

Joint Municipal Regional Disaster Debris Management Operational Plan For Metro Vancouver region and members



October 2017
Version 2.0

Integrated Partnership for Regional Emergency Management in Metro Vancouver

Metro Vancouver region and members

Disaster Debris Management Operational Plan

Acknowledgements

This Plan was developed by the Metro Vancouver Regional Engineers Advisory Solid Waste Sub Committee Disaster Debris Working Group with support by IPREM (Integrated Partnership for Regional Emergency Management) and Critical Continuity & Emergency Management (CCEM) Strategies.

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Thank you to Robert A. L. White (Seismic Specialist, [Emergency Management BC](#), Ministry of Public Safety and Solicitor General) and Murray Journeay (Research Scientist, Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada) for their assistance in sourcing and interpreting the HAZUS Debris Estimation Calculations contained within this document.



Integrated Partnership for Regional Emergency Management in Metro Vancouver

IPREM is an equal partnership between the Government of BC and Metro Vancouver (on behalf of member municipalities, Treaty First Nations and Electoral Area) providing regional emergency management planning for the Metro Vancouver region.

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CCEM Strategies develops practical solutions to help organizations prepare for emergencies, providing analysis, assessments, planning support, exercises & training, and strategic engagement & facilitation services.

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Joint Municipal Regional Disaster Debris Management Operational Plan

Version Change

Version	Date of Version	Change(s)
1	December 2016	Completed Plan development to be validated in a regional tabletop exercise
	September 21, 2017	<p>At its September 21, 2017 meeting, the Regional Administrators Advisory Committee reviewed the report dated August 25, 2017, titled “Joint Municipal Regional Disaster Debris Management Operational Plan” to the Regional Engineers Advisory Committee and adopted the following resolution:</p> <p style="padding-left: 40px;">a) <i>That Metro Vancouver and member municipalities prioritize the integration of the Joint Municipal Regional Disaster Debris Management Operational Plan within their emergency management plans within a one-year timeframe; and</i></p> <p style="padding-left: 40px;">b) <i>That Metro Vancouver be requested to coordinate biennial reviews and required updates to the Joint Municipal Regional Disaster Debris Management Operational Plan with the REAC Solid Waste Subcommittee and IPREM.</i></p>
2	October 2017	<p>General layout and content updates based on results from Tabletop Validation Exercise (Exercise Rumble) from June 9, 2017</p> <p>Updated the Plan Activation Criteria to be tonnage only</p> <p>Centralized the subsequent debris estimations into Appendix B; revised instructions to streamline and clarify the debris estimation process.</p> <p>Included an automated debris estimation spreadsheet</p> <p>Inclusion of updated HAZUS Debris Forecasting content; replaced the calculation details and tables with a link to HAZUS application for Local Authorities</p>

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¹ By clicking on the organization name, the user will be linked to the selected organization's emergency management information on their corporate website.

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LIST OF ACRONYMS

Acronym	Meaning
BCEMS	British Columbia Emergency Management System
DG	Dangerous Goods
DDM	Disaster Debris Management
DFA	Disaster Financial Assistance
DMS	Debris Management Site
DRT	Disaster Response Transportation
EMBC	Emergency Management British Columbia
EOC	Emergency Operations Centre
GIS	Geographic Information System
HHW	Household Hazardous Waste
ICS	Incident Command System
PCBs	Polychlorinated Biphenyl
PREOC	Provincial Regional Emergency Operations Centre
ROC	Recovery Operations Centre
TTS	Temporary Transfer Station

USING THE PLAN TO RESPOND TO AN EMERGENCY

Below are tables that will quickly direct the reader to sections of the Plan that relevant to their role during the various stages of a debris generating emergency.

Using the tables:

- Look in the top row of the tables to find which one applies to your role
- In that table, read from left to right
 - what plan section to consulted
 - when procedures within the section should be implemented; and
 - purpose/use of the section.

Plan Usage Guidelines: Post-emergency event activities

WHO: EOC Director		
Plan Section	When to Use	Section Purpose/Use
Section 3: Plan Activation	<ul style="list-style-type: none">• At the onset of an emergency or during the Plan Activation Period.	<ul style="list-style-type: none">• Defines the level of DDM activation<ul style="list-style-type: none">○ Local○ Sub-regional○ Regional• Outlines high level activities that the DDM Team are to undertake

WHO: Operations Section Chief		
Plan Section	When to Use	Section Purpose/Use
Section 4: Operational Strategies and Procedures	<ul style="list-style-type: none"> At the onset of an emergency or during the Plan Activation Period. 	<ul style="list-style-type: none"> Defines the level of DDM activation <ul style="list-style-type: none"> Local Sub-regional Regional Outlines high level activities that the DDM Team are to undertake Section 4 provides guidance on which operational strategies; procedures and the corresponding appendices should be used throughout emergency response and recovery. <p>It also provides guidance in documenting decisions and activities</p>

WHO: DDM Team (including the Team Lead)		
Plan Section	When to Use	Section Purpose/Use
Section 4: Operational Strategies and Procedures	<ul style="list-style-type: none"> At the onset of an emergency or during the Plan Activation Period. When preparing, or exercising for an emergency. 	<ul style="list-style-type: none"> Refer to the corresponding DDM activity. Find appropriate emergency management phase (response or recovery). Use in conjunction with the List of Acronyms (pg. 10) and Glossary.

Note: You may see text or graphic references to debris management in additional guidelines and plans, including the *Metro Vancouver Regional Emergency Advisory Group Operations Guide (October 2016)*.



Debris Management

Such references may be identified by graphics such as the one to the left.

EXECUTIVE SUMMARY

In the aftermath of a debris generating emergency event, it is not uncommon for there to be a large volume of debris, which needs to be managed in a timely manner. The process of disaster debris management is relatively systematic, and follows a distinct order from preparedness through to recovery.

The *Joint Municipal Regional Disaster Debris Management Operational Plan for Metro Vancouver region and members* (the Plan) provides an operational framework for disaster debris management for the 23 Local Authorities (member municipalities, Treaty First Nation and Electoral Area) within the Metro Vancouver region. The guiding principles and tools provided in this Plan will enable the Local Authorities to collaborate and coordinate the efforts, resources, and communications specific to disaster debris, which required to maintain continuity and recover from emergencies in the Metro Vancouver region.

Criteria is provided to aid the Local Authority in activating the Plan at a sub-regional or regional level inclusive of geographic impact, debris estimations, the capacity to manage the impacts, and actual or potential consequences, and risks related to the disaster debris.

When a sub-regional emergency occurs, the Plan will be referenced alongside the individual Local Authorities' disaster debris management plans. For regional debris generating emergencies, the Plan integrates with the Provincial Regional Emergency Operations Centre (PREOC) structure and aligns with relevant Provincial plans. If the debris generating emergency is confined to one Local Authority who has the capacity to manage the resulting debris, the Local Authority will activate only their Disaster Debris Management (DDM) plan.

During an activation, the participating Local Authority's DDM Team will operate out of their respective Local Authority Emergency Operations Centre (EOC), coordinating the management of debris within their individual jurisdiction. The DDM Lead will work with other activated Local Authority DDM Teams to coordinate disaster debris management activities and resources.

To support the response to the event and with assist community recovery, specific disaster debris management activities will need to be considered and implemented. Included in the Plan is an overview of key activities, associated procedures and identification of objectives and priorities for each of these core activities:

- **Debris estimation:** a post-emergency event activity which estimates the physical amount of disaster debris caused by a specific emergency.
- **Debris clearing:** the act of clearing debris for the purposes of access and egress as prioritized by the EOC to meet the British Columbia Emergency Management System (BCEMS) goals.
- **Debris hauling:** the act of moving debris from one location to another.

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- **Debris classification:** the act of classifying debris for the purposes of debris hauling and identification of temporary waste handling facilities.
- **Debris collection:** the act of gathering debris from the impacted area.
- **Debris processing:** the act of sorting, reducing and disposing of debris using permanent and/ or temporary waste handling facilities (neighbourhood drop-off points, collection centres, temporary transfer stations and debris management sites).
- **Re-use, energy recovery or recycling:** the act of reducing the quantity and physical size of debris; to reduce the strain on resources, through facilities which specialize in re-use, energy recovery and recycling.
- **Final disposal:** the final destination of processed debris that is not recyclable or re-usable, e.g. landfill.

See Figure 1 on page 17 for an overview of the disaster debris management process.

Additionally, recognizing that preparedness and planning are core to an effective response and recovery, the Plan discusses disaster debris management activities, which should be undertaken by the Local Authority to plan for the management of disaster debris. These include:

- **Site identification:** a process of identifying and assessing sites for possible use as temporary waste handling facilities.
- **Debris forecasting:** a preparedness activity that estimates the volume of anticipated debris after an emergency event based on materials present in defined areas.
- **Debris clearing prioritization:** a preparedness activity to identify key transportation routes that will be prioritized for the activity of debris clearing.

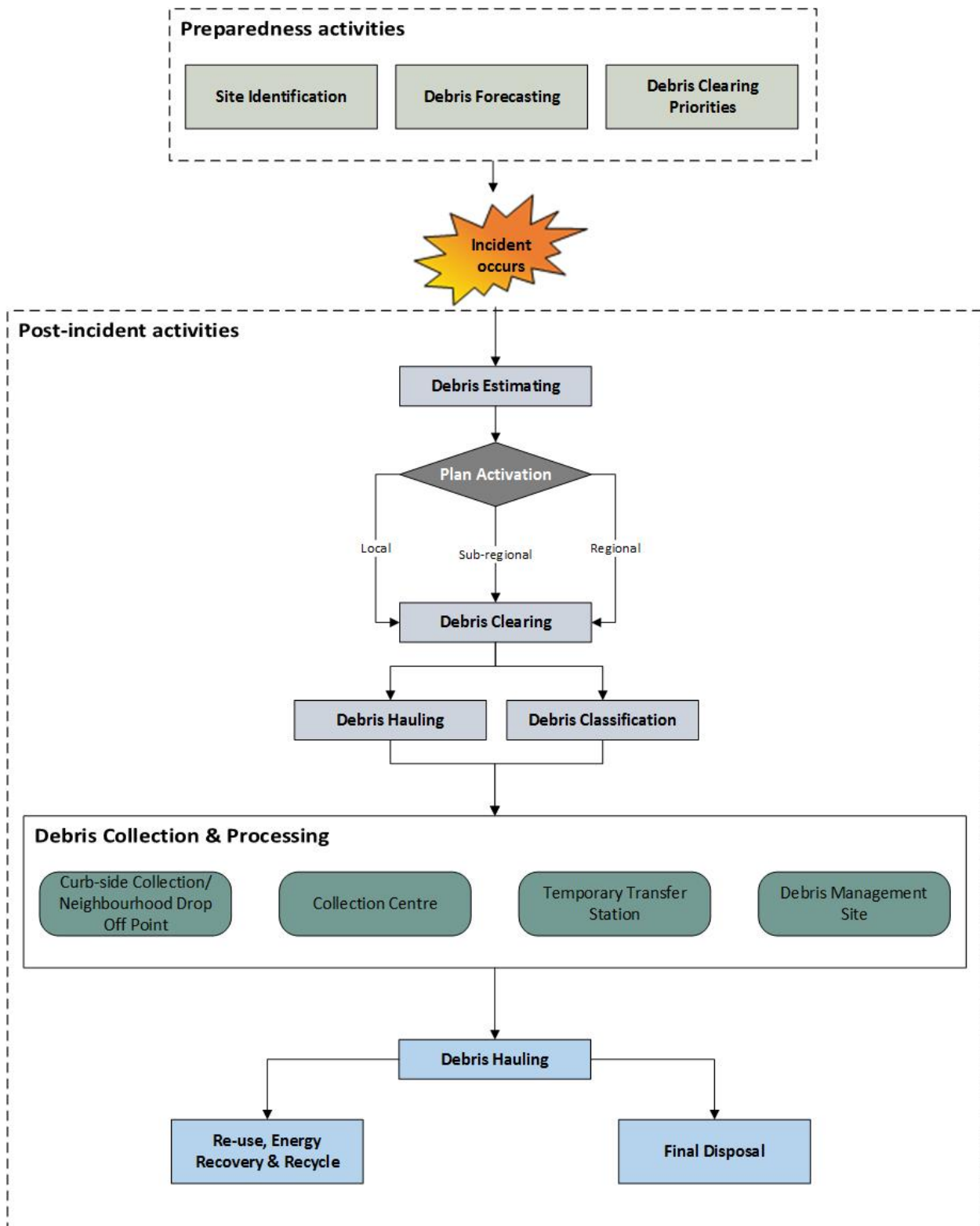
Conclusion

This Plan lays the foundation for addressing the management of disaster debris in the Metro Vancouver region with a joint municipal regional approach through coordinated and integrated effort. It describes operational strategies for sustained response and recovery.

With the goal of continuous improvement, this Plan encourages the incorporation of evolving joint municipal and Regional Concept of Operations, the expansion of debris management strategies and tools, and the incorporation of lessons learned from Plan activations and world events.

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Figure 1 -- Disaster Debris Management



1. PLAN OVERVIEW

1.1 Intent

The intent of the Joint Municipal Regional Disaster Debris Management Operational Plan (the Plan) is to provide a framework for disaster debris management for the 23 Local Authorities (21 municipalities, one Treaty First Nation and one Electoral Area A) within the Metro Vancouver region. This Plan will enable Local Authorities to collaborate and coordinate effort, DDM resources, and communications, to maintain continuity and recover from emergencies.

For regional debris generating emergencies, the Plan integrates with the Provincial Regional Emergency Operations Centre (PREOC) structure and references Provincial plans. When a sub-regional emergency occurs, the Plan will be referenced alongside the Local Authorities' disaster debris management plans.

If the debris generating emergency is confined to one Local Authority, and capacity to manage the resulting debris is available, the Local Authority will activate their DDM plan, which should align with the activities highlighted in the Preparedness Section of this Plan. The Local Authorities' DDM plans will need to expand on these components, based on their hazards, capacity, capability, as well as their Municipal emergency plan. The DDM guiding principles and tools provided in this Plan should be used to enable the consistent and coordinated approach for Local Authorities require to work together during a sub-regional, or regional, activation.

The guiding principles for disaster debris management in the Metro Vancouver region are:

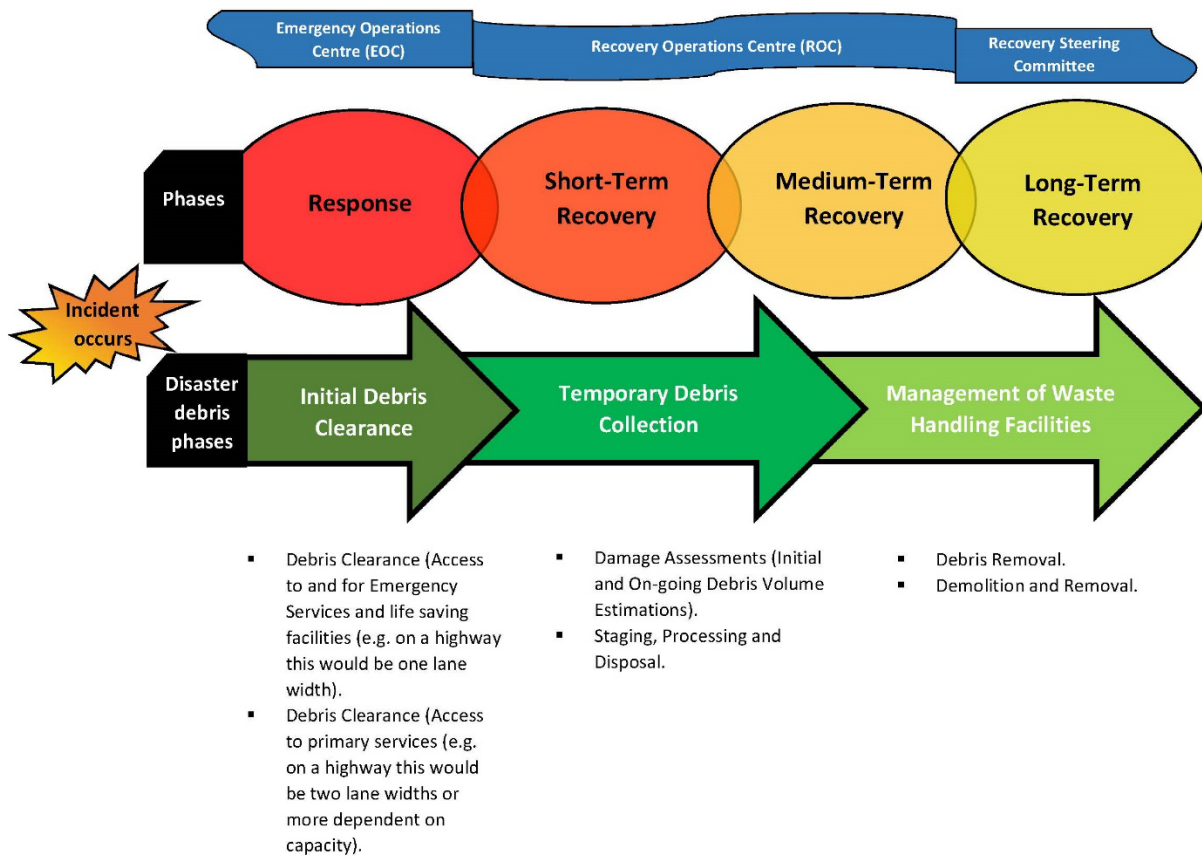
1. Disaster debris processes include initial debris clearance, temporary debris collection, management of temporary waste handling facilities and final disposal. Underlying each of these processes is the estimation of the debris volume and weight. These activities are, preferably, to be carried out within the region.
2. Manage disaster debris in order to support the region's environmental, economic, social, and recovery objectives.
3. Encourage supportive legislative and regulatory provisions to enable effective disaster debris management and processing.
4. Where practical, separate disaster debris to reduce health risks and safely manage hazardous disaster debris.
5. Minimize interim and long-term impacts to the natural environment from disaster debris management operations.
6. Promote the re-use, recycling, and energy recovery of disaster debris, where possible.
7. Provide the public with clear and concise instructions regarding disaster debris management.

1.2 Scope

The Plan uses consistent terminology and management approaches, applicable for use at the local, sub-regional and regional levels, to provide guidance and management strategies on the various aspects of disaster debris management from preparedness, through to response and recovery. Included are detailed activities to prepare for, and manage, disaster debris, with a focus on municipal owned and regulated land, through the response phase, short-term recovery phase, and medium-term recovery phase. Considerations for long-term recovery are included.

Figure 2 illustrates the various phases and their relationship with one another.

Figure 2 -- Phases



The end state of the phases is based on conditions met, rather than time elapsed. Due to the necessary overlap of activities within all phases, this transition is not definitive.

Post-Emergency Event Phases Transition Considerations and Features

Response to Short-Term Recovery Transition

The transition from response to recovery starts before the end of the response phase. The response phase end state is based on conditions met, rather than time elapsed. Due to the necessary overlap of activities within all phases, the transition between stages is not definitive.

Short-Term Recovery Features

- This stage begins simultaneously with the onset of response activities.
- The focus is on ensuring the continued provision of life safety and basic human needs and key support services.
- As the emergency response progresses, steps toward recovery are taken and planning objectives are established. The restoration of basic functions of society depends on how quickly recovery activities and plans are initiated.
- A period of overlapping response and recovery activities may occur; response activities will be underway to support those most heavily affected by the emergency, while the areas less affected begin transitioning to restoration and other recovery activities.
- The duration and timing of the overlap depends on the type and severity of the damage incurred.

Medium-Term Recovery Phase Features

- By this stage, emergency response activities have been, or will soon be, completed; there is movement toward activities geared specifically to recovery.
- The focus is on re-establishing the movement of goods and services, resuming business and economic functions, and undertaking environmental rehabilitation.

Long-term Recovery Phase Features

- This stage involves sustained efforts to adapt to the “new normal,” which may include the replacement, rebuilding, or improvement of what was affected by or lost in the emergency/disaster.
- Financial, political, and environmental issues are addressed, and efforts are geared towards rehabilitating or improving the livelihood of disaster-affected communities.

1.3 Audience

The primary audience for the Plan is the 23 Local Authorities within the Metro Vancouver region, who are responsible for disaster debris planning, response and recovery. Additional audiences include organizations, waste management agencies, and other levels of government and First Nations, who could support debris management efforts within the Metro Vancouver region.

Figure 3 -- Local Authority Boundaries



1.4 Out of Scope

This Plan does not apply to:

- solid waste management activities that fall within normal operating (routine) levels;
- liquid waste management;
- debris managed under other response plans, i.e. hazardous spills;
- debris in ocean and river waterways;
- rail corridors; and
- human casualties.

Additionally, damage assessments and Neighbourhood Drop-off Points are out of scope for the Plan.

1.5 Defining debris

In a disaster, debris can be caused by and is classified as one of the following categories:

- Direct from disaster
 - e.g. rubble from damaged buildings and infrastructure (likely to be co-mingled categories of debris).
- Indirect from disaster
 - e.g. spoiled food because of power disruptions.
- Abnormal behavioural patterns (resulting from disaster)
 - e.g. increased consumption of bottled water.

Although the cause of the debris is not critical to its clean up, understanding likely contributors can assist those responsible for managing debris by providing guidance to determine when or where certain materials may be a concern post-response to the emergency event.

Additionally, debris can be classified by:

- type;
- origin;
- disaster debris phase; and
- post-response to the emergency event phase.

