Mountain has been

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able to optimize and enhance its EM program, and specifically the GRPs, based on the detailed local knowledge provided.

Trans Mountain commenced its consultation and engagement process in 2012 and these activities continue today. The overarching theme is one of inclusivity with multiple opportunities and channels for stakeholders and Indigenous communities to provide feedback on the EM Program with a view to its enhancement. Consultation and engagement efforts are focused on municipal and regional governments, districts, counties, the corresponding first responders along the pipeline corridor, Federal and Provincial agencies, Indigenous communities with Traditional Territory that overlaps the pipeline corridor, and Right-of-Way (ROW) landowners.

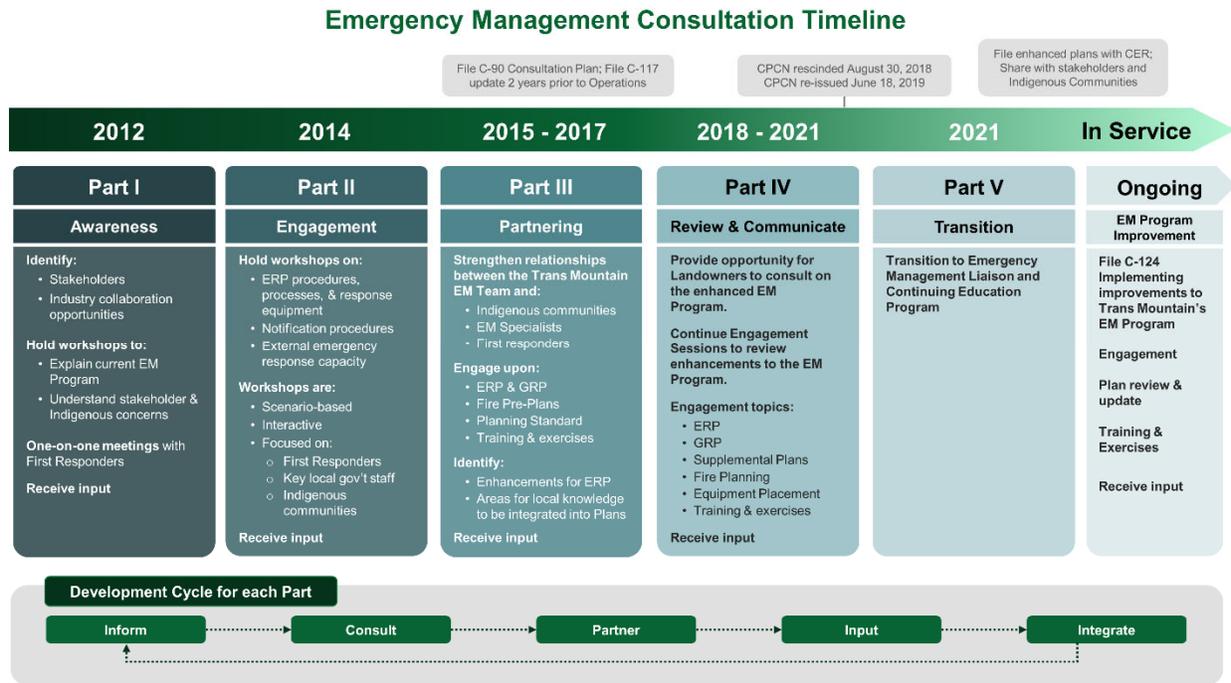
Trans Mountain's progressive approach to consultation consists of the following phases, with each phase building on the preceding phase:

- Part I. Awareness
- Part II. Engagement
- Part III. Partnering
- Part IV. Review and Communicate
- Part V. Continuous Improvement

These phases, with more explanatory information, are displayed in Figure 1.

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Figure 1 – Emergency Management Consultation Timeline



During the development of the GRPs, consultation was designed to be inclusive, progressive, and open to interested participants so as to facilitate and promote positive dialogue, open communication, and meaningful input. Avenues for participation included workshops, one-on-one meetings, and an inclusive field program.

Workshops and Meetings

Consultation and engagement workshops brought together first responders, Indigenous community leaders, municipal and agency emergency managers, and government environmental leads. Multiple sessions were held in each of the operational districts and provided Trans Mountain a more accurate picture of the combined external response capacity available along the pipeline ROW.