1.6 Legislation

The Local Authorities will respond to emergencies by working within the operational framework of the BC Emergency Management System (BCEMS) and in accordance with the BC *Emergency Program Act* and the Canada *Emergency Management Act*. A single, overall authority on emergency management or disaster debris management specifically for the Metro Vancouver region does not reside within one entity alone. Provincial support for emergencies would be provided through the Provincial Regional Emergency Operations Centre (PREOC).

Established under the *Emergency Program Act RSBC 1996*, the *Emergency Program Management Regulation 477/94* outlines the provincial ministry mandates and the obligations for the Province and Local Authorities to have emergency plans and procedures developed and in-place.

The *Emergency Program Act* assigns the Minister responsible with several powers and duties including the ability to declare a Provincial State of Emergency in any area of the province.

The Act empowers Local Authorities to declare a Local State of Local Emergency, which provides the local authority access to the same emergency powers available to the Minister responsible during the declaration of emergency. More specific powers and duties of local government during emergency declarations may be further defined by each Local Authority's respective bylaws.

Through the emergency powers of the Act, the Minister may:

- employ the assistance of any qualified personnel;
- use private property; and
- initiate evacuations in any jurisdiction.

Also, the Minister could empower any employee of Emergency Management BC (EMBC) to have access to the powers enabled during a Provincial State of Emergency to coordinate resources province-wide and fix prices e.g. rates charged by contractors.

The *Emergency Management Act* recognizes the roles that all stakeholders must play in Canada's emergency management system. It sets out the leadership role and responsibilities of the Minister of Public Safety and Emergency Preparedness, including coordinating emergency management activities among government institutions and in cooperation with the provinces and other entities. Responsibilities of other federal ministers are also set out in the *Emergency Management Act*. The federal government exercises leadership at the national level relating to emergency management responsibilities in its exclusive fields of jurisdiction and on lands and properties under federal responsibility.

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Should the Province determine; in consultation with the Local Authorities, that federal resources or special powers (e.g. an exemption or variance to Federal regulation) are required to support the response to, or recovery from the disaster, the Province will issue the request for assistance.

Regional Concept of Operations

The 23 Local Authorities comprising Metro Vancouver and EMBC established the Metro Vancouver Regional Emergency Advisory Group (REAG) to support the South West Provincial Regional Emergency Operations Centre with high-level consultation and decision-making during emergency events of regional significance within Metro Vancouver jurisdictions. The purpose of the REAG is to share situational information; confirm regional priorities; collaborate on regional decisions; and coordinate sharing and allocation of resources across the Metro Vancouver region. Members of REAG are Local Authority Chief Administrative Officers and senior level management from EMBC. The Metro Vancouver Regional Emergency Advisory Group is intended to address regional issues (multi-jurisdictional) where additional high-level input or recommendations are required that cannot be obtained through normal EOC to PREOC processes or through existing policies and guidelines.

1.7 British Columbia Emergency Management System (BCEMS)

In the Province of British Columbia, the British Columbia Emergency Management System (BCEMS) is a comprehensive framework that helps ensure a coordinated and organized approach to emergencies and disasters. It is intended to:

- provide a structure for standardized approach to developing, coordinating, and implementing emergency management programs across the Province;
- establish guiding principles, processes, and a common terminology, thus enabling a range of stakeholders to participate in all phases of emergency management; and
- emphasize integration and partnerships that facilitate communication and coordination on all levels.

BCEMS defines response goals, which guide decision makers in prioritizing response activities for Local Authorities. Although the goals are listed in order of priority, personnel are to take all available information into account when determining emergency-specific priorities. In line with this, the DDM Team should consider these goals throughout all post response phases:

1. **Ensure the health and safety of responders** - The well-being of responders must be effectively addressed or they may be unable to respond to the needs of those at risk.
2. **Save lives** - The importance of human life is paramount over all other considerations. When lives are at risk, all reasonable efforts must be made to eliminate the risk.
3. **Reduce suffering** - Physical and psychological injury can cause significant short and long-term impact on individuals, families, and communities. Response measures

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- should take into considerations all reasonable measures to reduce or eliminate human suffering.
4. **Protect public health** - Public health measures essential to the well-being of communities should be maintained or implemented. Enhancing surveillance and detection, eliminating health hazards, minimizing exposure, and implementing programs such as widespread immunization may need to be considered.
 5. **Protect infrastructure** - When necessary to sustain response efforts, maintain basic human needs, and support effective recovery, infrastructure that is critical to the livelihood of the community should be protected ahead of other property.
 6. **Protect property** - Property can be essential to the livelihood of communities. When determining priorities, response personnel should evaluate the importance of protecting private and community property.
 7. **Protect the environment** - The environment is essential to communities. When determining priorities, response personnel should evaluate the importance of protecting the environment and implement protective strategies that are in the best interest of the broader community.
 8. **Reduce economic and social losses** - The loss of economic generators can have short- and long-term impact on communities, including social losses related to the loss of community support networks and reduced employment, investment, and development. Response measures may be necessary to reduce these losses, and psychosocial interventions may be required for those impacted by the disaster.

To meet the BCEMS response goals, the Province of British Columbia has an established a chain of command to provide support to Local Authorities and Regional Districts. When assistance is required, requests for resources and personnel can be made to the next level of command, e.g. if the EOC requires assistance they would submit a request to the Provincial Regional Emergency Operations Centre (PREOC).

In a disaster, DDM Teams will form part of this structure, sitting under the Operations Section and Planning Section, as shown in Figure 4 -- Emergency Operations Centre (EOC) Organizational Chart.

1.8 Custodianship

A Custodian for the Plan has been designated to act as a single repository for the Joint Municipal Regional Disaster Debris Management Operational Plan (the Plan). The custodial responsibilities lie with the Integrated Partnership for Regional Emergency Management (IPREM), together with and Metro Vancouver Regional District. Applicable updates for the Plan will be facilitated, every two years, or as needed, through Metro Vancouver Regional District working in conjunction with IPREM and the Regional Engineers Advisory Committee Solid Waste Sub-Committee (REAC SWSC).

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The expectation is that each Local Authority within the Metro Vancouver region will inform the Custodians of any changes affecting the Plan or its execution utilizing the Revision Request Form. Local Authority emergency planning coordinators will coordinate with IPREM, and Metro Vancouver Regional District will coordinate with the REAC SWSC.

Responsibilities of the Plan Custodian include:

- initiating the annual update of the Plan’s designated representative contact list, and distributing the revised list to the designated representative contacts of each Local Authority, by no later than the last business day of March of each year.
- coordinating and facilitating meetings if requested, or after activation of the Plan, either sub-regionally or regionally, to capture lessons learned and opportunities for enhancement, or, upon request by the Local Authorities within the Metro Vancouver region, IPREM or EMBC.
- Metro Vancouver will work with the Plan Custodian and REAC SWSC in coordinating and facilitating a meeting every two years, or as needed, of all designated representatives, which should include at a minimum:
 - o review of the Plan, inclusive of changes to legislation, concept of operations, operational strategies and procedures, and appendices;
 - o review of any debris generating emergencies or relative waste management topics, for lessons learned;
 - o confirmation of identified temporary waste handling facilities (sites);
 - o identification of new or alternate sites for inclusion in the Plan; and
 - o confirmation of IPREM as the Plan Custodian.
- providing meeting minutes.

Each Local Authority shall keep the Custodian informed of any change to their designated representative and shall promptly reply to all reasonable requests from the Custodian for information regarding the administration of this Plan. Each Local Authority is to provide a designated representative- a member from REAC SWSC and an emergency planning coordinator.

Once a review has been completed and all the necessary amendments have been incorporated into the Plan, it will be forwarded to REAC for approval.

In addition to reviews, the Plan should also be regularly exercised. Where possible, objectives related to debris management should be embedded into regional, sub-regional and government body exercises to allow for familiarization, execution and validation of the Plan.

2. PREPAREDNESS ACTIVITIES AND STRATEGIES

2.1 Disaster Debris Management within the Incident Command System Framework

Through the establishment of a DDM Team, operating out of their respective EOC, the impacted Local Authorities will coordinate and manage debris within their individual jurisdiction. The DDM Lead will work from their individual Local Authority EOC and converse with other DDM Leads dependent on the scope and scale of the emergency.

Representatives from the following departments should be engaged and trained to undertake tasks and activities identified in this Plan:

- **Public Works/ Engineering Department (Lead):** Provide leadership to the DDM Team undertaking all activities which are not delegated to one of the DDM Team members.
- **Emergency Planning Coordinator:** Provides guidance to the DDM Team on emergency management processes and procedures as they relate to disaster debris management.
- **Geographical Information Systems (GIS) Department:** Provide data creation, gathering, analysis and mapping to the DDM Team.
- **Purchasing Department:** Identify existing contract services and rental equipment companies along with possible alternative out-of-area service providers.
- **Planning and Development Department:** Provide information to the DDM Team to assist with the creation and maintenance of a building inventory for the Local Authority.
- **Communications Department:** Provide support to the EOC's Information Officer.
- **Legal Department:** Advise of bylaws which may pertain to debris management in routine operations and disaster debris management in non-routine operations, prepare contract templates identified in the Plan, and provide legal advice as required.
- **Health, Safety and Environment Department:** Assist with the development of the Temporary Waste Handling Facilities Safety Plans and associated training.

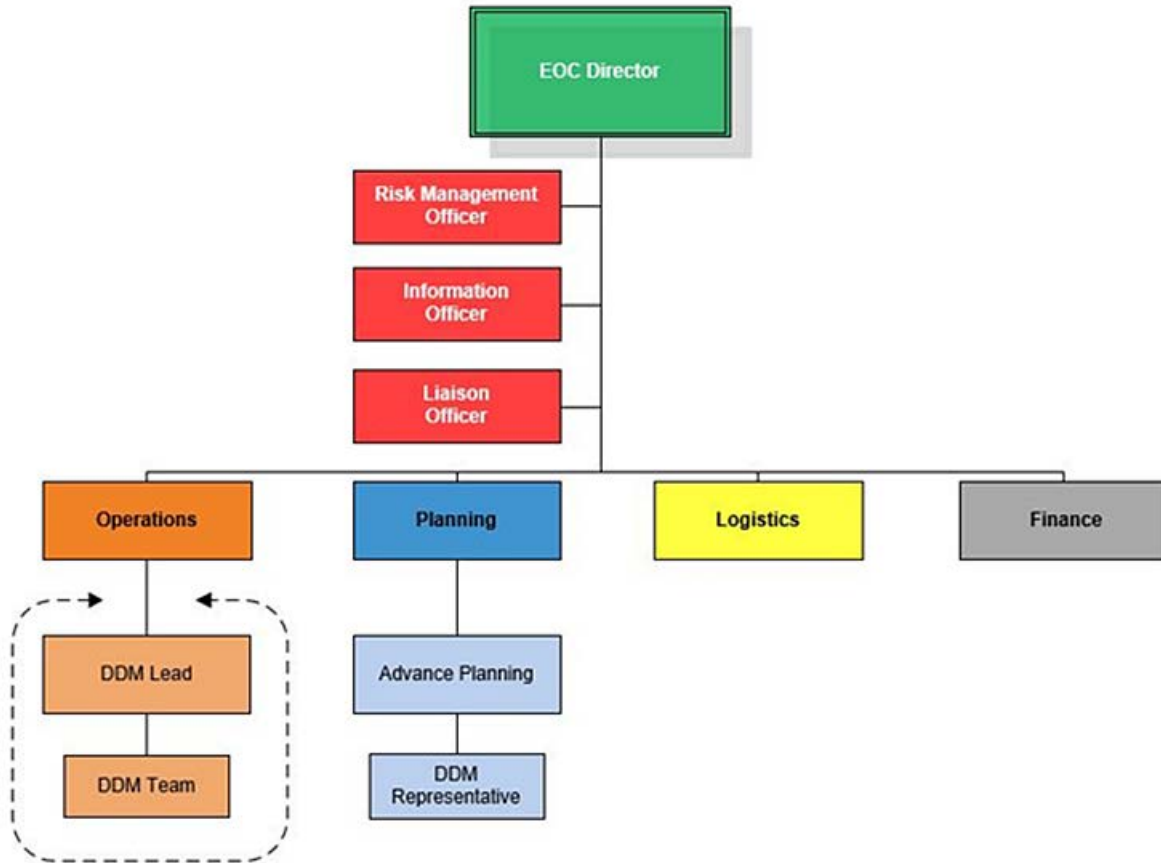
The DDM Lead and Team member(s) will report to the Operations Section, whereas the DDM Representative assigned to work with Advance Planning will report to the Planning Section Chief and work closely with the DDM Lead in the Operations Section.

Local Authorities should amend their EOC organizational chart to include Disaster Debris Management (DDM), noting that the DDM Teams will be situated in the Operations and

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Planning Sections, as shown in Figure 4 -- Emergency Operations Centre (EOC) Organizational Chart.

Figure 4 -- Emergency Operations Centre (EOC) Organizational Chart



For DDM Teams to effectively manage disaster debris, they will need to identify what will be required and requested of them at the local and sub-regional or regional levels. This Plan provides an overview of key activities; outlines associated procedures, identifies the objective and priorities for specific activities undertaken by the DDM Team from a sub-regional and regional perspective during each phase of the disaster. These activities would be managed by, supported by, or delegated to, the Local Authority's DDM Team.

2.2 Types of Temporary Waste Handling Facilities

Local Authorities should pre-identify sites for use as temporary waste handling facilities, using the site identification matrix, which may also be used as sub-regional sites.

Temporary waste handling facilities provide a buffer, which allows waste to move out of affected areas quickly while long-term recycling and disposal options are being established. However, not all of these facilities may be necessary and use of multiple facility types can increase costs. Efforts to minimize handling costs should be made as it may be challenging to

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recoup the operating costs associated with multiple facilities from the Province and/or insurance providers.

In addition to the temporary waste handling facilities, permanent waste handling facilities, such as existing transfer stations and landfills should also be considered for use if they have the capacity and resources necessary to do so.

If local re-use, recycling and disposal facilities are unable to manage an increased volume of debris post an emergency event, the Regional and Provincial focus will be on identifying alternate re-use, recycle and disposal facilities.

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Figure 5 -- Temporary Waste Handling Facilities

Site attributes/ considerations	Curbside Collection	Neighbourhood Drop-off Points	Collection Centres	Temporary Transfer Stations (TTS)	Debris Management Sites (DMS)
Site purpose	Gather debris prior to moving it from the impacted area to a final re-use, recycling and disposal facilities or to a temporary transfer station (TTS) or debris management site (DMS).	Gather debris prior to moving it from the impacted area to a final re-use, recycling and disposal facilities or to a temporary transfer station (TTS) or debris management site (DMS).	Gather debris prior to moving it from the impacted area to a final re-use, recycling and disposal facilities or to a temporary transfer station (TTS) or debris management site (DMS).	Centralize collecting, storing, sorting and reducing debris prior to transporting it to a final recycling and disposal facilities or to a debris management site (DMS).	Centralize collecting, storing, sorting and reducing debris prior to transporting it to a recycle or disposal facility.
Site distance from the impacted area	Nil, within the impacted area.	Nil, within the impacted area.	Nil, within the impacted area.	Within the City's boundaries. ²	Within the regional district of Metro Vancouver.
Site size	Minimal space required, e.g. debris will be separated by type at curbside through use of routine waste collection disposal bins or through the use of debris type piles (communicate clear and concise instructions for public consumption).	Minimal space required for debris type specific bins provided, e.g. corner of a block or in a small parking lot.	A small space is required, e.g. park or parking lot	≥ 2 acres.	≥ 2 acres.
Access type	Public.	Public.	Public.	Limited Public.	Limited Public or Closed.
Sorting method	Self-sorting.	Self-sorting.	Self-sorting.	Sorted by City personnel and contractors.	Sorted by City personnel and contractors.
Type of site debris would move to	Final disposal site, TTS, or DMS	Final disposal site, TTS, or DMS.	Final disposal site, TTS, or DMS.	Final disposal site. Alternatively, a DMS.	Final disposal site.

² Temporary Transfer Stations may be set up outside of the Local Authority's boundaries should a more appropriate site be available for use in a neighbouring Local Authority.

2.3 Site Identification

To assist with debris management, it is recommended that all Local Authorities identify sites for use as temporary waste handling facilities. These sites may be used:

- to manage debris resulting from a local emergency;
- as a site to service a number of Local Authorities in a sub-regional or regional debris generating emergency; or
- to assist neighbouring Local Authorities with a debris generating emergency through mutual assistance activation.

As part of the development of the Local Authorities' Disaster Debris Management Plan, the determination of potential sites for use as temporary waste handling facilities should be conducted. The Site Identification and Suitability Matrix (refer to Appendix G – Site Identification and Suitability Matrix) is to be used to ensure consistency in evaluation and communication of suitability between Plan members.

When completing the site identification and suitability matrix, individuals engaged in this activity should:

- collaborate with their Geographic Information System (GIS) Team(s) to use existing mapping overlays, inclusive of:
 - o snow removal routes;
 - o designated truck routes/dangerous goods routes;
 - o disaster response transportation (DRT) or formally known as disaster response routes (DRR);
 - o rail networks;
 - o marine highways and dock facilities;
 - o pre-identified staging areas and reception centres;
 - o parks and wetlands;
 - o land ownership and zoning;
 - o site gradient and drainage;
 - o flood plains; and
 - o proximity to critical infrastructure.
- determine what facility type the proposed sites are most suitable as, e.g. a collection centre, temporary transfer station (TTS) and/ or debris management site (DMS);
- analyse the sites selected to identify gaps in location or type; and
- identify alternate sites to address the gaps.

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Considerations when identifying sites should include:

- access/egress;
- security, including fencing and lighting;
- usability through all seasons, noting that debris management sites (DMS) can be operational for an extended period and across one or more seasons; and
- proximity to schools and hospitals.

Debris Management Sites (DMS) may not be set up until the short- or medium-term recovery phases, and regional recycle and disposal facilities may be limited in functionality or capacity. This makes curbside collection and neighbourhood drop-off points a viable option in progressing the removal of debris caused by the initial disaster and the debris clearing phase. Noting that curbside collection and neighbourhood drop-off points are the responsibility of individual Local Authorities and are not addressed at the regional level.

Existing sites to be considered for use as a temporary waste handling facility, focusing on Local Authority owned land, include:

- transfer stations;
- landfills (including closed landfills);
- Public Works yards;
- parks;
- vacant lots;
- recycling facilities;
- parking lots; and
- rights-of-way.

The sites identified will be subjective, rather than exclusive. When the Plan is activated, all sites identified will need to be reviewed to confirm if they are still applicable and functional through the emergency response and/or recovery phases.

2.4 Debris Forecasting

Debris forecasting is a preparedness activity that should be completed prior to an debris-generating emergency. If available to the DDM Team, it provides guidance and information, such as anticipated types and quantities of debris, which can be used to conduct debris estimations; a process which translates the estimated degree of damage to amount of debris (further information on debris estimations can be found in Sections 4.1.4 - Debris Estimations (Response) and 4.2.4 - Debris Estimations (Recovery); and Appendix B - Debris Estimation Tools and Calculations). It also provides a pre-emergency overview of what existed in an impacted area prior to an emergency.

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To accurately complete debris forecasting, Local Authorities should gather, regularly review and update if required, the following information:

- details regarding the built environment, e.g. a building inventory inclusive of:
 - o civic address;
 - o stories;
 - o total floor area;
 - o building type; and
 - o simplified HAZUS building type.
- hazards present within the Local Authority's boundaries, e.g. such as risk maps and Hazards, Risk, and Vulnerability Analysis (HRVA).

2.4.1 Forecasting Tools

There are a limited number of tools, which are available to assist with debris forecasting, a preparedness activity that provide a means of calculating the amount (volume and weight) of anticipated debris for a given geographic area based on disaster type.

Hazards United States (HAZUS) is a standardized methodology that estimates potential losses from earthquakes, floods hurricanes and winds. Natural Resources Canada (NRCan), using the HAZUS methodology, has prepared earthquake and flood modelling across Canada; these models have been used in various initiatives within British Columbia. HAZUS uses a Geographic Information System (GIS) to map and display hazard data (table format) and the results of damage and economic estimates for buildings and infrastructure. It allows users to estimate the impacts of earthquakes and floods from a local, sub-regional to regional levels.

Information required to use the HAZUS modelling will be dependent on the hazard type. An example of information required for examining debris generated from damaged buildings in an earthquake is as follows:

- information on the earthquake including the specific parameters of peak ground acceleration, peak ground velocity, spectral acceleration at 0.3 seconds and 1 second, and magnitude. If available information on earthquake related hazards such as liquefaction susceptibility will also be required;
- type of structure and material used in the structures construction (e.g. light wood frame, steel braced frame, concrete frame with concrete shear walls, etc.);
- the structure's design code to which it is built;
- the number of above ground storeys for the structure;
- the general occupancy type of the structure (e.g. residential, commercial, industrial, etc.);
- the total area of the structure (total area is the area of a single storey multiplied by the total number of above ground storeys); and
- unit weight of construction material for structural and non-structural elements of the structure.

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The Hazus Canada application is available to Local Authorities at hazuscanada.ca/hazus-canada-application-request

Debris forecasting for an significant earthquake in the Metro Vancouver region has been completed and have been included in Appendix A - HAZUS Debris Forecasting for easy reference.