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During the workshops, participants were presented with an overview of Trans Mountain's EM Program, then provided the opportunity to provide input for consideration on the various components of the Program. Topics of focus included:

- i. EM Program
- ii. Planning Standard
- iii. Emergency Response Plans
- iv. GRPs
- v. Fire Pre-Plans and Fire Safety Plans
- vi. Equipment Availability
- vii. Exercises and Training

The workshop agenda included breakout sessions to grant participants an opportunity to talk about the topics presented in the previous session. The sessions also enabled participants to identify opportunities for enhancement, as well as to establish closer working relationships with both the Trans Mountain EM team, and other participating entities and agencies. Holding dedicated breakout sessions with small group sizes offered a sound environment to discuss the issues of most concern, which in turn led to constructive communication and meaningful input.

Engaging in this manner enabled Trans Mountain to:

- Identify and explore adjustments that could be made to enhance external response procedures and plans.
- Detail any proposed adjustments to Trans Mountain's Emergency Response Plan and GRPs that should be considered.

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- Enhance external notification processes and the information to be communicated to stakeholders if an incident were to occur.
- Inform and augment the GRPs by identification of potential Control Points and HCAs through interactive mapping sessions.
- Collect local knowledge and expertise to enhance the EM program.

Trans Mountain also offered participants the opportunity to complete a survey at the end of each workshop. The survey afforded an additional opportunity for attendees to submit feedback and make specific requests for one-on-one meetings with Trans Mountain.

Throughout the workshops, Trans Mountain EM representatives documented areas of interest and opportunities to further explore enhancements to the Program. Capturing ideas and feedback from EM specialists and first responders who participated was important in facilitating a consultative process that was both adaptive and responsive to input.

One-on-One Meetings

The workshops generated numerous requests for subsequent one-on-one meetings. The agendas for these meetings included topics that stakeholders and Indigenous Communities wished to further consult upon. This sequential step in the consultation process allowed Trans Mountain to:

- Consult with subject matter experts.
- Have more focused and detailed discussions on topics of specific interest.
- Gather detailed local knowledge.

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- Enable stakeholders and Indigenous communities to provide input as to how the Trans Mountain Emergency Response Plan can integrate with their plans and optimize synergies.

Each one-on-one meeting fostered an environment open to constructive dialogue with Trans Mountain and as such yielded information to support enhancements to the EM Program. Additional results from these individual meetings included requests to participate in GRP fieldwork, attend Trans Mountain exercises, and continue the dialogue to strengthen the coordination of Emergency Plans and processes, thus enhancing both entities' preparedness.

Field Verification

The Desktop Review plus input received from stakeholders, Indigenous communities, and landowners generated approximately 885 potential points for assessment. These identified points need to be assessed against factors such as:

- Accessibility to site
- Responder safety
- Equipment deployment feasibility
- Implementation of tactics

To confirm that the potential control points were viable, Trans Mountain conducted an extensive, multi-year field program. A multi-disciplinary team including spill response experts and specialists with expertise related to shoreline characterization, river flow identification, and species at risk, along with local stakeholders and members from Indigenous communities was assembled. This team travelled the pipeline corridor and verified proposed control points while documenting environmental, social and cultural HCAs. A small unmanned aerial vehicle (UAV)

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was used to capture land and water features and to provide aerial photos for inclusion in the Data Sheets.

For culturally sensitive areas, mechanisms were implemented to capture the information in the Trans Mountain GIS system, while honoring confidentiality and sensitivity. For example, a feature point was entered into the GIS system noting “sensitive areas,” which included the contact information for the community representative, so that if an incident should occur, the information would be exchanged to better understand and protect the feature.

In one district alone, Trans Mountain’s EM team evaluated over 200 potential GRP control points, staging areas, and/or boat launches. Some proposed control points were removed for a variety of reasons; primarily due to poor or no access such as steep riverbanks, which is difficult to see on the Desktop Review.

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RESULTS/DISCUSSION

Through the completion of the field verification program in which stakeholders, Indigenous communities, and landowners identified, verified, and provided critical local knowledge on the feasibility of the potential control points, 600 control points were confirmed. A Data Sheet was prepared for each of the control points along with four GRPs (one for each of Trans Mountain's operational districts).

The GRPs are divided into eight components:

1. Introduction – Provides an overview of the GRP and district-specific information.
2. Initial Response Actions – Outlines actions to ensure the safety of responders, public and to protect the environment and property; safety is always the first priority in any response
3. Notification – Describes protocols for immediate notification to the TM Control Centre and, depending on the situation, local first responders and emergency services. Immediate notification is a key element of any emergency response action.
4. Tactical Response Actions – Describes when certain tactics are best used and provides instructions on how to implement the tactic. The information within the GRP increases the initial spill response efficiency by providing guidance on the resources and capabilities required to complete the tactic(s) identified for each Control Point. Winter response tactics are also included.
5. Decontamination Procedures – Decontamination is critical to health and safety at release sites and protects workers from hazardous substances. Procedures are outlined for establishing a decontamination area in a safe, convenient location.