2.5 Debris Clearing Prioritization

Because transportation routes enable both response and recovery operations, prioritization of effort must be considered. The following are guidelines, which should be used and referenced, when completing this activity:

1. Lifelines: Routes essential to life safety transportation, e.g. evacuation routes.
2. Critical Infrastructure, e.g. hospitals, ambulance halls, police stations, EOCs, telecommunication sites, water sanitation sites, power generation and transmission sites.
3. Clear major freeways and arterial routes.
4. Clear areas necessary for movement of goods and services and/ or economic restoration.
5. Clear minor arterial routes.
6. Clear local routes.

When determining debris clearing priorities³ prior to a disaster, Local Authorities may choose to use their snow removal routes as a base, noting that other sources of information may include:

- evacuation routes;
- disaster response routes\transportation (DRT);
- pre-identified location of reception centres; and
- pre-identified location of staging areas.

These pre-identified priorities will need to be reviewed during an activation of the Plan, amended where necessary and communicated to the relevant sections within the EOC, and should be captured in the Incident Actions Plans (IAP).

³ Debris clearing priorities are to be based on the BCEMS response goals and DDM guiding principles.

2.6 Other Strategies

To aid Local Authorities in effectively and efficiently planning for a debris generating emergency event, the following disaster debris management strategies should be developed prior:

Regional Strategies

- Review pre-identified temporary waste handling facilities flagged for use in sub-regional or regional debris generating emergency events; and
- Work with the Province to discuss disaster debris management processes to expedite permitting, as well as exemptions, to Provincial and Federal regulations.

Local Authorities' Strategies

- Determine availability of equipment resources;
- Ensure access to and provide training for how to use the debris tracking templates;
- Identify existing contractual agreements with contracted services;
- Prepare lump sum contract, time and material contracts and other contractor tools and templates;
- Conduct training for individuals who have been identified to fill the roles within the DDM Team; and
- Work with the Province to discuss disaster debris management processes to expedite permitting, as well as exemptions, to Provincial and Federal regulations.

3. PLAN ACTIVATION

Individual Local Authorities will activate their DDM Plan when their EOC confirms that a disaster has generated debris, such that debris management is greater than the capacity of routine day-to-day operating processes, and requires the DDM Team (Lead) to undertake the required steps to coordinate disaster debris management efforts.

The level of activation (local, sub-regional, or regional) will be based on four criteria identified in Figure 6. Information on how to complete the initial debris estimate, and an example of the plan activation decision-making process is available in Appendix B.

Figure 6 -- Activation Level

	Local⁴	Sub-regional	Regional
Geographic impact	Confined within one Local Authority geographic boundary	Impacts more than one Local Authority with debris.	Impacts more than one Local Authority with debris.
Debris estimation	500 to 1,000 tonnes	1,001 to 8,000 tonnes	> 8,000 tonnes
Capacity	Debris management exceeds the Local Authorities normal operation’s capacity to manage impacts, and actual, or potential, consequences or risks. ⁵	Debris management exceeds the Local Authorities (sub-regional) capacity to manage impacts, and actual, or potential, consequences or risks.	Exceeds the region’s capacity to manage impacts, and actual, or potential, consequences or risks.
Debris disaster examples	Minor flooding Small landslide Windstorms	Moderate flooding Winter storms	Significant earthquake

⁴ For a local level emergency event, the Local Authority’s DDM Plan should be referenced; in the absence of a local plan, this Plan can be used to guide the DDM Team through the procedures and strategies to address debris.

⁵ When a Local Authority’s capacity to address disaster debris is exceeded but the debris volume does not exceed 500 tonnes, consider utilizing private contractors and mutual aid agreements or requesting assistance from the Province.

3.1 DDM Team Key Activities by Phase

Implementation of the Plan will be done by:

- the DDM Team;
- the regional waste management services; and
- contracted services.

The DDM Team will be supported by the EOC sections (Management, Operations, Planning, Logistics, and Finance).

The following breakdown of activities does not indicate specific positions to be filled within the DDM Team, but rather the areas where the DDM team member(s) need to coordinate with the established EOC Sections to ensure the key activities are carried out.

3.1.1 Response (Disaster Debris Phase: Initial Disaster Debris Clearance)

Priorities

In the Response Phase of a disaster, the goal is **initial debris clearance** with the priorities being:

- Debris clearance and access for emergency services and life-saving services
 - e.g. on a highway this would be one lane width
- Debris clearance and access to primary services
 - e.g. on a highway this would be two lane widths or more dependent on capacity

Key activities are:

- activate the Joint Municipal Regional Disaster Debris Management Operational Plan;
- gain situational awareness to assist with debris management planning and coordination;
- identify priority activities and initial locations of focus for debris clearance in-line with the BCEMS Response Goals;
- support personnel on-site, and in the EOC on matters pertaining to disaster debris management; and
- document or communicate to the EOC Scribe all activities and decisions for inclusion in the EOC diary.

Note: The following breakdown of activities does not indicate specific positions to be filled within the DDM Team, but rather the areas where the DDM team member(s) need to coordinate with the established EOC Sections to ensure the key activities are carried out.

The DDM Team will be supported by the EOC sections (Management, Operations, Planning, Logistics, and Finance).

Response Activities Checklist

Management

- Provide overall management of disaster debris management activities.
- Report in to the Operations Section Chief and Planning Section Chief as per the instructions received from the EOC at the time the Plan is activated.
 - o The DDM Team Member in Advance Planning will report to the Planning Section Chief and work closely with the DDM Lead in the Operations Section.
- Liaise with the EOC Director, or DDM Lead, from other impacted Local Authorities to share situational information, confirm regional DDM priorities; collaborate on regional DDM decision; and coordinate sharing and allocation of DDM resources.
- Develop a roster for the DDM Team.
- Confirm personnel undertaking DDM activities are aware of responsibilities and use of relevant DDM Plan tools and activities.
- Request support from the Information Officer, and the Logistics, Planning and Finance Sections specifically for the disaster debris management.
- Maintain situational awareness through EOC briefings, Section briefings and communications with the EOC Operations Section, inclusive of what area(s) were impacted and to what degree.
- Confirm all documentation has been completed and submitted to the appropriate EOC Section.
- Provide updates to the EOC Director as requested.

Response Activities Checklist		Page 2 of 4
Liaison/ Information		
<input type="checkbox"/>	Inform the Information Officer about potential disaster debris management specific messaging requirements, and public communication templates (refer to Appendix L - Public Communications Samples).	
<input type="checkbox"/>	Provide disaster debris specific information to the Information Officer, which will be used when coordinating communication efforts inclusive of: <ul style="list-style-type: none">o disaster specific call centre messages;o media interviews; ando public communications for dissemination through appropriate channels, e.g. media (print, radio, news), corporate websites, flyers/ notifications, and social media.	
<input type="checkbox"/>	Request that the Information and Liaison Officer share any disaster debris specific information obtained through videos, social media or photographs with the DDM Team.	
Operations		
<input type="checkbox"/>	Gather data for the initial debris estimate.	
<input type="checkbox"/>	Conduct initial debris estimate (refer to Appendix B).	
<input type="checkbox"/>	Coordinate with the Public Works/ Engineering Department or Contracted Services to commence clearing, hauling and collection activities.	
<input type="checkbox"/>	Support the personnel on-site as requested.	
<input type="checkbox"/>	Communicate with Metro Vancouver Regional District and permanent waste handling facilities regarding the impact to their services, capacity, and resources.	

Response Activities Checklist	Page 3 of 4
Planning	
<ul style="list-style-type: none"><input type="checkbox"/> Identify types of debris and associated hazards.<input type="checkbox"/> Determine debris clearing priorities.<input type="checkbox"/> Determine hauling and collection priorities based on types of identified debris (refer to Section 2.5 - Debris Clearing Prioritization);<input type="checkbox"/> Provide the EOC Logistics Section with a list of required resources: personnel inclusive of Local Authority and regional personnel, contractors, equipment and materials.<ul style="list-style-type: none">o provide a copy of these documents: Appendices N - Public Works Mutual Aid Agreement;o Equipment Classification; ando Section 4.1.11 - Engaging Contractors.	
Pre-planning actions for subsequent disaster phases	
<ul style="list-style-type: none"><input type="checkbox"/> Determine the ability of residents to self-haul to neighbourhood drop-off points or collection centres.<input type="checkbox"/> Consider and coordinate the use of all transportation methods when developing debris hauling strategies, including the use of:<ul style="list-style-type: none">o road;o rail; ando water (barge).<input type="checkbox"/> Gather data for subsequent debris estimations from the EOC briefings, Section briefings and Operations and Planning Sections, including:<ul style="list-style-type: none">o aerial / terrestrial images or other types of data (e.g. LiDAR);o rapid damage assessments;o damage assessments, ando safety assessments.<input type="checkbox"/> Develop a DDM strategy which identifies locations and types of temporary waste handling facilities to be used for debris collection and processing.<input type="checkbox"/> Plan for opening of sites;<ul style="list-style-type: none">o refer to site analysis where sites need effort to become functional and operational.<input type="checkbox"/> Coordinate opening of temporary waste handling facilities identified for use.<input type="checkbox"/> Plan contingencies for processing and disposal.	

Response Activities Checklist

Logistics

- Confirm availability of all contracted services required through the Procurement division (refer to Section 4.1.11 - Engaging Contractors).
- Determine availability and capacity of existing transfer stations and disposal sites inclusive of recycling facilities and landfills.
- Contact entities with which a mutual aid agreement has been established for disaster debris management, informing them of the intent (or potential) to request aid.
- Through the EOC Logistics Section, request equipment and supplies required for the DDM Team (if required).

Finance

- Inform the EOC Finance Section about disaster debris management specific requirements and available funding.
- Provide the EOC Finance Section with details regarding the disaster debris management specific financial requirements and available funding outlined in Section 3.3 - Finance.
- Provide the EOC Finance Section with copies of all debris tracking forms and invoices received for services and equipment used to address the disaster debris.

3.1.2 Short-Term Recovery (Disaster Debris Phase: Temporary debris collection)

Priorities

In the Short-Term Recovery Phase of a disaster, the goal is **temporary debris collection** with the priorities being:

- damage assessments (subsequent debris estimations); and
- staging, processing and disposal.

Key activities are:

- support personnel on-site with matters pertaining to disaster debris management;
- support the EOC on matters pertaining to disaster debris management;
- maintain situational awareness to assist with disaster debris management planning and coordination;
- complete subsequent debris estimations as needed;
- commence the coordination and opening of additional temporary waste handling facilities, as required;
- ensure all operating sites are staffed, equipped with the required resources and monitored, as needed;
- develop and implement a strategy for the collection of disaster debris;
- coordinate and open temporary waste handling facilities;
- determine additional transfer stations and disposal sites;
- prepare for debris processing and disposal;
- support financial reporting and documentation; and
- document or communicate to the EOC Scribe all activities and decisions for inclusion in the EOC diary.

Note: The following breakdown of activities does not indicate specific positions to be filled within the DDM Team, but rather the areas where the DDM Team member(s) need to coordinate with the established EOC Sections to ensure the key activities are carried out.

The DDM Team will be supported by the EOC sections (Management, Operations, Planning, Logistics, and Finance).

Short-Term Recovery Activities Checklist

Management

- Continue to provide overall management of disaster debris management activities.
- Provide guidance regarding disaster debris management to Section Chiefs within the EOC.
- Maintain contact with the EOC Director, or DDM Lead, from other impacted Local Authorities to share situational information, confirm regional DDM priorities; collaborate on regional DDM decision; and coordinate sharing and allocation of DDM resources.
- Maintain the DDM Team roster.
- Confirm new personnel undertaking DDM activities are aware of responsibilities and use of appropriate DDM plan tools and activities.
- Maintain situational awareness through EOC briefings, Section briefings and communications with the EOC Operations Section, inclusive of what area(s) were impacted and to what degree.
- Confirm all documentation has been completed and submitted to the appropriate EOC Section.

Liaison/ Information

- Provide disaster debris specific information to the Information Officer, which will be used when coordinating communication efforts inclusive of:
 - o disaster specific call centre messages;
 - o media interviews; and
 - o public communications for dissemination through appropriate channels, e.g. media (print, radio, news), corporate websites, flyers/ notifications, and social media.

Short-Term Recovery Activities Checklist

Operations

- Gather data for subsequent debris estimations.
- Conduct subsequent debris estimations (refer to Appendix B).
- Continue coordinating debris clearing activities based on identified priorities.
- Continue coordinating hauling debris activities from neighbourhood drop-off points and collection centres to temporary transfer stations, debris management sites or final re-use, recycling or disposal facilities.
- Prepare sites that need effort to become functional and operational.
- Open temporary waste handling facilities identified for use.
- Support personnel on-site, as requested.
- Communicate with Metro Vancouver Regional District and permanent waste handling facilities regarding the impact to their services, capacity and resources.

Planning

- Identify additional types of debris and associated hazards.
- Update debris clearing priorities.
- Update debris hauling and collection priorities.
- Coordinate the opening of additional temporary waste handling facilities, ensuring they are staffed, and equipped with the required resources.
- Determine debris processing priorities based on identified debris types (refer to Section 4.1.10 - Debris Processing).
- Plan contingencies for processing and disposal.
- Plan for staged public and industry collection, associated logistics and communications.

Short-Term Recovery Activities Checklist

Pre-planning actions for subsequent disaster phases

- Continue gathering data for subsequent debris estimations from the EOC briefings, Section briefings and Operations and Planning Sections, including:
 - o aerial / terrestrial images or other types of data (e.g. LiDAR);
 - o rapid damage assessments;
 - o damage assessments, and
 - o safety assessments.
- Coordinate the use of additional transfer stations and disposal sites.
- Consider the need for long-term storage to address limited capacity and ability of local re-use, recycle and disposal facilities to process the disaster debris.
 - o contingency planning for sites, processing and disposal.
- Plan for medium- and long-term recovery debris management, including:
 - o storage;
 - o processing; and
 - o disposal.

Logistics

- Ensure temporary waste handling facilities are staffed, equipped with the required resources and monitored as needed.
- Confirm availability and capacity of existing transfer stations and disposal sites inclusive of recycling facilities and landfills.
- Request equipment and supplies required for the DDM Team (if required), through the EOC Logistics Section.

Finance

- Assist the EOC Finance Section with any queries related to costs recovery and insurance paperwork being submitted.
- Monitor for emerging disaster debris funding streams and associated requirements to qualify for them.
- Provide the EOC Finance Section with copies of all debris tracking forms and invoices received for services and equipment used to address disaster debris.

3.1.3 Medium-Term Recovery (Disaster Debris Phase: Temporary debris collection and waste handling facilities)

Priorities

In the Medium-Term Recovery Phase of a disaster, the goal is **temporary debris collection and waste handling facilities** with the priorities being:

- damage assessments (on-going debris estimations);
- debris removal (hauling, collection and disposal);
- initiation of demolition and removal; and
- staging, processing and disposal.

Key activities are:

- support the personnel on-site on matters pertaining to disaster debris management, e.g. establish temporary waste handling facilities;
- support the Recovery Operations Centre (ROC) Section Chiefs, on matters pertaining to disaster debris management;
- maintain situational awareness to assist with disaster debris management planning and coordination;
- complete subsequent debris estimations as needed;
- develop and implement a plan for the collection of disaster debris;
- coordinate and open temporary waste handling facilities;
- determine additional transfer stations and disposal sites;
- support financial reporting and documentation; and
- document or communicate to the ROC Scribe all activities and decisions for inclusion in the ROC diary.

Note: The following breakdown of activities does not indicate specific positions to be filled within the DDM Team, but rather the areas where the DDM Team member(s) need to coordinate with the established EOC Sections to ensure the key activities are carried out.

The DDM Team will be supported by the EOC sections (Management, Operations, Planning, Logistics, and Finance).

Medium-Term Recovery Activities Checklist

Management

- Continue to provide overall management of disaster debris management activities.
- Provide guidance regarding disaster debris management to Section Chiefs within the ROC.
- Maintain contact with the ROC Director, or DDM Lead, from other impacted Local Authorities to share situational information, confirm regional DDM priorities; collaborate on regional DDM decision; and coordinate sharing and allocation of DDM resources.
- Maintain roster for DDM Team.
- Confirm new personnel undertaking DDM activities are aware of the relevant DDM plans tools and activities.
- Provide updates to the ROC Director as requested.
- Maintain situational awareness through ROC briefings, Section briefings and communications with the ROC Operations Section, including what area(s) were impacted and to what degree.
- Confirm all documentation has been completed and submitted to the appropriate EOC Section.

Liaison/ Information

- Provide disaster debris specific information to the Information Officer, which will be used when coordinating communication efforts inclusive of:
 - o disaster specific call centre messages;
 - o media interviews; and
 - o public communications for dissemination through appropriate channels, e.g. media (print, radio, news), corporate websites, flyers/ notifications, and social media.

Medium-Term Recovery Activities Checklist

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Operations

- Prepare additional subsequent debris estimations based on data obtained.
- Continue coordinating debris clearing activities based on identified priorities.
- Continue coordinating hauling debris activities from neighbourhood drop-off points and collection centres to temporary transfer stations, debris management sites or final re-use, recycling or disposal facilities.
- Commence and manage the sorting, processing and disposal of debris as per the identified priorities through the opening of temporary waste handling facilities.
- Prepare sites that need effort to become functional and operational.
- Monitor and manage established temporary waste handling facilities.
- Support the personnel on-site as requested.
- Communicate with Metro Vancouver Regional District and permanent waste handling facilities regarding the impact to their services, capacity and resources.

Planning

- Update types of debris and associated hazards.
- Update debris hauling and collection priorities.
- Coordinate the opening of additional temporary waste handling facilities.
- Determine disposal priorities based on identified debris types.
- Plan contingencies for processing and disposal.
- Plan for staged public and industry collection, associated logistics and communications.

Medium-Term Recovery Activities Checklist

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Pre-planning actions for long-term recovery

- Gather data for final debris calculation from the ROC briefings, and Operations and Planning Sections, including:
 - o aerial / terrestrial images or other types of data (e.g. LiDAR);
 - o damage assessments; and
 - o safety assessments.
- Consider and coordinate use of all transportation methods when developing debris hauling strategies, including the use of:
 - o road;
 - o rail; and
 - o water (barge).
- Coordinate the use of additional transfer stations and disposal sites.
 - o there may be a need for long-term storage to address the capacity of local re-use, recycle and disposal facilities processing the increased volume of waste.
- Plan for activation of sites opening.
 - o Refer to site analysis where sites need effort to become functional and operational.
- Plan for prolonged management (>60 days) debris management, including:
 - o storage;
 - o processing; and
 - o disposal.
- Contingency planning for sites, processing and disposal.
 - o Plan for restoration of activated temporary waste handling facilities.

Medium-Term Recovery Activities Checklist	Page 4 of 4
Logistics	
<ul style="list-style-type: none"><input type="checkbox"/> Ensure sites are staffed, equipped with the required resources and monitored as needed.<input type="checkbox"/> Update capacity of existing transfer stations and disposal sites inclusive of recycling facilities and landfills.<input type="checkbox"/> Assess the logistics requirements of temporary and permanent waste handling facilities for long-term disaster debris management.	
Finance	
<ul style="list-style-type: none"><input type="checkbox"/> Assist the ROC Finance Section with any queries related to cost recovery and insurance paperwork being submitted.<input type="checkbox"/> Monitor for emerging disaster debris funding streams and the associated requirements to qualify for them.<input type="checkbox"/> Provide the ROC Finance Section with copies of all debris tracking forms and invoices received for services and equipment used to address disaster debris.	

3.1.4 Long-Term Recovery (Disaster Debris Phase: Debris Management Sites)

Priorities

In the Long-Term Recovery Phase of a disaster, the goal is **managing temporary waste handling facilities** with the priorities being:

- debris removal,
- demolition and removal; and
- processing and disposal.

Key activities are:

- support the personnel on-site, as well as the Recovery Steering Committee Section Chiefs, on matters pertaining to disaster debris management;
- support the Recovery Steering Committee Section Chiefs, on matters pertaining to disaster debris management;
- maintain situational awareness to assist with disaster debris management coordination and planning;
- complete subsequent debris estimations as needed;
- complete the final debris calculation (volume and type) for the disaster;
- coordinate disaster debris removal;
- support financial reporting and documentation; and
- document or communicate to the Scribe all activities and decisions for inclusion in the diary.

Note: The following breakdown of activities does not indicate specific positions to be filled within the DDM Team, but rather the areas where the DDM Team member(s) need to coordinate with the established EOC Sections to ensure the key activities are carried out.

The DDM Team will be supported by the EOC sections (Management, Operations, Planning, Logistics, and Finance).

Long-Term Recovery Activities Checklist

Management

- Continue providing overall management for disaster debris activities.
- Provide guidance regarding disaster debris management to members of the Recovery Steering Committee.
- Maintain contact with the EOC Director, or DDM Lead, from other impacted Local Authorities to share situational information, confirm regional DDM priorities; collaborate on regional DDM decision; and coordinate sharing and allocation of DDM resources.
- Maintain roster for DDM Team.
- Provide updates to the Recovery Steering Committee as requested.
- Obtain situational awareness through Committee briefings, and communications with the on-site personnel.
- Confirm all documentation has been completed and submitted to the Recovery Steering Committee.

Liaison/ Information

- Provide disaster debris specific information to the Information Officer, which will be used when coordinating communication efforts inclusive of:
 - o disaster specific call centre messages;
 - o media interviews; and
 - o public communications for dissemination through appropriate channels, e.g. media (print, radio, news), corporate websites, flyers/ notifications, and social media.

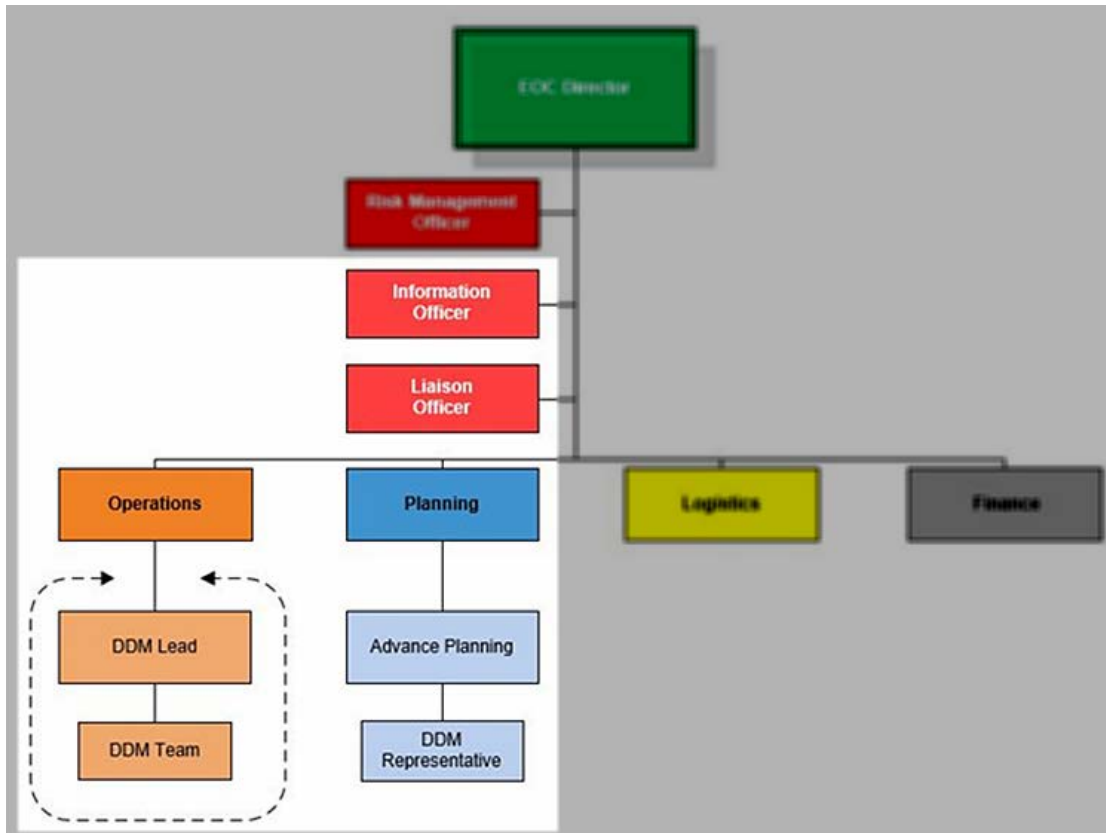
Operations

- Calculate final debris calculation.
- Continue hauling, collection, processing and disposal of debris based on identified priorities.
- Monitor and manage established temporary waste handling facilities.
- Commence closure of temporary waste handling facilities, ensuring sites are restored to their original condition.
- Support the personnel on-site as requested.
- Communicate with Metro Vancouver Regional District and permanent waste handling facilities regarding the impact to their services, capacity and resources.

Long-Term Recovery Activities Checklist	Page 2 of 2
Planning	
<ul style="list-style-type: none"><input type="checkbox"/> Prepare final debris calculation based on data obtained.<input type="checkbox"/> Update types of debris and associated hazards.<input type="checkbox"/> Plan for remediation of activated temporary waste handling facilities.	
Logistics	
<ul style="list-style-type: none"><input type="checkbox"/> Ensure sites are staffed, equipped with the required resources and monitored as needed.<input type="checkbox"/> Update ongoing capacity of existing transfer stations and disposal sites inclusive of recycling facilities and landfills.<input type="checkbox"/> Assess the logistics requirements of temporary and permanent waste handling facilities for long-term disaster debris management.	
Finance	
<ul style="list-style-type: none"><input type="checkbox"/> Assist the Recovery Steering Committee with any queries related to cost recovery and insurance paperwork being submitted. Refer to Section 3.3 - Finance.<input type="checkbox"/> Monitor for emerging disaster debris funding streams and the associated requirements to qualify for them.<input type="checkbox"/> Provide the ROC Finance Section with copies of all debris tracking forms and invoices received for services and equipment used to address disaster debris.	

3.2 Communications

Figure 7 -- Liaison Officer and DDM Team



In an emergency, it is important to communicate in a consistent and timely manner, while ensuring an array of communication channels are utilized to reach those impacted by the disaster.

Within the Incident Command Structure, communications are developed and managed by the Information Officer. In relation to disaster debris, the Information Officer will acquire disaster debris details from the DDM Team, e.g. what day refrigerators are being collected on, per neighbourhood.

The Information Officer will coordinate the communication efforts inclusive of:

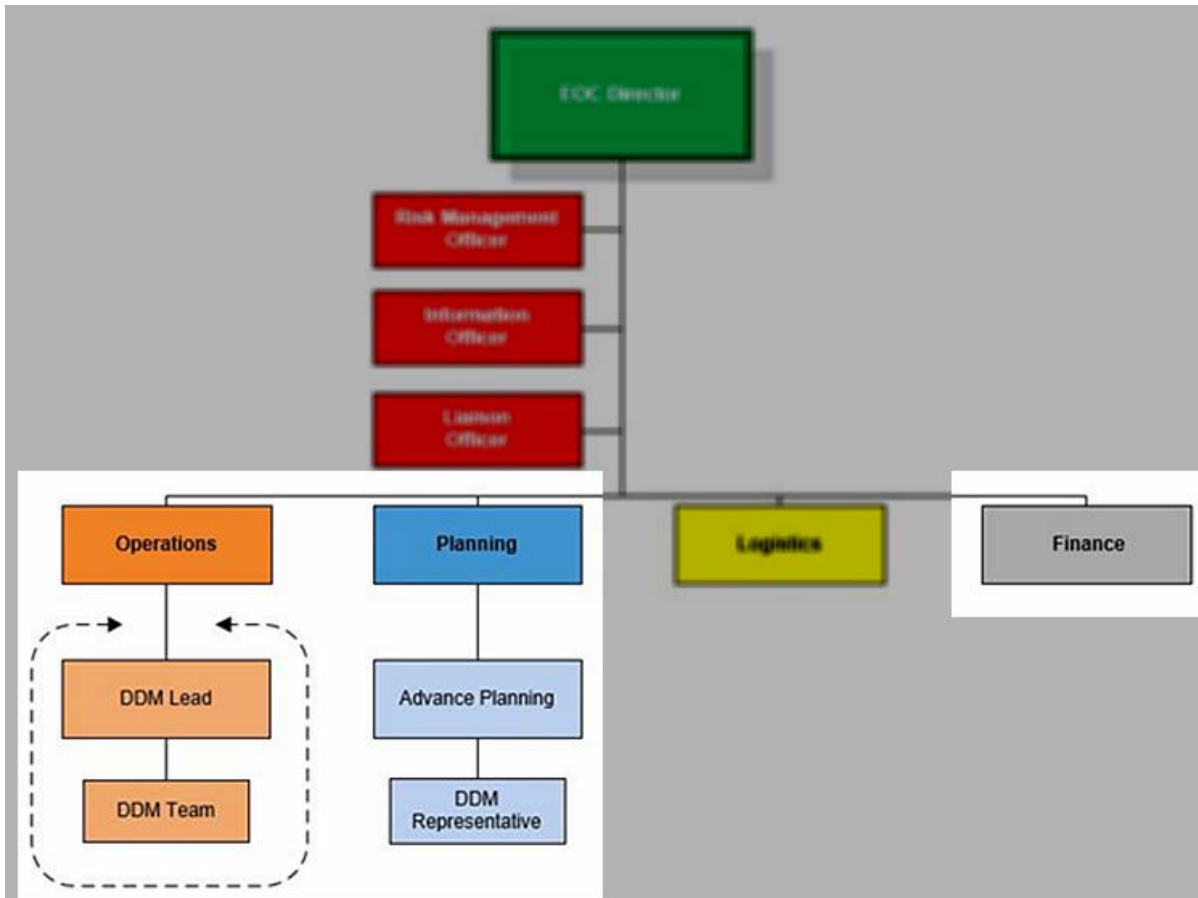
- disaster specific call centre messages;
- media interviews; and
- public service announcements for dissemination through the appropriate channels.

Refer to Appendix L - Public Communications Samples for sample disaster debris communications.

Specific actions pertaining to communications are listed in Sections 3.1 - DDM Team Key Activities by Phase and 4 - Operational Strategies and Procedures.

3.3 Finance

Figure 8 -- DDM Team and Finance



Within the Incident Command Structure, financial considerations and funding will be managed by the Finance Section in the EOC.

To assist the Finance Section in effectively and efficiently undertaking their responsibilities, the DDM Team will need to coordinate and work closely with the Finance Team to determine available disaster debris funding streams and the associated requirements to qualify for them.

The costs of debris management can range from 25-45%⁴ of the total cost of a disaster. Many of these costs can be recovered through financial aid and insurance programs. In BC, the primary programs are the Provincial Disaster Financial Assistance program and Municipal Insurance Association.

Provincial Disaster Financial Assistance is authorized by the *BC Emergency Program Act, Section 20*.

⁴ Source: <http://www.drc-group.com/project/jitt-eoc-debrismanagement.html>

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Scope of assistance, during Response Phase, includes:

- measures taken to reduce the extent of damage by the removal of hazardous materials, valuable chattels, and assets from the area of immediate risk, including the provision of storage space and transportation costs.⁵

Scope of assistance, during Recovery Phase, includes:

- cleanup and debris removal
 - o removal of damaged structures that constitute a threat to public safety
 - o pruning or removal of trees that constitute a threat to public safety
 - o removal of emergency works and the restoration of their sites to pre-disaster condition
 - o necessary clearance of debris and wreckage from channels and streams, intakes and outfalls of sewers and storm drains and water supply reservoirs. *Schedule 5, Section 1(c)*
- insurance deductibles
 - o DFA will support up to 80% the deductible portion;
 - o DFA funds are not available for losses that are insurable, regardless of whether they have insurance or not.

DFA cannot fund the cleanup (and repairs) for which there is no proof of ownership.

Documentation is key to reimbursement. The Finance Team will need to substantiate labour, equipment and contractor costs associated with performing eligible work. Confirm with the Finance Team frequently criteria for eligible work, e.g. overtime hours, definition of eligible work (equipment time, fuel, maintenance, etc.).

It is critical that all DDM activities that are initiated due to a threat to public safety are clearly documented; this will assist in efficient cost recovery.

Debris associated with privately owned buildings needs to be covered by the insurance provider for the building. Debris management processes for privately owned buildings and infrastructure should be minimalized, as cost recovery is negligible for debris that the Local Authority is not responsible for unless it is a threat to public safety.

Early and frequent communications with representatives of Provincial Regional Emergency Operations Centre (PREOC), Municipal Insurance Association, and Insurance Bureau of Canada will assist with awareness of eligibility, coverage, documentation requirements and gaps.

⁵ As per Public Safety Canada's Guidelines for the Disaster Financial Assistance Arrangements: Chapter V, 5.1.1

4. OPERATIONAL STRATEGIES AND PROCEDURES

4.1 RESPONSE ACTIVITIES

4.1.1 Situational Awareness

Situational awareness should be maintained throughout all disaster debris management activities. The information which is obtained through this activity will assist in determining the debris estimations, and requirements for resources, sites and advance planning needs.

DDM Team members will need to listen to and observe other teams within the EOC to determine what is relevant to disaster debris management. Information specific to disaster debris can be obtained through:

- rapid damage assessments (visual/ windshield);
- damage assessments (inspected by registered professionals);
- EOC and Section briefings;
- situation reports;
- aerial/ terrestrial images or other types of data (e.g. LiDAR);
- social media pictures; and
- news broadcasts.

During the response phase, specific activities undertaken to obtain situational awareness may include, but are not limited to:

- Gather data to provide situational awareness from the EOC briefings, Section briefings and Operations and Planning Sections, including:
 - o aerial/ terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency assessments (rapid damage, damage and safety);
 - o initial debris estimations for the total impacted area, regardless of jurisdiction;
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.
- Input debris specific items to the damage assessment team checklist.
- Consider the potential for a resource limited environment; access resources already available.

4.1.2 Debris Monitoring

Debris monitoring should be completed throughout all disaster debris management activities.

Through use of Appendix M – Debris Tracking Template, the DDM Team will be able to track the movement of debris from the impacted area through to the temporary waste handling facilities or final disposal sites.

During the response phase, specific activities undertaken when monitoring debris may include, but are not limited to:

- Provide debris tracking forms to the Logistics Section for distribution to personnel and/ or contractors performing debris hauling.
- Through use of the debris tracking forms, identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Request all completed debris tracking forms from personnel and/or contractors be submitted to the DDM Team in the EOC, taking note of debris types and associated hazards.
- Collate the data provided in the debris tracking forms provided from personnel and/or contractors, taking note of debris types and associated hazards.
- Submit all processed debris tracking forms to the Documentation Section for filing purposes.
- Include any pertinent information regarding debris monitoring in EOC briefings.
- Provide accurate information regarding debris movement to the Information Officer for inclusion in public service announcements.

4.1.3 Identifying Debris Types and Associated Hazards

The DDM team will need to identify what types of debris and associated hazards are present. The identification of materials present will provide critical information when establishing temporary waste handling facilities, and assist in determining what facilities need to be accessed for final re-use, recycling, energy recovery and disposal.

Determination of debris types and associated hazards; and guidelines on re-use, recycle, energy recovery or disposal methods are provided in Appendix C - Debris Separation and Processing.

During the response phase, activities to identify debris types and hazards may include, but are not limited to:

- Gather data to identify debris types and associated hazards present from briefings, and Operations and Planning Sections, including:
 - o aerial/ terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency assessments (rapid damage, damage and safety);
 - o initial debris estimations for the total impacted area regardless of jurisdiction;
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.
- Determine what debris types and associated hazards are present.
- Through use of the debris tracking forms (Appendix M - Debris Tracking Template), identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Include any pertinent information regarding debris types and associated hazards in EOC briefings.

4.1.4 Debris Estimations

The Operations Section is responsible for completing the initial debris estimate for the impacted area within their jurisdiction. This is a vital step in determining how much debris will need to be managed. Information gathered through debris forecasting, debris monitoring, and identifying debris types and associated hazards will provide the information required to complete this activity.

Debris estimations are conducted for both public and private land. Although Local Authorities are only responsible for addressing the debris on public lands, the debris from private lands may be collected and then disposed of through the temporary waste handling facilities implemented by Local Authorities, or through the permanent waste handling facilities, which already exist within the impacted area. Therefore, it is important to coordinate efforts and communicate with private land owners on how they should dispose of debris.

Should the Plan be activated, the DDM Team will be tasked with completing subsequent debris estimations and the final debris calculation. Refer to Appendix B for information on the initial and subsequent debris estimation tools, and the final debris calculation.






The use of the same estimation methodology by all Local Authorities is critical to providing common objective measurements for decision making and situational awareness across the Metro Vancouver region.

During the response phase, activities to estimate the amount of debris may include, but are not limited to:

- ❑ Gather data for the initial debris estimate from EOC briefings, Section briefings and Operations and Planning Sections, including:
 - o debris forecasting from Local Authority Disaster Debris Management Plans;
 - o aerial/ terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency assessments (rapid damage, damage and safety);
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.
- ❑ Perform the initial debris estimate calculation for the total impacted area to assist with debris hauling and clearing efforts (refer to Sections 4.1.5 - Debris Clearing and 4.1.7 - Debris Hauling for further information), by referencing the Local Authority's Building Inventory.
- ❑ Determine the level of activation for the emergency event (refer to Figure 6 -- Activation Level).
- ❑ Include any pertinent information regarding debris estimations in EOC briefings as part of recovery planning.

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Visual references, to provide gross estimates of the volume of debris:

Visual Estimation References		
Visual Reference	Item	Dimensions
	Debris pile the size of a Porta-potty	1.5 m ³
	Roll-off bin volume	4.6 m x 1.8 m x 1.8 m: 15 m ³
	Tandem-axel dump truck volume	10 m ³
	Dump trailer volume	(12.8 m x 2.6 m x 1.8 m: 64 m ³)
	Single Story Family Home	140 m ³
	Mobile Home	Single wide 220 m ³ Double wide 315 m ³
	One acre of debris pile i.e. size of a football field	4050 m ² 3m high debris pile: 12,319 m ³

4.1.5 Debris Clearing

Debris clearing is the action of removing debris from transportation routes, such as roads, rail, and waterways. Debris clearing does not include collection of debris materials. It is the sole act of removing debris from transportation routes, and providing access to critical infrastructure. It will result in debris accumulating beside or near these facilities until such a time as the DDM Team has organized and commenced collection activities.

The primary objective during the response phase of this activity is to ensure emergency services personnel can provide critical services to the Local Authority, and to remove any life-threatening debris and waste from the impacted area.

From a Local Authority perspective, the activity of debris clearing is related to public land only, as debris on private land is the responsibility of the land owner, unless the debris is posing a public safety hazard.

Any private property debris cleared must be documented with appropriate details of being a public safety hazard.

During the response phase, activities for debris clearing may include, but are not limited to:

- Review pre-identified clearing routes for baseline approval. Incorporate disaster specific needs and EOC priorities.
- Implement the debris clearing priorities and strategies for the disaster.
- Submit a request to the Logistics Section for all specified equipment and/ or personnel.
- Provide relevant and appropriate information on debris clearing to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris clearing in EOC briefings.

4.1.6 Debris Classification

The DDM Team will need to classify the debris to identify site requirements, prior to debris hauling and collection. Debris hauling efforts may be limited in a regional activation until temporary and/or permanent waste handling facilities have been identified.

Once the classification of debris is complete, the DDM Team should review and consider impacts to:

- Capability and logistics required for the hauling of the debris safely and appropriately;
- Logistics, resources and capabilities required to manage and store the debris safely and appropriately; and
- The facilities required for final re-use, recycling, energy recovery and disposal.

During the response phase, activities for debris classification may include, but are not limited to:

- Review what debris types are present; reference Identifying debris types and Associated Hazards.
- Analyze the debris types for associated hazards.
- Communicate to Public Works personnel and Contractors protective measures required for safe hauling, handling, and storage of the identified debris types.
- Determine what types of sites should be open based upon the debris classification and requirements to safely manage the disaster debris.
- Determine which sites are best able to address the management and special considerations of the debris as classified; consider the pre-identified temporary waste handling facilities first.
- Include any pertinent information regarding debris types and associated hazards in EOC briefings.

4.1.7 Debris Hauling

After a disaster, debris will need to be removed from across the impacted area and sorted for re-use, recycling or disposal. The act of moving the debris from one location to another is classified as debris hauling.

For public land, this activity may be undertaken by the Local Authority's Public Works/ Engineering Department utilizing available employees and resources, or contracted services (refer to Section 4.1.11 - Engaging Contractors).

For private land, this activity is addressed by the private land owner. Local Authorities do not have jurisdiction to go on to private land without a Local Declaration State of Emergency.

All debris will need to be tracked and documented. By doing so, the Local Authority is able to accurately monitor, assess and analysis the debris volume and types to process and reduce or mitigate risks, and aid in financial reimbursement processes. Debris tracking templates are available in Appendix M - Debris Tracking Template.

Any private property debris cleared must be documented with appropriate details of being a public safety hazard.

When tracking, and hauling debris during the response phase, activities may include, but are not limited to:

- Establish where the debris is located, and what special considerations may need to be made in regard to hazardous materials.
- Consider use and applicability of all methods of debris hauling, including:
 - o road;
 - o water; and
 - o rail.
- Request those hauling debris identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Monitor to ensure all Public Works personnel and contractors are completing and submitting the debris tracking forms.
- Determine if supplemental or alternate resources are needed for debris hauling.

4.1.8 Activation of Temporary Waste Handling Facilities

Pre-identified sites may be used as various types of temporary waste handling facilities (refer to Section 2.2 - Types of Temporary Waste Handling Facilities), including:

- neighbourhood drop-off points;
- collection centres;
- temporary transfer stations (TTS); and
- debris management sites (DMS).

Prior to activating any pre-identified or new sites, the DDM Team should consider the following:

- curbside collection and neighbourhood drop-off points are the responsibility of individual Local Authorities and are not addressed at the regional level.
 - curbside collection, neighbourhood drop-off points and collection centres are only effective if members of the public are able to transport debris to the site location.
- regional recycle and disposal facilities may be limited in functionality or capacity, making curbside collection and neighbourhood drop-off points a viable option to manage debris in the early days of the emergency event and to assist debris clearing.
- where possible the following types of debris should be taken directly to a landfill or disposal site, rather than being stored or managed in a TTS or DMS:
 - vehicles;
 - boats;
 - heavy duty equipment;
 - healthcare waste;
 - sediment, soil, and liquefaction silt; and
 - concrete and rocks.
- DMS may not be set up until the short- or medium-term phases; staggered and delayed options to open sites can be considered.
- efforts to minimize handling costs should be made as it may be challenging to recoup the operating costs associated with multiple facilities.