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6. Route Maps – Pipeline base route maps are composed and indexed, illustrating the routes within the operational district. The maps illustrate:

- Active pipelines
- Inactive pipelines
- Pipeline facilities
- Valves
- Equipment locations
- Control Points
- Directions for responders to access the Control Point

7. Control Point Data Sheets - The Control Point Data Sheets provide responders with quick and detailed information to assist spill responders in deploying containment and recovery tactics and strategies. The Data Sheets provide:

- Geographical details
- Waterbody information
- Shoreline information
- Safety concerns
- Resources at risk
- Logistical information, including staging areas
- Staging area photographs
- CP tactical diagram and implementation instructions
- Implementation strategies
- Implementation and equipment resources
- Support and technical services
- Wildlife at risk
- Wildlife mitigation tactics
- Decontamination area information

8. Forms - Samples of the forms required during the early period of a response are included.

Of particular significance is the 600 Control Point Data Sheets, which document the site-specific tactics, and the resources and equipment required to implement the tactics. Individual

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Control Point Data Sheets were created for waterbody Control Points, land-based Control Points and boat launches. The Control Point Data Sheets set out actions to be taken to protect sites such as municipal water intakes, sensitive environmental features, coastline areas, river crossings, or places of significance (cultural or environmental) to an Indigenous community. Table 2 below shows the number of data points provided directly by stakeholders and Indigenous communities during the workshops conducted in 2017.

Table 2 – Number of Data Points Provided in Workshops (2017)

Eight Workshops spanning 1,500km	Feature of Interest*	Potential Access	Potential CP	Water Intake Wells	HCA
Totals	124	17	120	52	1

* *Feature of Interest – natural, environmental or culturally sensitive area*

High Consequence Areas, of a wide diversity, are located along, and in the vicinity of, the pipeline right-of-way, including marine and freshwater habitats, shorelines, forested areas, and urban developed areas. The input received from local stakeholders, Indigenous communities, and landowners regarding these HCAs was invaluable and resulted in the addition of Control Points, boat launches and staging areas, strengthening the efficiency of response in the event of a spill. The identification of HCAs and appropriate control points enables the Trans Mountain incident management team to mitigate risk and limit potential impacts from a pipeline incident.

All the Control Point Data Sheets are available publicly through a GIS platform and web interface. In 2018, when posted, this was the first time a pipeline company in North America had publicly disclosed this data to a wider response community in an open and transparent manner,

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with the goal to enable communities and agencies to benefit from and leverage the work.

Identification of Control Point locations ahead of time and enabling responders to access data readily through the web interface, enables Trans Mountain to respond rapidly, more effectively and thus limits the potential impacts to sensitive areas downstream of a release point.

CONCLUSIONS

The development of Geographic Response Plans has been an extensive, multi-step, ongoing process in which local and traditional knowledge from Indigenous groups was sought out through various engagement opportunities including face to face meetings, workshops, and field visits.

Additionally, through a comprehensive review, and in consultation with Indigenous communities and stakeholders, Trans Mountain has made improvements to existing elements of the EM Program and added several new components to support emergency preparedness and response. Highlights include:

- Implementation of Geographic Response Plans (GRPs)
- Enhancements to existing emergency response plans
- Development of additional supplemental plans and guidelines
- Investment in new equipment
- Establishment of mutual aid agreements.

Trans Mountain's EM Program is an all-hazards emergency management program of mitigation, preparedness and response that is continually evolving with ongoing enhancements and improvements being implemented regularly. Significant enhancements to Trans Mountain's Emergency Management Program have been made to increase the ability to prevent, prepare for,

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respond to, mitigate and recover from an incident. Development of the GRP has contributed not only to Trans Mountain being as prepared as possible to mitigate and minimize environmental and socio-economic impacts in the unlikely event of a spill, but has also enabled First Responders, Indigenous Peoples and communities, and fellow infrastructure operators to fortify their response toolbox and enhance their ability to respond.

All the Data Sheets are stored in a GIS platform with web interface and, together with their parent GRPs, have been made publicly available by Trans Mountain at

<https://grp.transmountain.com>

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