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During the response phase, activities to activate temporary waste handling facilities may include, but are not limited to:

- Determine the types and number of sites required, based on debris estimations.
- Assess pre-identified and other potential sites which may be available for use, using the Site Identification and Suitability Matrix (Appendix G).
- Determine what the site requires to be functional.
- Initiate preparation activities.
- Determine when the site can be made functional and used.
- Submit a request to the Logistics Section for all specified equipment and/or personnel.
- Provide relevant and appropriate information about the temporary waste handling facilities to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding temporary waste handling facilities in EOC briefings.

4.1.9 Debris Collection

Debris from public and private lands will be collected at established temporary waste handling facilities. However, the responsibility for collecting the debris varies.

If on public land (e.g. municipal parks), the Local Authority will coordinate the debris collection.

If on private land (e.g. residential dwellings), the land owner is responsible and may be required to transport debris to the temporary waste handling facilities set up to service the surrounding area.

Debris collection is likely to rely on the rapid disposal of mixed solid waste loads, with less emphasis on re-use, recycling and energy recovery opportunities. However, where possible, collection centres should be set up and members of the public encouraged to self-sort.

Considerations for private land debris collection, include:

- clean-up operations on private lands is the responsibility of private land owners;
- debris threatening public health or safety may be prioritized to be collected by the Local Authority;
- work may hinge on discussions with insurance companies; and
- involvement of the Local Authority in private land cleanup could be met with public discord.

During the response phase, activities for debris collection may include, but are not limited to:

- Consider the debris types (refer to Appendix C - Debris Separation and Processing) and facility capacity before commencing the collection of debris.
- Confirm if local facilities can manage the volume of debris resulting from the disaster; consider facilities in neighbouring Local Authorities, regions and even out-of-province to support debris processing.
- Reference the debris clearing priorities to schedule collection.
- Submit a request to the Logistics Section for all specified equipment and/or personnel.
- Provide information on debris collection to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris collection in EOC briefings as part of recovery planning.

4.1.10 Debris Processing

When managing disaster debris there are four primary methods of addressing the debris:

- re-use;
- recycle;
- energy recovery; and
- dispose.

Where possible it is preferable to **re-use** first, **recycle** second, **energy recovery** third, and should none of these options be viable, **dispose** of the debris.

Considering the size of the disaster and amount of debris generated, there may be limited capacity to manage the debris with permanent waste handling facilities. An option to enhance capacity is to establish supplemental temporary waste handling facilities, such as temporary transfer stations (TTS) or debris management sites (DMS). These facilities aid in addressing the debris and would lower the overall costs of waste handling if re-use and recycling sections are set up and operating within the TTS/ DMS.

During the response phase, activities for debris processing may include, but are not limited to:

- Determine availability and capacity of permanent waste handling facilities inclusive of recycling facilities and landfill.
- Investigate options to process debris when local facilities are at capacity or are inaccessible; procure alternatives within or outside the region.
- Provide relevant and appropriate information on debris processing to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris processing in EOC briefings as part of recovery planning.

4.1.11 Engaging Contractors

After a disaster, solid waste services available through Local Authorities may be used for other activities besides debris management, or there may be an insufficient number of resources, both personnel and equipment, available to address the demands of disaster debris management.

During response, activities for engaging contractors during the response phase may include, but are not limited to:

- Submit a request to the Logistics Section to engage *local* contractors.
- Request mutual aid to support debris activities.
- Submit a request to the Logistics Section to engage *new* contractors, including out-of-region service providers.
- Request assistance from the EOC Director to settle disputes with other Local Authorities regarding access to limited resources, such as contracted services.
- Provide relevant and appropriate information on contractor engagement to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding contractor engagement in EOC briefings as part of recovery planning.

4.2 RECOVERY ACTIVITIES

4.2.1 Situational Awareness

Situational awareness should be maintained throughout all disaster debris management activities. The information which is obtained through this activity will assist in determining the debris estimations, and requirements for resources, sites and advance planning needs.

DDM Team members will need to listen to and observe other teams within the EOC or Recovery Operations Centre (ROC) to determine what is relevant to disaster debris management.

Information specific to disaster debris can be obtained through:

- rapid damage assessments (visual/ windshield);
- damage assessments (inspected by registered professionals);
- EOC and Section briefings;
- situation reports;
- aerial/ terrestrial images or other types of data (e.g. LiDAR);
- social media pictures; and
- news broadcasts.

During the recovery phase, specific activities undertaken to obtain situational awareness may include, but are not limited to:

- Gather data to provide situational awareness from the EOC/ ROC briefings, Section briefings and Operations and Planning Sections, including:
 - o aerial/ terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency damage assessments (rapid damage, initial damage and safety);
 - o initial debris estimations for the total impacted area regardless of jurisdiction;
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.
- Input debris specific items to the damage assessment team checklist.
- Consider the potential for a resource limited environment, access resources already available.

4.2.2 Debris Monitoring

Debris monitoring should be completed throughout all disaster debris management activities.

Through use of the Debris Tracking Forms in Appendix M – Debris Tracking Template, the DDM Team will be able to track the movement of debris from the impacted area through to the temporary waste handling facilities or final disposal sites.

During the recovery phase, specific activities undertaken when monitoring debris may include, but are not limited to:

- Provide debris tracking forms to the Logistics Section for distribution to personnel and/ or contractors performing debris hauling.
- Through use of the debris tracking forms, identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Request all completed debris tracking forms from personnel and/or contractors be submitted to the DDM Team in the EOC/ ROC, taking note of debris types and associated hazards.
- Collate the data provided in the debris tracking forms provided from personnel and/or contractors, taking note of debris types and associated hazards.
- Submit all processed debris tracking forms to the Documentation Section for filing purposes.
- Include any pertinent information regarding debris monitoring in EOC/ ROC briefings.
- Provide accurate information regarding debris movement to the Information Officer for inclusion in public service announcements.

4.2.3 Identifying Debris Types and Associated Hazards

The DDM team will need to identify what types of debris and associated hazards are present. The identification of materials present will provide critical information when establishing temporary waste handling facilities, and assist in determining what facilities need to be accessed for final re-use, recycling, energy recovery and disposal.

Determination of debris types and associated hazards; and guidelines on re-use, recycle, energy recovery or disposal methods are provided in Appendix C - Debris Separation and Processing.

During recovery, specific activities when identifying debris types and hazards may include, but are not limited to:

- Gather data to identify any new debris types and associated hazards present briefings, and Operations and Planning Sections, including:
 - o aerial/terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency assessments (Rapid damage, damage and safety);
 - o subsequent and total debris estimations for the total impacted area.
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.
- Determine what new debris types and associated hazards are present.
- Identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Include any pertinent information regarding debris types and associated hazards in EOC/ ROC briefings.

4.2.4 Debris Estimations

During the Response Phase, the Operations Section will have completed an initial debris estimate for the impacted area within their jurisdiction, which supported decision-making pertaining to the activation of their Plan. If the Plan was activated, the DDM Team will be tasked with completing subsequent debris estimations, and the final debris calculation.

Completing these debris estimations is a vital step in determining accurate debris volumes and weights, which influences what DDM strategies are utilized. Information gathered from the initial debris estimate, debris monitoring, and identifying debris types and associated hazards will provide the data required to complete the formulas provided in Appendix B.

Calculating debris estimations using these tools can take considerable time, and requires a building inventory, pre-assigned HAZUS building types, and estimations of building damage based on field observation.

Although there are other tools available, the use of the same estimation methodology by all Local Authorities is critical to providing a common objective measurement for decision-making and situational awareness across the Metro Vancouver region. Dependent of the scale and scope of the emergency event, the Province may access the HAZUS modelling tool, to support Local Authorities in completing these estimations.

It is important to note that debris estimations are conducted for both public and private land. Although Local Authorities are only responsible for addressing the debris on public lands, the debris from private lands may be collected and then disposed of through the temporary waste handling facilities implemented by Local Authorities, or through the permanent waste handling facilities, which already exist within the impacted area. Therefore, it is important to coordinate efforts and communicate with private land owners on how they should dispose of debris.

During the recovery phase, activities to estimate the amount of debris may include, but are not limited to:

- ❑ Gather data to update the debris estimation from briefings, and Operations and Planning Sections, including:
 - o debris forecasting from Local Authority Disaster Debris Management Plans;
 - o aerial/ terrestrial images or other types of data (e.g. LiDAR);
 - o relevant agency assessments (rapid damage, damage and safety);
 - o social media pictures;
 - o news broadcasts; and
 - o debris tracking forms.

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- Perform subsequent debris estimation calculation for the total impacted area intermittently to assist with debris clearing and hauling efforts as data is updated, and additional damage assessments are performed, by referencing the Local Authority's Building Inventory.
- Perform final debris calculation for the total impacted area.
- Include any pertinent information regarding debris estimations in EOC/ROC briefings as part of recovery planning.

4.2.5 Debris Clearing

Debris clearing is the action of removing debris from transportation routes, such as roads, rail, and waterways. Debris clearing does not include collection of debris materials. It is the sole act of removing debris from transportation routes, and providing access to critical infrastructure. It will result in debris accumulating beside or near these facilities until such a time as the DDM Team has organized and commenced collection activities.

The primary objective during the response phase of this activity is to ensure emergency services personnel can provide critical services to the Local Authority, and to remove any life-threatening debris and waste from the impacted area.

From a Local Authority perspective, the activity of debris clearing is related to public land only, as debris on private land is the responsibility of the land owner, unless the debris is posing a public safety hazard.

Any private property debris cleared must be documented with appropriate details of being a public safety hazard.

During recovery, activities for clearing debris may include, but are not limited to:

- Complete all debris clearing priorities and strategies identified for the disaster.
- Submit a request to the Logistics Section for all specified equipment and/ or personnel.
- Provide information on debris clearing to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris clearing in EOC/ ROC briefings.

4.2.6 Debris Classification

The DDM Team will need to classify the debris to identify site requirements, prior to debris hauling and collection. Debris hauling efforts may be limited in a regional activation until temporary and/or permanent waste handling facilities have been identified.

Once the classification of debris is complete, the DDM Team should review and consider impacts to:

- Capability and logistics required for the hauling of the debris safely and appropriately;
- Logistics, resources and capabilities required to manage and store the debris safely and appropriately; and
- The facilities required for final re-use, recycling, energy recovery and disposal.

During the recovery phase, activities for debris classification may include, but are not limited to:

- Review what debris types are present; reference Identifying Debris Types and Associated Hazards.
- Analyze the debris types for associated hazards.
- Communicate to Public Works personnel and Contractors protective measures required for safe hauling, handling, and storage of the identified debris types.
- Determine what types of sites should be open based upon the debris classification and requirements to safely manage the disaster debris.
- Determine which sites are best able to address the management and special considerations of the debris as classified; consider the pre-identified temporary waste handling facilities first.
- Include any pertinent information regarding debris types and associated hazards in EOC briefings.

4.2.7 Debris Hauling

After a disaster, debris will need to be removed from across the impacted area and sorted for re-use, recycling or disposal. The act of moving the debris from one location to another is classified as debris hauling.

For public land, Public Works may undertake this activity utilizing available employees and resources, or contracted services.

For private land, the private land owner manages this activity.

All debris will need to be tracked and documented. By doing so, the Local Authority is able to accurately monitor, assess and analysis the debris volume and types to process and reduce or mitigate risks, and to aid in financial reimbursement processes. Samples of debris tracking forms are available in Appendix M - Debris Tracking Template.

Any private property debris cleared must be documented with appropriate details of being a public safety hazard.

During recovery, activities to track and haul debris may include, but are not limited to:

- Confirm where the debris is located, and what special considerations may need to be made in regard to hazardous materials.
- Consider use and applicability of all methods of debris hauling, including:
 - o road;
 - o water; and
 - o rail.
- Determine if additional resources are required to complete debris hauling.
- Request additional resources identified be sourced by the Logistics Section.
- Request those hauling debris identify the location from which the debris was found, tagging any valuables or personal possessions found.
- Monitor to ensure all Public Works personnel and contractors are completing and submitting the debris tracking forms.
- Determine if supplemental or alternate resources are needed for debris hauling.

4.2.8 Activation of Temporary Waste Handling Facilities

Pre-identified sites may be used as various types of temporary waste handling facilities (refer to Section 2.2 - Types of Temporary Waste Handling Facilities), including:

- neighbourhood drop-off points;
- collection centres;
- temporary transfer stations (TTS); and
- debris management sites (DMS).

Prior to activating any pre-identified or new sites, the DDM Team should consider the following:

- curbside collection and neighbourhood drop-off points are the responsibility of individual Local Authorities and are not addressed at the regional level.
 - curbside collection, neighbourhood drop-off points and collection centres are only effective if members of the public are able to transport debris to the site location.
- regional recycle and disposal facilities may be limited in functionality or capacity, making curbside collection and neighbourhood drop-off points a viable option to manage debris in the early days of an emergency event and to assist debris clearing.
- where possible the following types of debris should be taken directly to a landfill or disposal site, rather than being stored or managed in a TTS or DMS:
 - vehicles;
 - boats;
 - heavy duty equipment;
 - healthcare waste;
 - sediment, soil, and liquefaction silt; and
 - concrete and rocks.
- DMS may not be set up until the short- or medium-term phases; staggered and delayed options to open sites can be considered.
- efforts to minimize handling costs should be made as it may be challenging to recoup the operating costs associated with multiple facilities.

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During the recovery phase, activities to activate temporary waste handling facilities may include, but are not limited to:

- Confirm the types and number of sites required, based on debris estimations.
- Assess pre-identified and other potential sites which may be available for use, using the Appendix G -Site Identification and Suitability Matrix.
- Determine what the site requires to be functional.
- Initiate preparation activities.
- Determine when the site can be made functional and used.
- Submit a request to the Logistics Section for all specified equipment and/or personnel.
- Coordinate the opening of sites identified.
- Support Operations of temporary waste handling facilities as requested or required from the site, which may include:
 - o staffing;
 - o operational needs; and
 - o risk assessment and mitigation.
- Commence closure of and remediation of site.
- Provide relevant and appropriate information about the temporary waste handling facilities to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding temporary waste handling facilities in EOC briefings.

4.2.9 Debris Collection

Debris from public and private lands will be collected at established temporary waste handling facilities. However, the responsibility for collecting the debris varies.

If on public land, the Local Authority will coordinate the debris collection.

If on private land, the land owner is responsible and may be required to transport debris to the temporary waste handling facilities set up to service the surrounding area.

Debris collection is likely to rely on the rapid disposal of mixed solid waste loads, with less emphasis on re-use, recycling and energy recovery opportunities. However, where possible, collection centres should be set up and members of the public encouraged to self-sort.

Considerations for private land debris collection, include:

- clean-up operations on private lands is the responsibility of private land owners;
- debris threatening public health or safety may be prioritized to be collected by the Local Authority;
- work may hinge on discussions with insurance companies; and
- involvement of the Local Authority in private land cleanup could be met with public discord.

During the recovery phase, activities for debris collection may include, but are not limited to:

- Confirm if local facilities can manage the volume of debris resulting from the disaster; consider facilities in neighbouring Local Authorities, regions and even out-of-province to support debris processing.
- Reference the debris clearing priorities to schedule collection.
- Submit a request to the Logistics Section for all specified equipment and/or personnel.
- Provide information on debris collection to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris collection in EOC briefings as part of recovery planning.

4.2.10 Debris Processing

When managing disaster debris there are four primary methods of addressing the debris:

- re-use;
- recycle;
- energy recovery; and
- dispose.

Where possible it is preferable to **re-use** first, **recycle** second, **energy recovery** third, and should none of these options be viable, **dispose** of the debris.

Considering the size of the disaster and amount of debris generated, there may be limited capacity to manage the debris with permanent waste handling facilities. An option to enhance capacity is to establish supplemental temporary waste handling facilities, such as temporary transfer stations (TTS) or debris management sites (DMS). These facilities aid in addressing the debris and would lower the overall costs of waste handling if re-use and recycling sections are set up and operating within the TTS/ DMS.

During recovery, the activities for debris processing may include, but are not limited to:

- Determine availability and capacity of permanent waste handling facilities inclusive of recycling facilities and landfills.
- Investigate options to process debris when local facilities are at capacity or are inaccessible; procure alternatives within or outside the region.
- Commence and complete closure and remediation of all temporary waste handling facilities once all debris has been processed.
- Provide relevant and appropriate information on debris processing to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding debris processing in EOC briefings as part of recovery planning.

4.2.11 Engaging Contractors

After a disaster, solid waste services available through Local Authorities may be used for other activities besides debris management such as restoration of services, or there may be an insufficient number of resources, both personnel and equipment, available to address the demands of disaster debris management.

During recovery, activities for contracting services may include, but are not limited to:

- Submit a request to the Logistics Section to engage *local* contractors.
- Request mutual aid to support debris activities.
- Submit a request to the Logistics Section to engage *new* contractors, including out-of-region service providers.
- Request assistance from the EOC/ ROC Director to settle disputes with other Local Authorities regarding access to limited resources, such as contracted services.
- Provide relevant and appropriate information on contractor engagement to the Information Officer for public release (refer to Appendix L - Public Communications Samples).
- Include any pertinent information regarding contractor engagement in EOC/ ROC briefings as part of recovery planning.

GLOSSARY

Word/ Phrase (Abbreviation)	Definition
British Columbia Emergency Management System (BCEMS)	A recognized standard system for emergency response within the Province of British Columbia, which is currently mandated for use within the Government of B.C. and recommended to governmental bodies.
Collection centres	A temporary site set up to collect disaster debris throughout the impacted area. These sites assist with the collection and sorting debris, which will then be taken directly to the appropriate re-use, recycle or disposal site/ facility and are used only when members of the public can transport debris to the stations.
Dangerous Goods (DG)	<i>“A product, substance or organism included by its nature or by the regulations in any of the classes listed in the (Classes of Dangerous Goods) schedule.” [Transport Canada]</i>
Debris classification	The act of classifying debris for the purposes of commencing debris hauling and identifying temporary waste handling facilities.
Debris clearing	The act of clearing debris for the purposes of access and egress as prioritized by the EOC to meet the BCEMS goals.
Debris clearing prioritization	A Disaster Debris Management preparedness activity which uses existing mapping (e.g. snow removal routes, to identify key transportation routes), that will be prioritized for the activity of debris clearing.
Debris collection	The act of gathering debris from the impacted area.
Debris estimation	An activity which estimates the physical amount of disaster debris caused by a specific emergency event.

Joint Municipal Regional Disaster Debris Management Operational Plan

Word/ Phrase (Abbreviation)	Definition
Debris forecasting	A preparedness activity which estimates the volume of anticipated debris after a given emergency event based on materials present in defined areas.
Debris hauling	The act of moving debris from one location to another.
Debris Management Site (DMS)	A temporary site set up to collect, sort and reduce debris prior to being taken to the appropriate re-use, recycle or disposal site/facility. These sites have limited or no public access.
Debris processing	The act of sorting, reducing and disposing of debris.
Disaster	<i>“A calamity that (a) is caused by accident, fire, explosion, or technical failure or by the forces of nature, and (b) has resulted in serious harm to the health, safety, or welfare of people, or in widespread damage to property.” [BC Emergency Program Act]</i>
Disaster Debris	Various debris materials resulting from an emergency event.
Disaster Debris Management (DDM)	Coordination and management of activities related to debris caused by an emergency event.
Disaster Debris Phases	The phase(s) of management disaster debris.
Disaster Financial Assistance (DFA)	Financial assistance available for disasters the provincial government has declared eligible. Once declared, the DFA program may compensate individuals for essential uninsurable losses and/or reimburse local authorities for some response and recovery debris management activities.
Disaster Response Transportation (DRT) or formally known as Disaster Response Routes (DRR)	Pre-designated roadways that are utilized to enable emergency services and supplies to move quickly to where the need is greatest. This includes transporting and treating sick and injured people, fire suppression, restoring water and electricity, and other critical services.

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Word/ Phrase (Abbreviation)	Definition
Emergency	<p><i>“A present or imminent event or circumstance that:</i></p> <p><i>(a) is caused by accident, fire, explosion, technical failure or the forces of nature, and</i></p> <p><i>(b) requires prompt coordination of action or special regulation of persons or property to protect the health, safety or welfare of a person or to limit damage to property.” [BC Emergency Program Act]</i></p>
Emergency Management British Columbia (EMBC)	<p><i>“The provincial government’s lead coordinating agency for all emergency management and business continuity activities. It is responsible for reviewing BCEMS every four years to ensure that the system continues to reflect best practice and meet the needs in the field.” [BCEMS Guide]</i></p>
Emergency Operations Centre (EOC)	<p><i>“A facility where key personnel can gather to coordinate, plan, and manage overall response activities. It provides support to the site by facilitating long term operations, providing centralized access to information, and assisting in the identification, prioritization, and allocation of resources.” [BCEMS Guide]</i></p>
Final disposal	<p>The final resting place of processed debris that is not recyclable or re-usable, e.g. landfills.</p>
Final disposal sites/ facilities	<p>A facility or nominated site which is the debris’ final resting place.</p>
Geographic Information System (GIS)	<p>A software system that allows users to visualize, question, analyze, and interpret data to understand relationships, patterns, and trends.</p>
Household Hazardous Waste (HHW)	<p>Household Hazardous Waste includes items such as gasoline cans, paint, batteries, cleaning agents, lawn chemicals, etc.</p>
Incident Command System (ICS)	<p>A standardized approach to the command, control, and coordination of emergency response providing a common hierarchy within which responders from multiple agencies can be effective.</p>

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Word/ Phrase (Abbreviation)	Definition
Local Authority	<i>“(a) for municipality, the municipal council, (b) for an electoral area in a regional district, the board of the regional district.” [BC Emergency Program Act]</i>
Municipal Liquid Waste	“Refers to any source of waste that is discharged into the municipal sewer system is discharged into the ground or a municipal sewer system; waste specified by a director to be included in a waste management plan.” [BC <i>Environmental Act</i>]
Municipal Solid Waste	“Refuse that originates from residential, commercial, institutional, demolition, land clearing or construction sources, or waste specified by a director to be included in a waste management plan.” [BC <i>Environmental Act</i>]
Neighbourhood Drop-off Points	A temporary station set up to collect disaster debris throughout the impacted area, e.g. on the corner of each impacted block. These stations assist with the collection and sorting of debris, which will then be taken directly to the appropriate re-use, recycle or disposal site/ facility, and are used only when members of the public are able to transport debris to the stations.
Personal Property	Personal property includes furniture, appliances, clothing and “other personal property”, e.g. home content excluding fixtures.
Polychlorinated Biphenyl (PCBs)	<i>“Fluorescent lighting ballasts, power transformers, generators and other power supply and management equipment.” [Metro Vancouver DLC Waste Management Toolkit]</i>
Phases	The phase(s) of emergency response post an emergency event, inclusive of response and recovery stages.
Provincial Regional Emergency Operations Centre (PREOC)	<i>“Provides and coordinates provincial support for local authorities and First Nations within designated regional boundaries.” [BCEMS Guide]</i>
Putrescible Municipal Solid Waste	Food waste, human remains, and animal remains inclusive of perished livestock.

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Word/ Phrase (Abbreviation)	Definition
Re-use/ recycling facilities	A facility that specializes in the management of re-use and recycle materials.
Recovery Operations Centre (ROC)	A facility where key personnel can gather to coordinate, plan, and manage overall recovery activities. It provides support to the site by facilitating long term operations, providing centralized access to information, and assisting in the identification, prioritization, and allocation of resources.
Safety Assessment	An assessment completed by agencies and organizations to determine whether it is safe for their employees to complete work-related activities, either at their place of business or offsite.
Site identification	A process of identifying and assessing sites for possible use as temporary waste handling facilities, e.g. neighbourhood drop-off points, collection centres, temporary transfer stations (TTS) and debris management sites (DMS).
Temporary Transfer Station (TTS)	A temporary site set up to collect disaster debris from neighbourhood drop-off points and/or collection centres prior to being transported to a debris management site (DMS) or re-use, recycle, disposal facility. These sites have limited or no public access.
Valuables and Personal Possessions	Art, antiques, jewelry, money, photographs, items having sentimental value.
White Goods	Refrigerators, ranges, freezers, washing machines, and dryers.

Appendices

A. HAZUS DEBRIS FORECASTING

Disaster Debris Estimates for Metro Vancouver Based on Hazus-MH Methodology Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Analytic Methods

Assessment of physical vulnerability and damage potential for the Metro Vancouver area is based on procedures outlined in the Hazus loss estimation methodology for both aggregate and building specific analysis (FEMA 2011). As illustrated in Figure 1, the likelihood of building damage is a function of hazard exposure, type of construction and conformance to National Building Code guidelines for seismic safety. At the heart of the Hazus methodology is an extensive library of fragility curves that are used to analyze damage potential as a function of ground motion intensity and structural resistance.

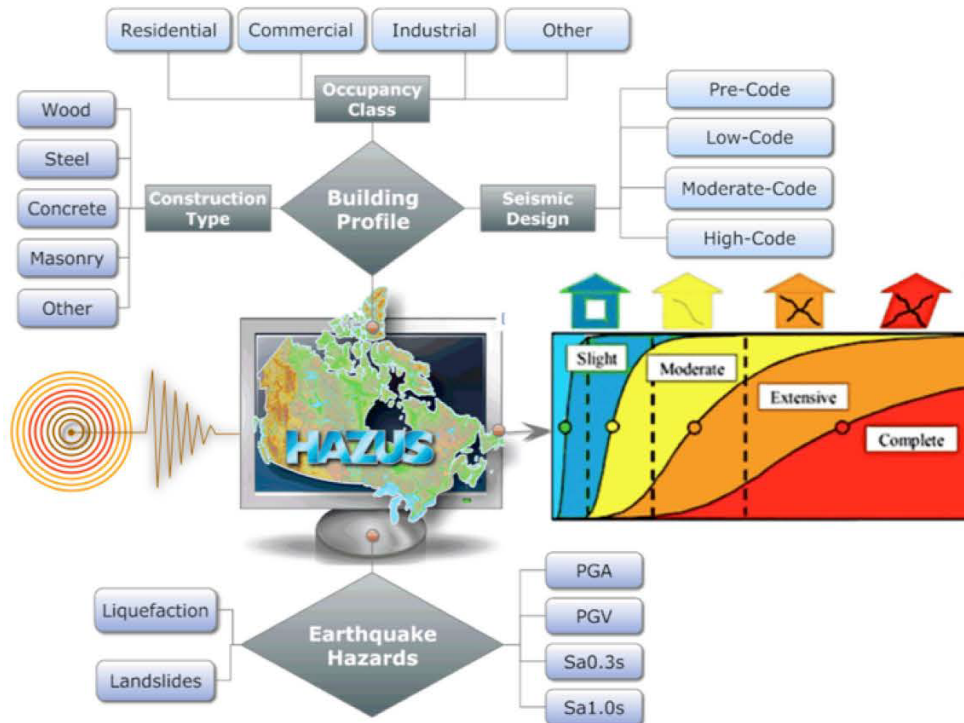


Figure 1: Analytic workflow for assessing physical vulnerability and damage probabilities for individual buildings and building aggregates using Hazus methodology (FEMA,2011).

Thirty-six building types are used in the Hazus model to classify specific characteristics of construction within the general categories of wood, steel, concrete, masonry and mobile homes. In addition, twenty-eight occupancy classes are used to distinguish between different types of building functionality within the general categories of residential, commercial, industrial, and other land use classes. The capacity of these structures to withstand the impacts of ground shaking is assessed on the basis of seismic design level and overall quality of construction. Building type and seismic design level are used to predict the extent of physical damage, which in

Joint Municipal Regional Disaster Debris Management Operational Plan

turn is used to determine the potential for injury and loss of functionality for any given level of ground shaking. Occupancy class is used to determine the extent of economic loss and social disruption that is expected based on building functionality (residential, commercial, etc.), and the level of physical damage sustained as a result of the earthquake event. For each combination of building type and seismic design level there is a corresponding fragility curve that is used in the generic Hazus model to analyze the probability of damage for individual structures and/or an aggregate group of structures.

Likelihood of Damage

Hazus uses fragility curves to assess the probability of exceeding minimum thresholds of damage for a given level of shaking and related ground failure. Damage probabilities are calculated for each of four states: Slight, Moderate, Extensive and Complete (See Figure 2).





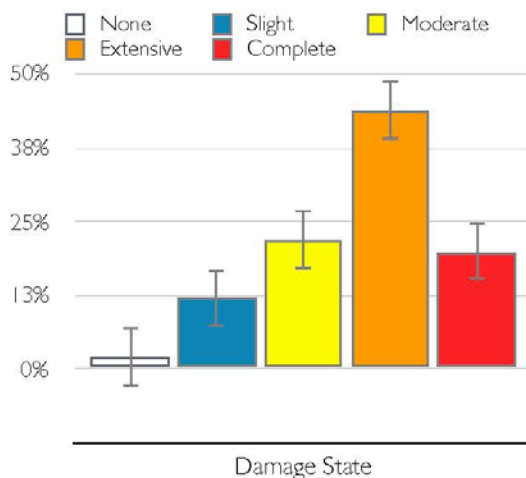
Damage State		Description
	Slight	Small plaster cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneers. Small cracks are assumed to be visible with a maximum width of less than 1/8 inch (cracks wider than 1/8 inch are referred to as "large" cracks).
	Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
	Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations.
	Complete	Structure may have large permanent lateral displacement or be in imminent danger of collapse due to cripple wall failure or failure of the lateral load resisting system; some structures may slip and fall off the foundation; large foundation cracks. Three percent of the total area of buildings with Complete damage is expected to be collapsed, on average.

Figure 2: Building performance measured in terms of damage state probabilities. Estimates are based on Hazus loss estimation methodology.



Building performance is reported on the basis of damage states with the highest probability of occurrence for an individual building or collection of buildings. Slight and moderate damage states describe physical impacts that exceed the yield point of a building but that do not compromise structural integrity. Extensive damage states are those in which load-bearing structural elements of a building are compromised beyond repair. Complete damage states are those in which there is a likelihood of structural failure by tilting and/or toppling with a potential for total collapse.

Disaster Debris

Debris generated as a result of physical damages to buildings during an earthquake has proven to be a significant issue in both response and recovery phases of a disaster. Fallen debris can pose a direct threat to individuals who are outside during an earthquake, and can also block roads and restrict access to hardest hit areas by first responders for days, weeks and months following the disaster event. The amount of debris generated during an earthquake can be significant and adds a significant cost to the recovery process in terms of both time and expense. It can take months to remove and dispose of the debris properly, and it has the potential to limit access to road and rail networks that are vital during the response and recovery process.

Hazus uses a generalized empirical model to estimate the types and amount of disaster debris that are likely to be generated as a result of ground shaking and related building damage (See Annex 1 for a description of analytic methodology). There are two different categories of disaster debris — large blocks of steel and/or reinforced concrete that must be broken into smaller pieces by heavy equipment before being hauled away; and smaller aggregates of brick, wood, glass and building contents that are more easily moved with bulldozers and light machinery. The amount of debris is dependent on building types and the extent of damage in more densely settled areas and is estimated at the level of individual neighbourhoods (Census Dissemination Areas). Debris generated from damaged buildings (in tons) is based on the following factors:

- Unit weight of structural and nonstructural elements (tons per 1000 sq. ft. of floor area) for each of the model building types
- Probabilities of damage states for both structural and drift-sensitive nonstructural elements by census tract
- Square footage of each of the model building types by census area
- Debris generated from different damage states of structural and nonstructural elements (% of unit weight of element)

Scenario-Based Disaster Debris Models

Deterministic earthquake damage/loss models represent plausible ‘what-if’ scenarios of what might be expected if an earthquake were to occur at some point in the future. Deterministic scenarios utilize process-based models of fault behaviour and seismic attenuation to predict the spatial pattern and intensity of ground motion over broad areas. They can be based on earthquake events that are known to have occurred in the past and/or have the potential to occur in the future.

While earthquake scenarios are effective in establishing cause-effect relationships between ground shaking and related physical impacts for a specific event, they do not represent the overall seismic risk for a particular location or region. For this reason, care must be taken in developing plausible scenarios that reflect the best available scientific knowledge about earthquake hazards for a given region, and that minimize uncertainties with respect to location, magnitude and likelihood of occurrence.

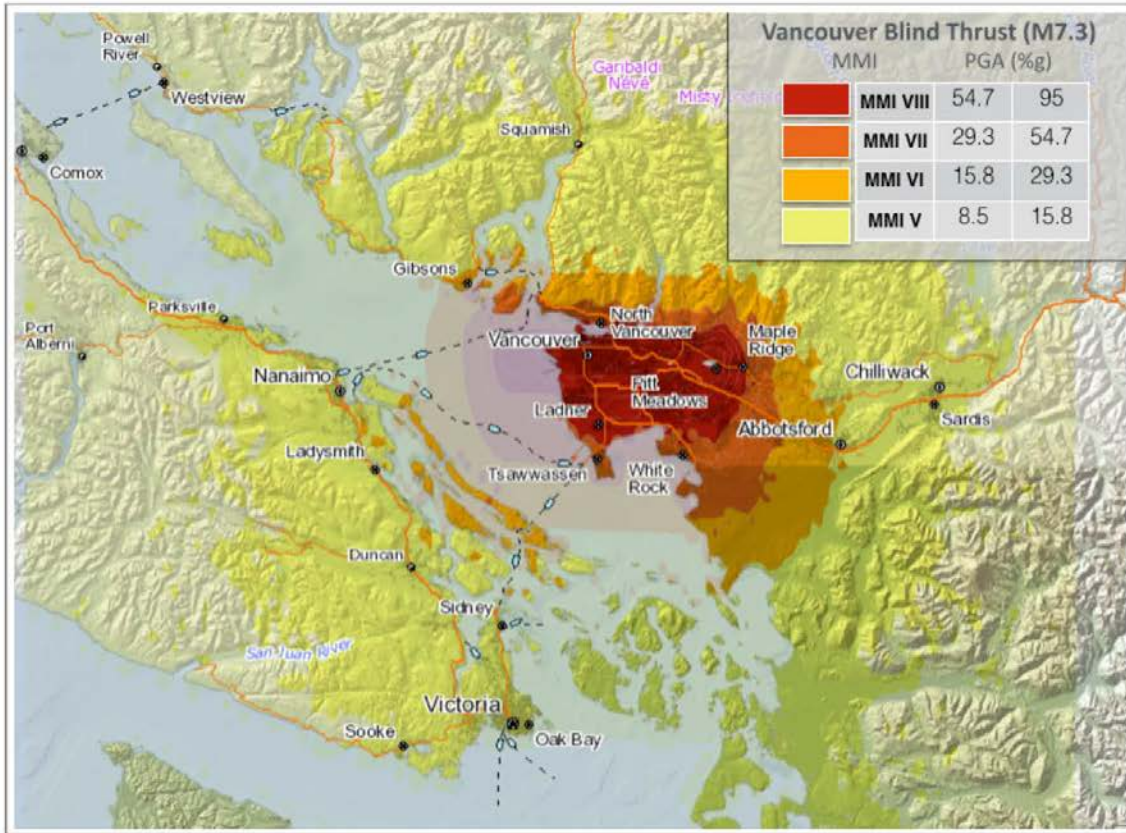
References

FEMA (2011). Hazus-MH 2.1 Multi-hazard loss estimation methodology; Earthquake model technical manual. Washington, DC USA, US Federal Emergency Management Agency.

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Metro Vancouver

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault



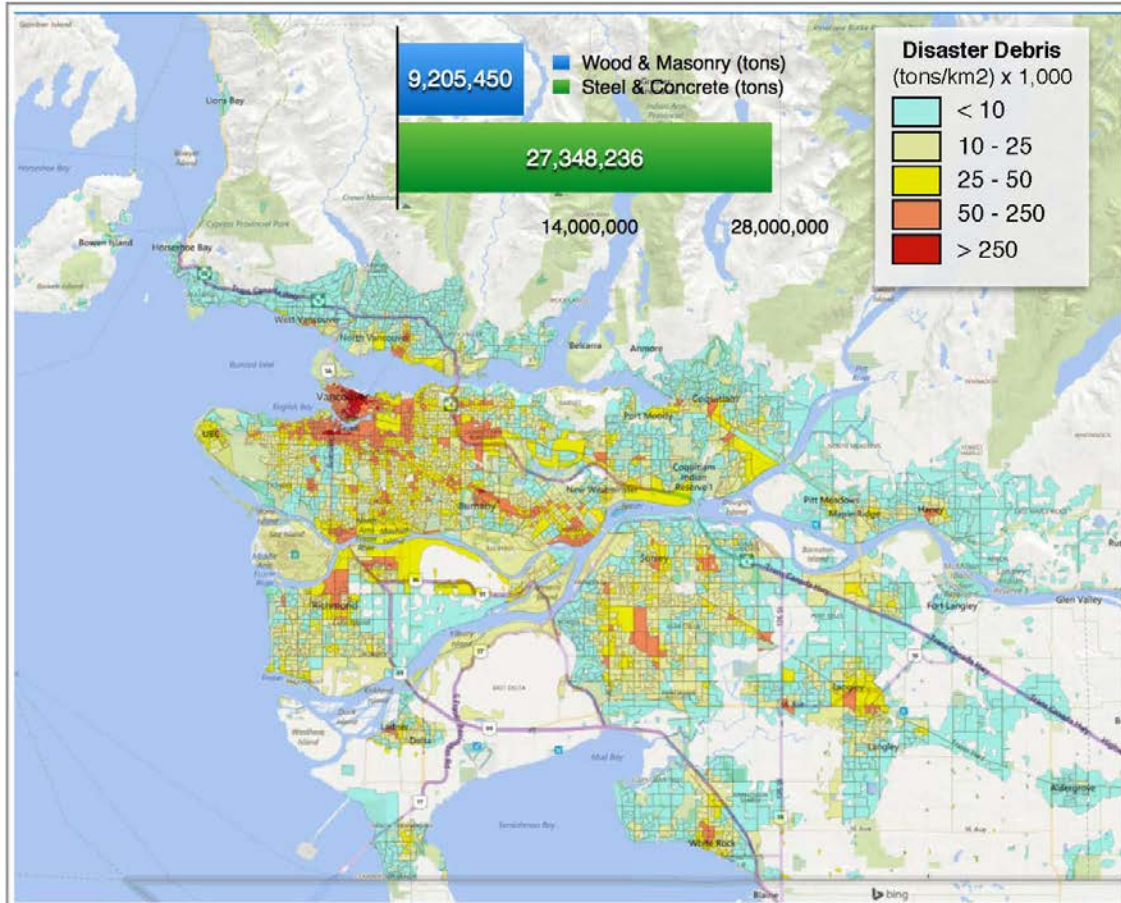
Catastrophic earthquakes are defined as less frequent, but capable of a high number of injuries, casualties and extensive damage to buildings and infrastructure (Russ, 2014). The recommendation to model a catastrophic earthquake came from EMBC. Upon a recent visit to Christchurch New Zealand following the 2011 earthquake events, New Zealand Emergency Managers advised EMBC staff, that if you are prepared for the worst case earthquake scenario, you can be prepared for any earthquake.

The Vancouver M7.3 scenario earthquake is a credible event based on available knowledge of regional fault structures in the region. However, it is considered to be exceedingly rare in terms of likelihood. The scenario approaches a ‘worst-case’ event, and, as such, presents the most challenging hazard to plan for, respond to and recover from. Shaking intensities were modified to include soil site amplification using the standard ShakeMap Vs30 model based on 30 arcsec SRTM data (Wald, 2007; Allen, 2009). This scenario represents the maximum likely magnitude that could occur for this type of earthquake in the region. The size of the fault was determined from equations that relate earthquake magnitude to fault area and represents a “blind thrust fault”, where the shallowest edge of the fault (northern edge) is buried beneath 1.5 km of sediment in the Georgia Basin. The fault dips from the northern edge at an angle of 30 degrees to a depth of 22 km at the southern edge with its orientation (or strike) being subparallel to Vancouver’s North Shore Mountains. Ground-shaking was calculated for the scenario using equations that relate the earthquake’s magnitude and the fault-to-site distance to a ground-shaking intensity using the USGS ShakeMap tool.

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Metro Vancouver - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



Disclaimer: Her Majesty the Queen in right of Canada, as represented by the Minister of Natural Resources ("Canada") does not warrant or guarantee the accuracy or completeness of the information ("Data") on this map and does not assume any responsibility or liability with respect to any damage or loss arising from the use or interpretation of the data. The Data on this map are intended to convey regional trends and should be used as a guide only.

	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris -Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
TOTALS	9,205,450	27,348,236	36,553,686	368,218	1,093,929	1,462,147

Joint Municipal Regional Disaster Debris Management Operational Plan

Metro Vancouver - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris estimates for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods

Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris -Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete Debris (truckloads)	Total Truckloads @25 tons/Truck	
Vancouver	3,032,294	9,345,001	12,377,295	121,292	373,800	495,092	
Surrey	1,658,158	4,386,512	6,044,670	66,326	175,460	241,787	
Richmond	994,463	3,075,278	4,069,741	39,779	123,011	162,790	
Burnaby	949,802	2,991,758	3,941,561	37,992	119,670	157,662	
Delta	483,643	1,425,067	1,908,710	19,346	57,003	76,348	
Coquitlam	339,889	994,495	1,334,384	13,596	39,780	53,375	
Langley	367,232	963,804	1,331,035	14,689	38,552	53,241	
New Westminster	238,998	710,844	949,841	9,560	28,434	37,994	
Port Coquitlam	223,914	685,691	909,605	8,957	27,428	36,384	
Langley (City)	153,624	480,615	634,239	6,145	19,225	25,370	
Maple Ridge	164,773	434,063	598,836	6,591	17,363	23,953	
North Vancouver (City)	116,982	444,364	561,346	4,679	17,775	22,454	
North Vancouver (District)	111,427	360,278	471,705	4,457	14,411	18,868	
White Rock	88,061	236,281	324,342	3,522	9,451	12,974	
Port Moody	77,562	214,445	292,007	3,102	8,578	11,680	
Electoral Area A	57,064	196,865	253,929	2,283	7,875	10,157	
Pitt Meadows	71,928	174,449	246,377	2,877	6,978	9,855	
West Vancouver	39,690	116,752	156,442	1,588	4,670	6,258	
Capilano 5	8,497	32,444	40,941	340	1,298	1,638	
Seymour Creek 2	3,472	16,700	20,172	139	668	807	
Musqueam 2	6,027	12,554	18,581	241	502	743	
Abbotsford	3,099	11,280	14,379	124	451	575	
Tsawwassen	3,932	9,259	13,191	157	370	528	
Burrard Inlet 3	2,722	8,883	11,605	109	355	464	
Bowen Island	2,790	7,785	10,575	112	311	423	
Anmore	1,514	2,162	3,675	61	86	147	
Mission 1	958	2,683	3,641	38	107	146	
Semiahmoo	819	2,820	3,639	33	113	146	
Katzie 1	900	2,037	2,937	36	81	117	
Belcarra	684	1,697	2,381	27	68	95	
Whonnock 1	167	656	823	7	26	33	
Coquitlam 2	68	317	385	3	13	15	
McMillan Island 6	89	197	285	4	8	11	
Mission	92	119	210	4	5	8	
Lions Bay	112	66	177	4	3	7	
Langley 5	5	20	25	0	1	1	
TOTALS	9,205,450.4	27,348,235.8	36,553,686.2	368,218	1,093,929	1,462,147	

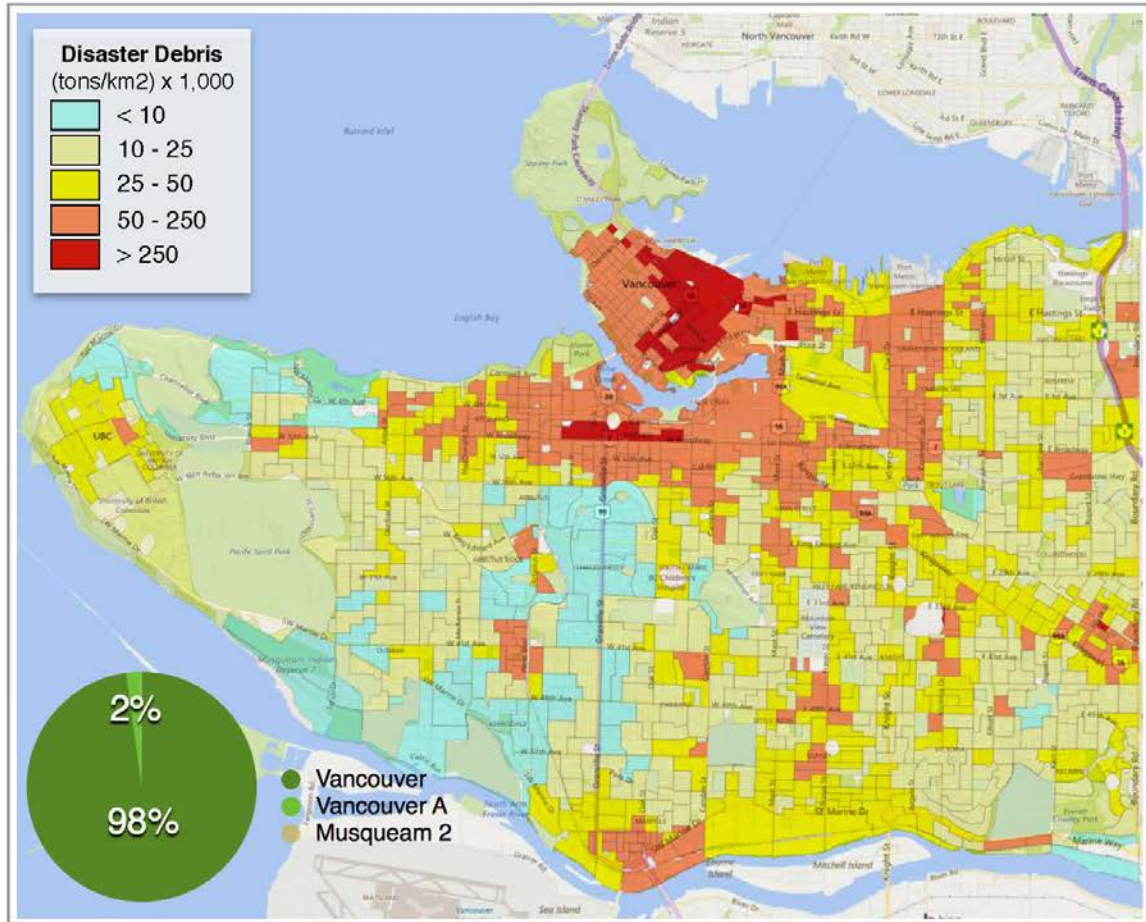
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Joint Municipal Regional Disaster Debris Management Operational Plan

City of Vancouver - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



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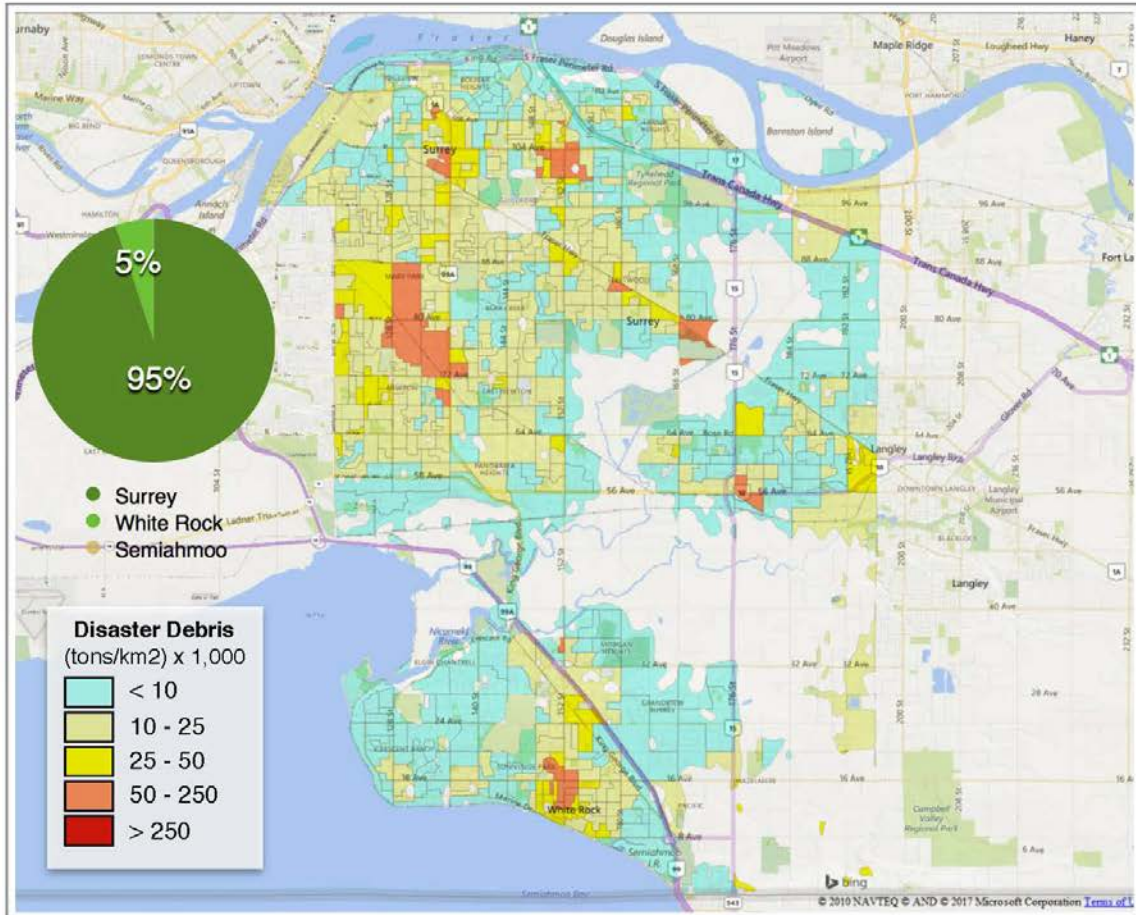
Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris-Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete Debris (truckloads)	Total Truckloads @25 tons/Truck
Vancouver	3,032,294.4	9,345,001.0	12,377,295.3	121,292	373,800	495,092
Electoral Area A	57,064.2	196,864.8	253,929.0	2,283	7,875	10,157
Musqueam 2	6,027.1	12,554.2	18,581.3	241	502	743
TOTALS	3,095,385.7	9,554,419.9	12,649,805.7	123,815	382,177	505,992

Joint Municipal Regional Disaster Debris Management Operational Plan

Surrey - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

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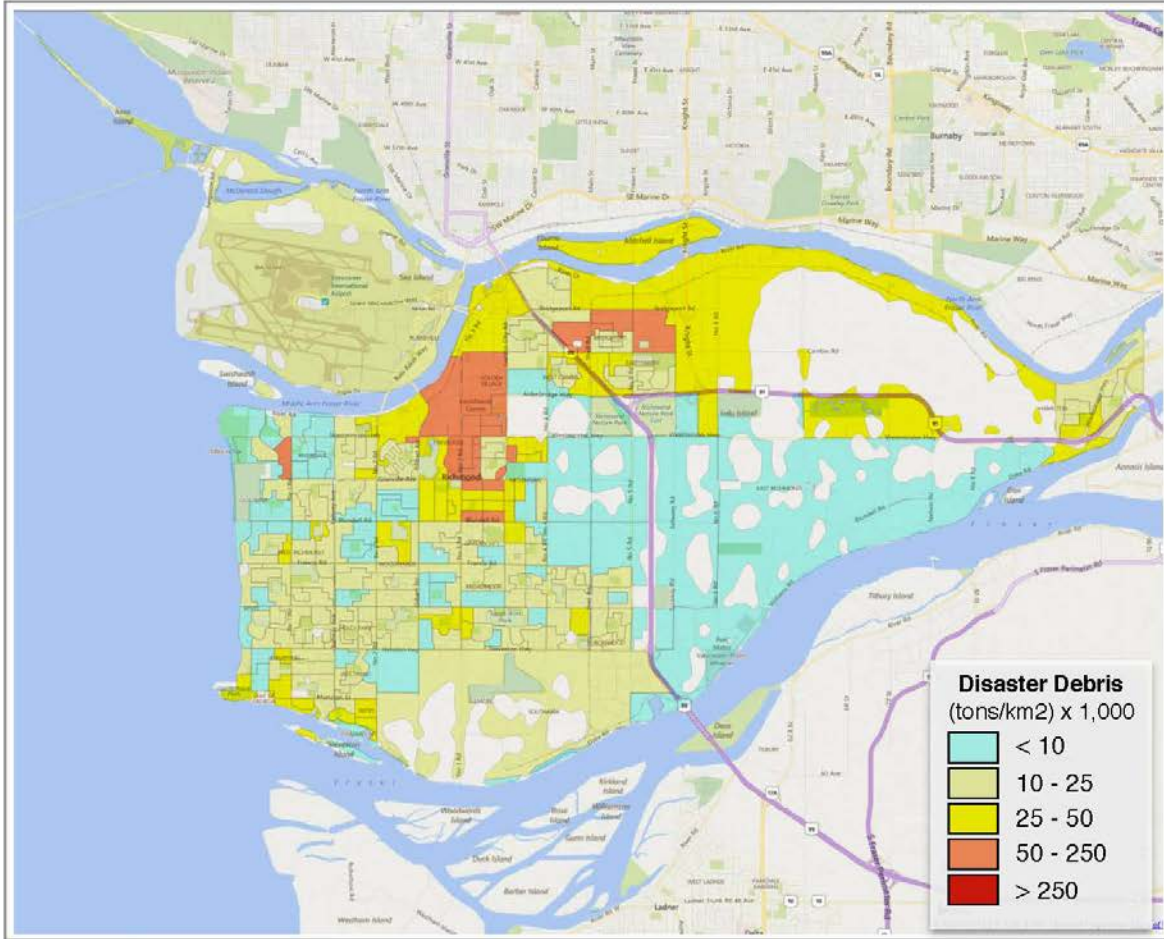
Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris- Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Surrey	1,658,158.1	4,386,511.6	6,044,669.7	66,326	175,460	241,787
White Rock	88,061.2	236,281.0	324,342.2	3,522	9,451	12,974
Semiahmoo	819.1	2,819.5	3,638.6	33	113	146
TOTALS	1,747,038.3	4,625,612.1	6,372,650.5	69,881.5	185,024	254,906

Joint Municipal Regional Disaster Debris Management Operational Plan

Richmond - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



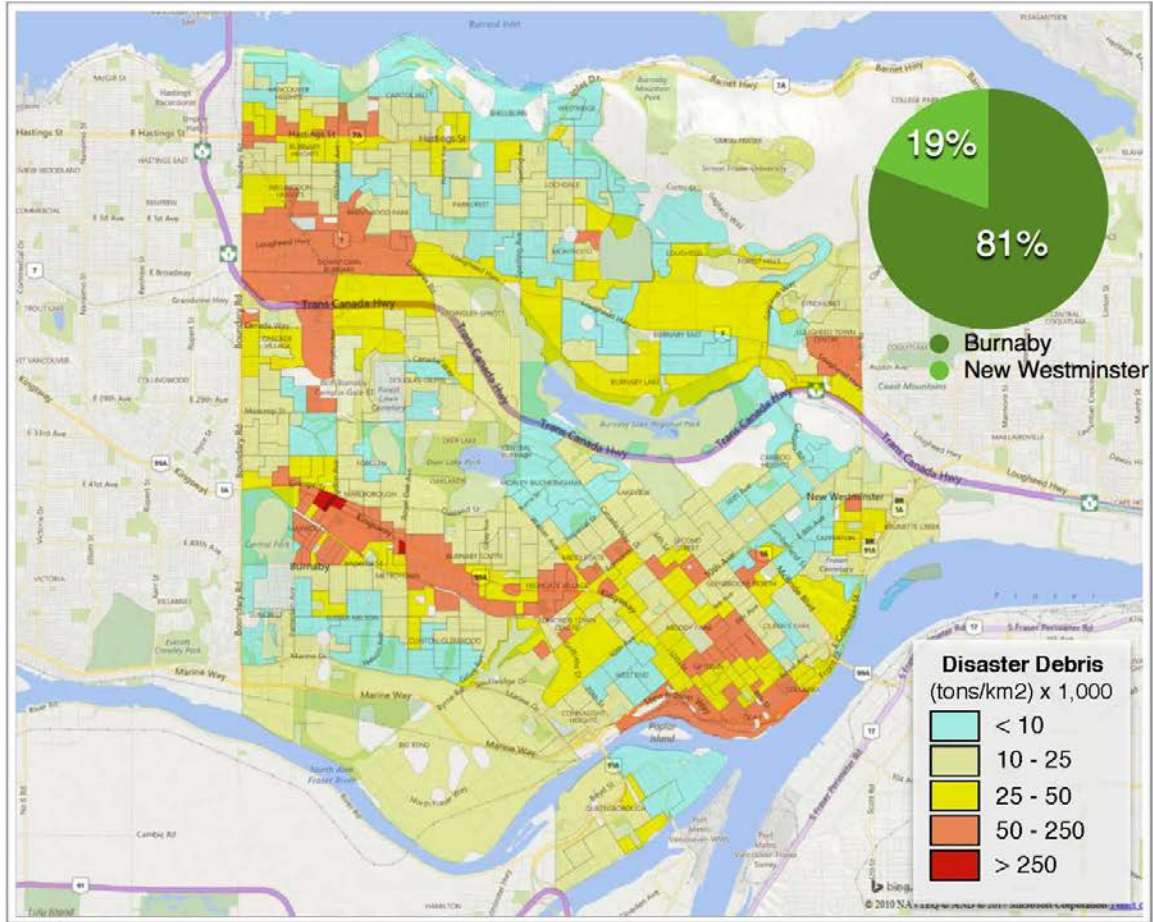
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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Richmond	994,462.8	3,075,278.1	4,069,740.9	39,779	123,011	162,790
TOTALS	994,462.8	3,075,278.1	4,069,740.9	39,779	123,011	162,790

Joint Municipal Regional Disaster Debris Management Operational Plan

Burnaby/New Westminster - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



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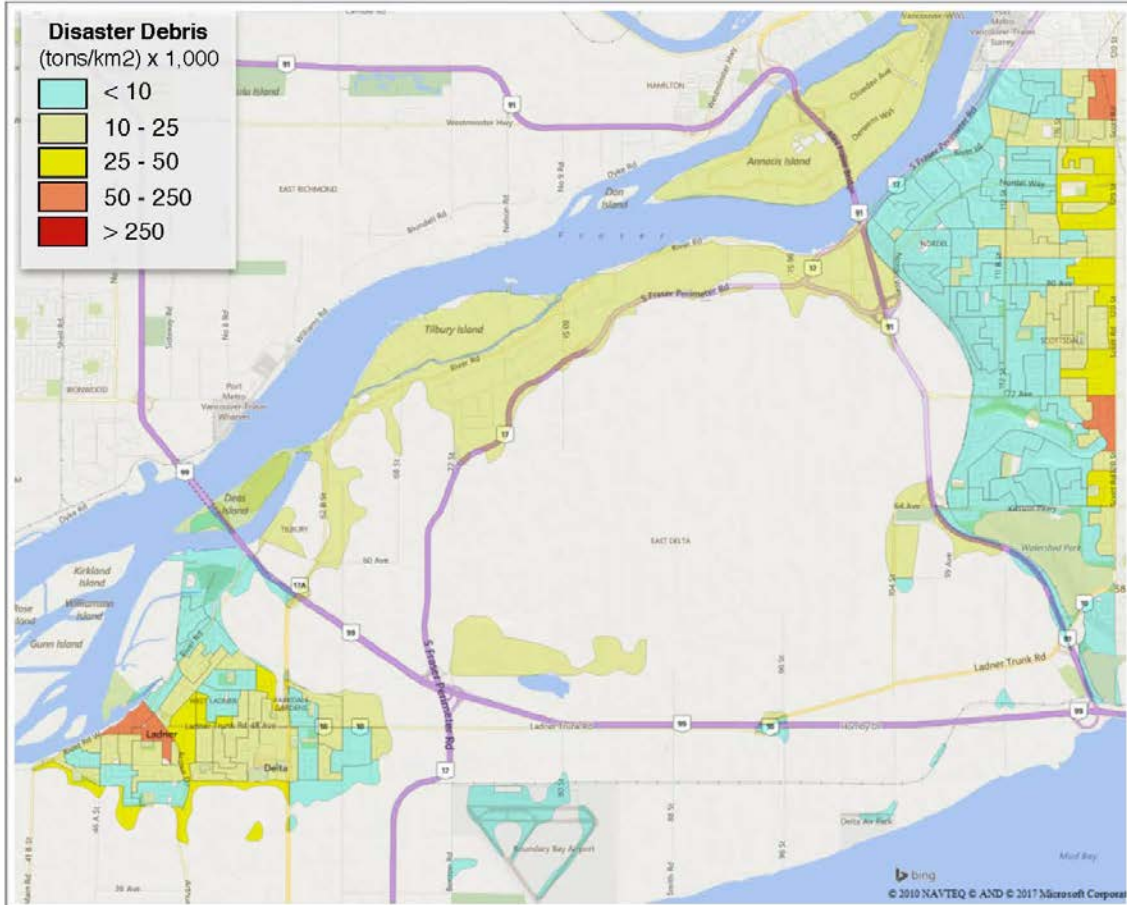
Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris-Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Burnaby	949,802.4	2,991,758.2	3,941,560.5	37,992	119,670	157,662
New Westminster	238,937.5	710,843.7	949,841.2	9,560	28,434	37,994
TOTALS	1,188,799.9	3,702,601.8	4,891,401.7	47,552	148,104	195,656

Joint Municipal Regional Disaster Debris Management Operational Plan

Delta - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



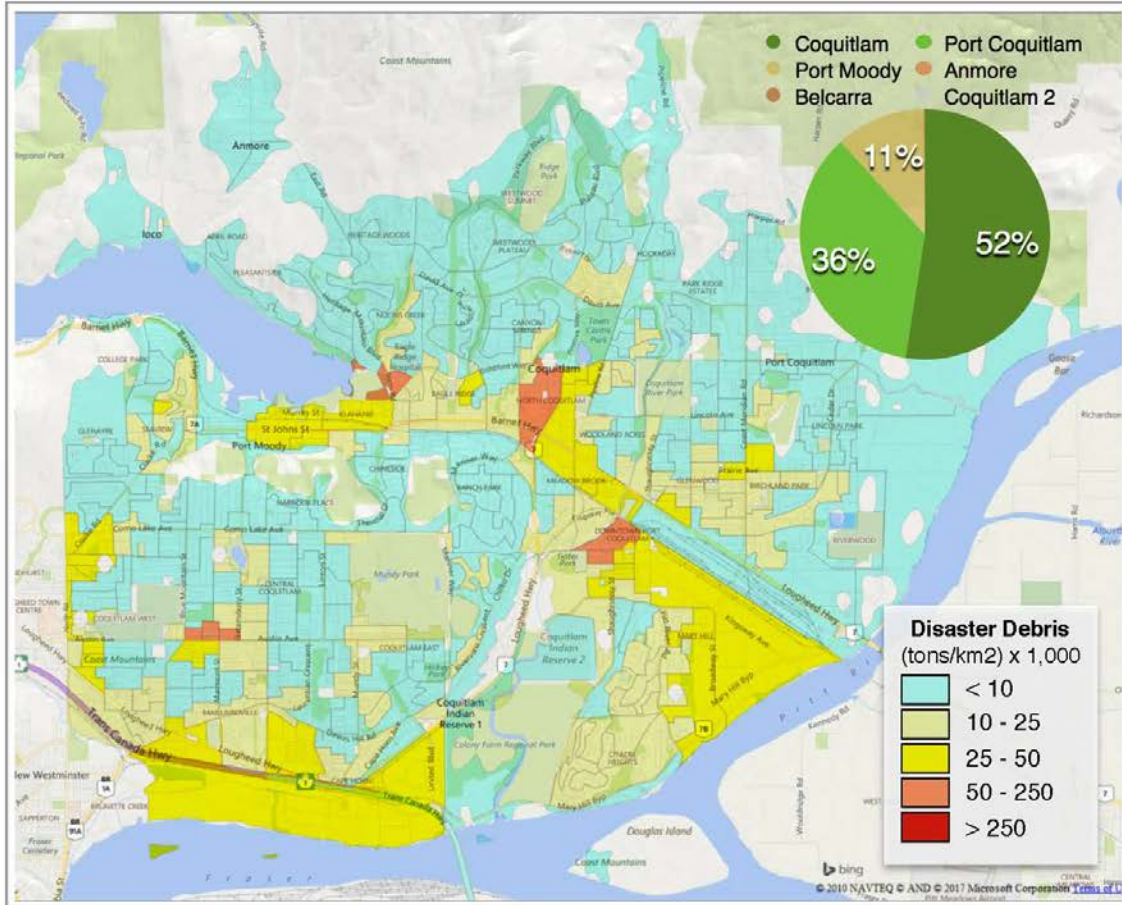
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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Delta	483,643.3	1,425,066.8	1,908,710.2	19,346	57,003	76,348
TOTALS	483,643.3	1,425,066.8	1,908,710.2	19,346	57,003	76,348

Joint Municipal Regional Disaster Debris Management Operational Plan

Coquitlam/Port Coquitlam/PortMoody - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



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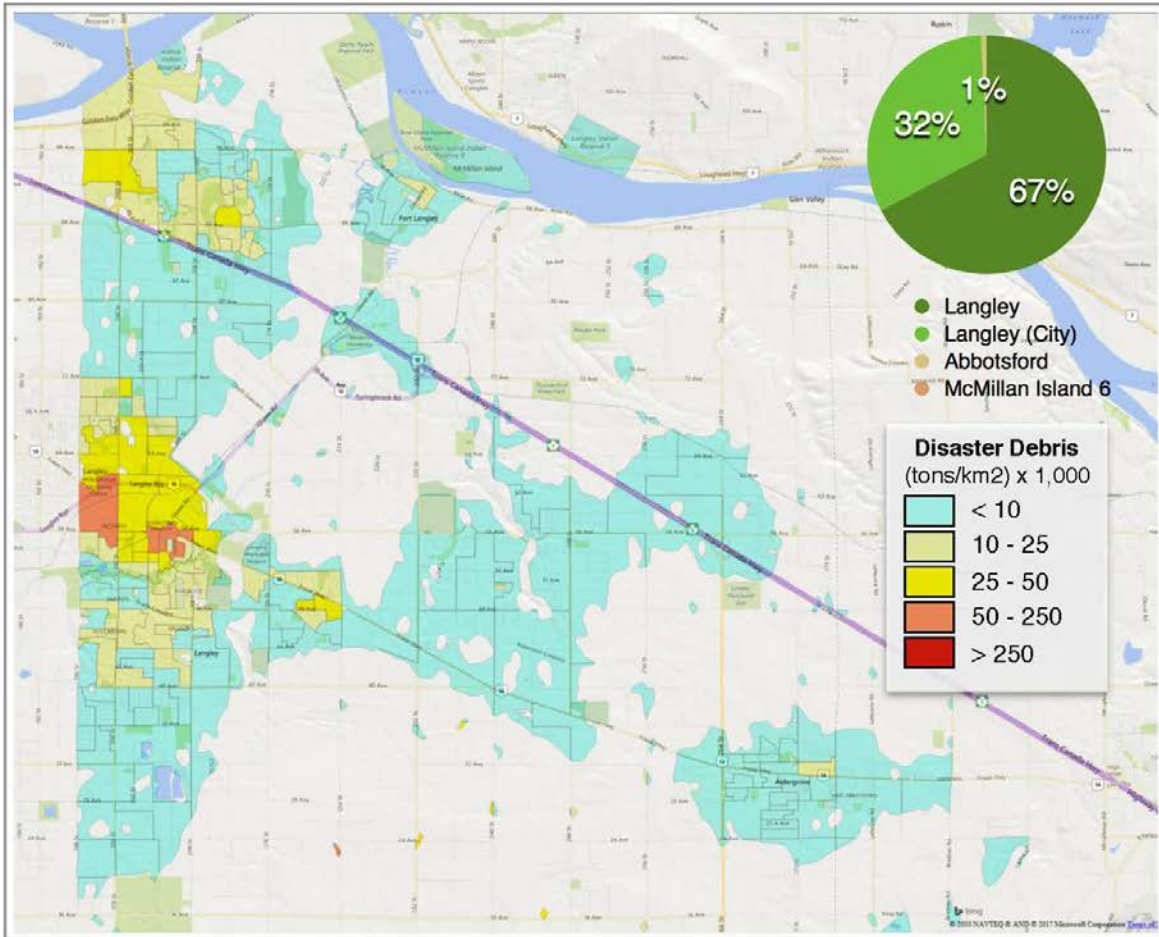
Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Coquitlam	339,888.7	994,495.0	1,334,383.7	13,596	39,780	53,375
Port Coquitlam	223,914.1	685,690.8	909,604.9	8,957	27,428	36,384
Port Moody	77,562.2	214,444.7	292,006.9	3,102	8,578	11,680
Anmore	1,513.7	2,161.6	3,675.3	61	86	147
Belcarra	683.7	1,696.9	2,380.6	27	68	95
Coquitlam 2	68.0	316.6	384.7	3	13	15
TOTALS	643,630.5	1,898,805.7	2,542,436.2	25,745	75,952	101,697

Joint Municipal Regional Disaster Debris Management Operational Plan

Langley/Abbotsford - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



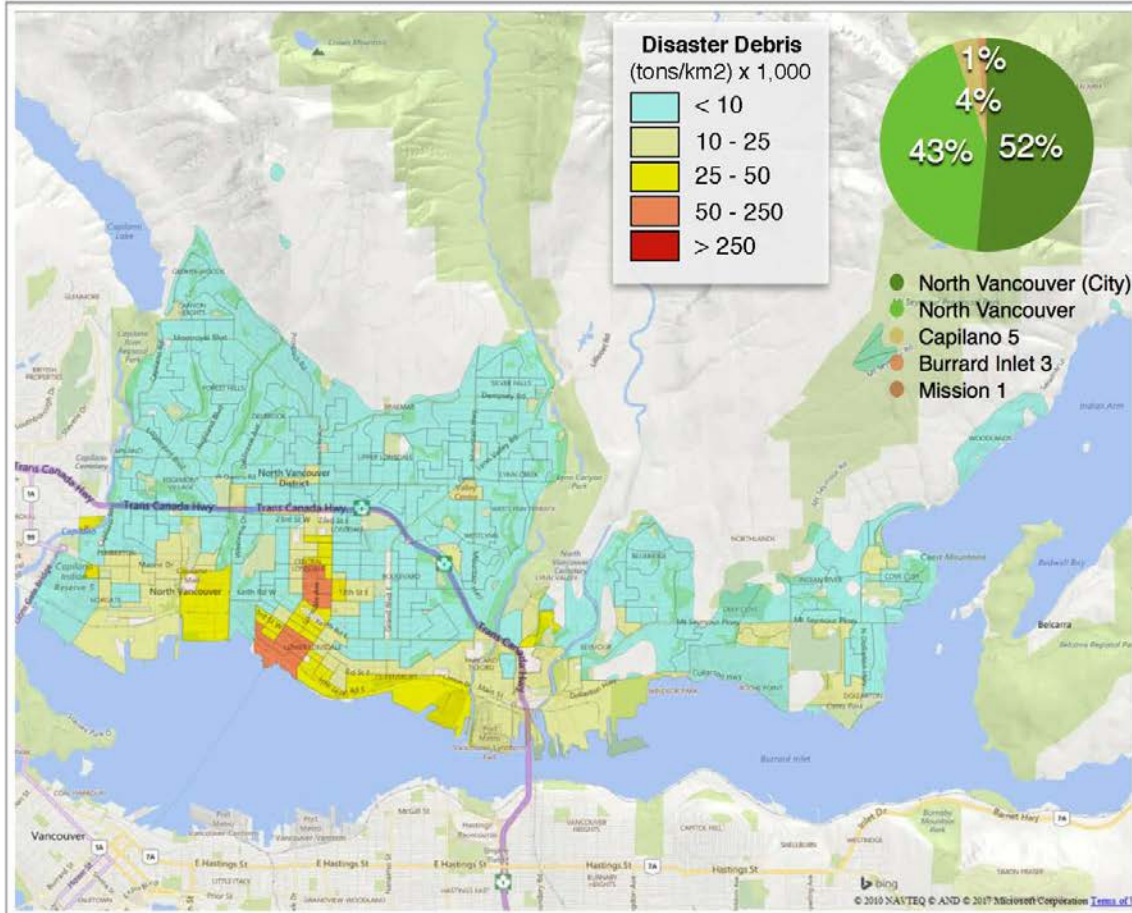
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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
Langley	367,231.6	963,803.6	1,331,035.1	14,689	38,552	53,241
Langley (City)	153,623.8	480,614.9	634,238.7	6,145	19,225	25,370
Abbotsford	3,098.6	11,280.1	14,378.6	124	451	575
McMillan Island 6	88.9	196.6	285.5	4	8	11
TOTALS	524,042.8	1,455,895.1	1,979,937.9	20,962	58,236	79,198

Joint Municipal Regional Disaster Debris Management Operational Plan

North Vancouver - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



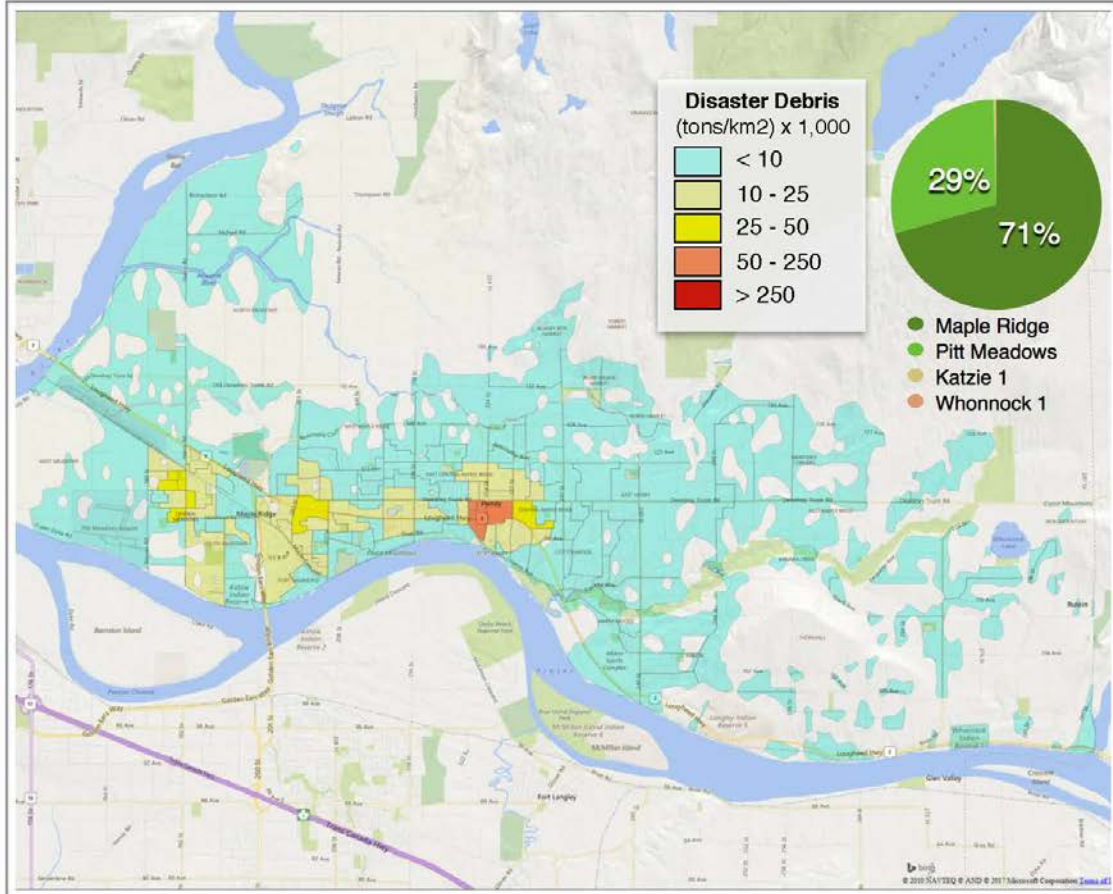
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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
North Vancouver (City)	116,982.4	444,363.6	561,346.1	4,679	17,775	22,454
North Vancouver (District)	111,426.8	360,278.4	471,705.2	4,457	14,411	18,868
Capilano 5	8,497.2	32,443.6	40,940.7	340	1,298	1,638
Burrard Inlet 3	2,722.1	8,883.2	11,605.4	109	355	464
Mission 1	958.5	2,682.5	3,641.0	38	107	146
TOTALS	240,587.0	848,651.3	1,089,238.4	9,623	33,946	43,570

Joint Municipal Regional Disaster Debris Management Operational Plan

Maple Ridge/Pitt Meadows - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



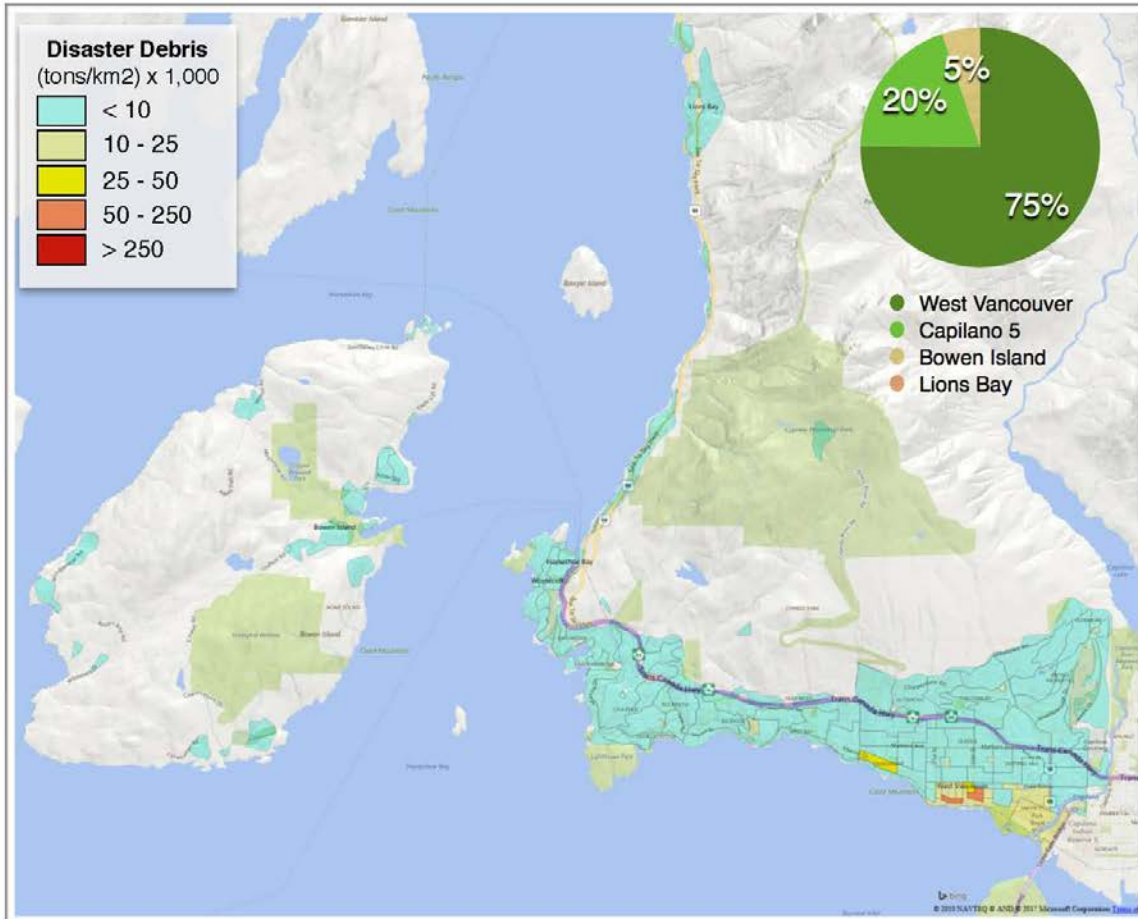
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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete Debris (truckloads)	Total Truckloads @25 tons/Truck
Maple Ridge	164,772.6	434,063.4	598,836.0	6,591	17,363	23,953
Pitt Meadows	71,928.4	174,448.6	246,377.0	2,877	6,978	9,855
Katzie 1	900.1	2,036.6	2,936.7	36	81	117
Whonnock 1	166.8	655.7	822.6	7	26	33
TOTALS	237,767.9	611,204.3	848,972.2	9,511	24,448	33,959

Joint Municipal Regional Disaster Debris Management Operational Plan

District of West Vancouver - Disaster Debris Estimates Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

Disaster debris maps created for REAC Solid Waste Sub Committee Working Group on Disaster Debris Management and IPREM (Integrated Partnership for Regional Emergency Management). Results intended to inform Joint Municipal Regional Disaster Debris Management Operational Plan. See Annex 1 for analytic methods



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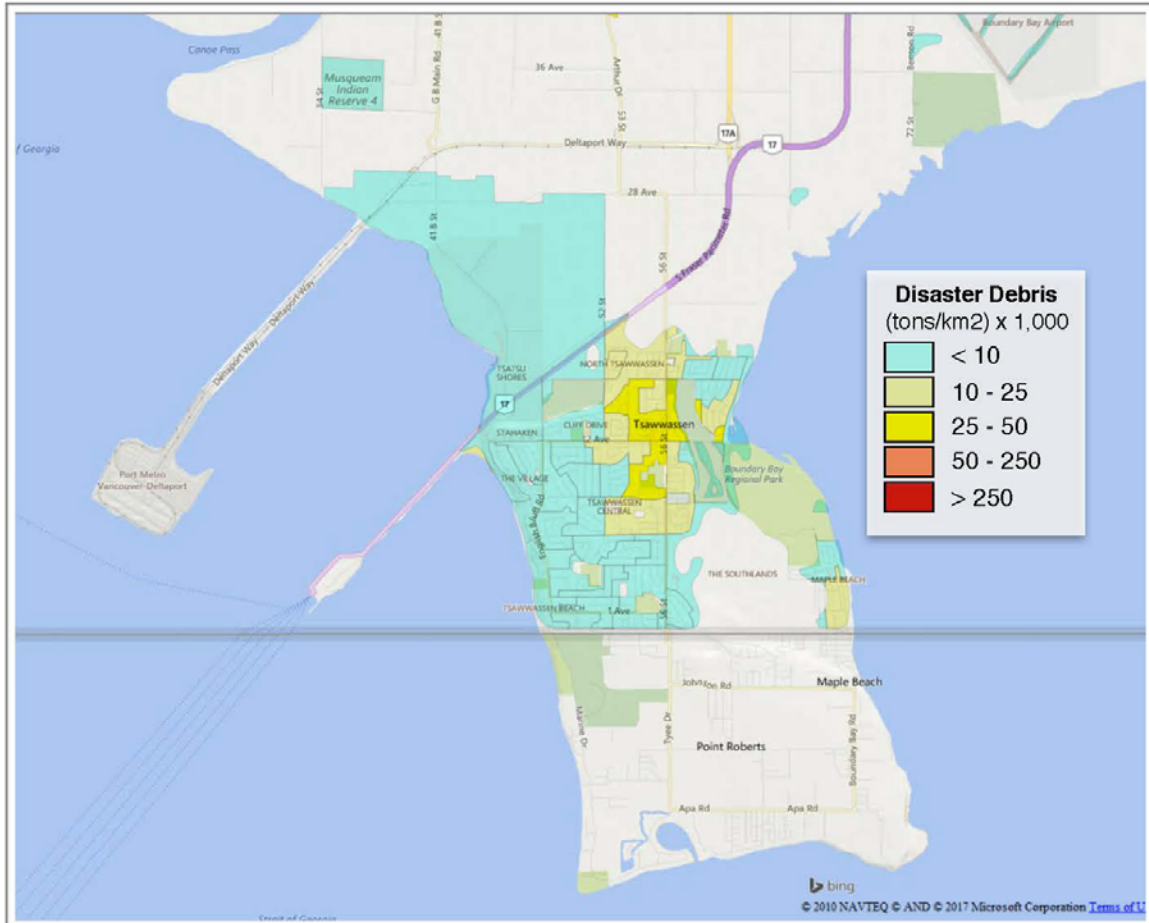
Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete (truckloads)	Total Truckloads @25 tons/Truck
West Vancouver	39,690.0	116,752.2	156,442.2	1,588	4,670	6,258
Capilano 5	8,497.2	32,443.6	40,940.7	340	1,298	1,638
Bowen Island	2,789.6	7,785.0	10,574.6	112	311	423
Lions Bay	111.7	65.7	177.4	4	3	7
TOTALS	51,088.4	157,046.5	208,134.9	2,044	6,282	8,325

Joint Municipal Regional Disaster Debris Management Operational Plan

Tsawwassen - Disaster Debris Estimates

Catastrophic Earthquake Planning Scenario - M7.3 Shallow Crustal Fault

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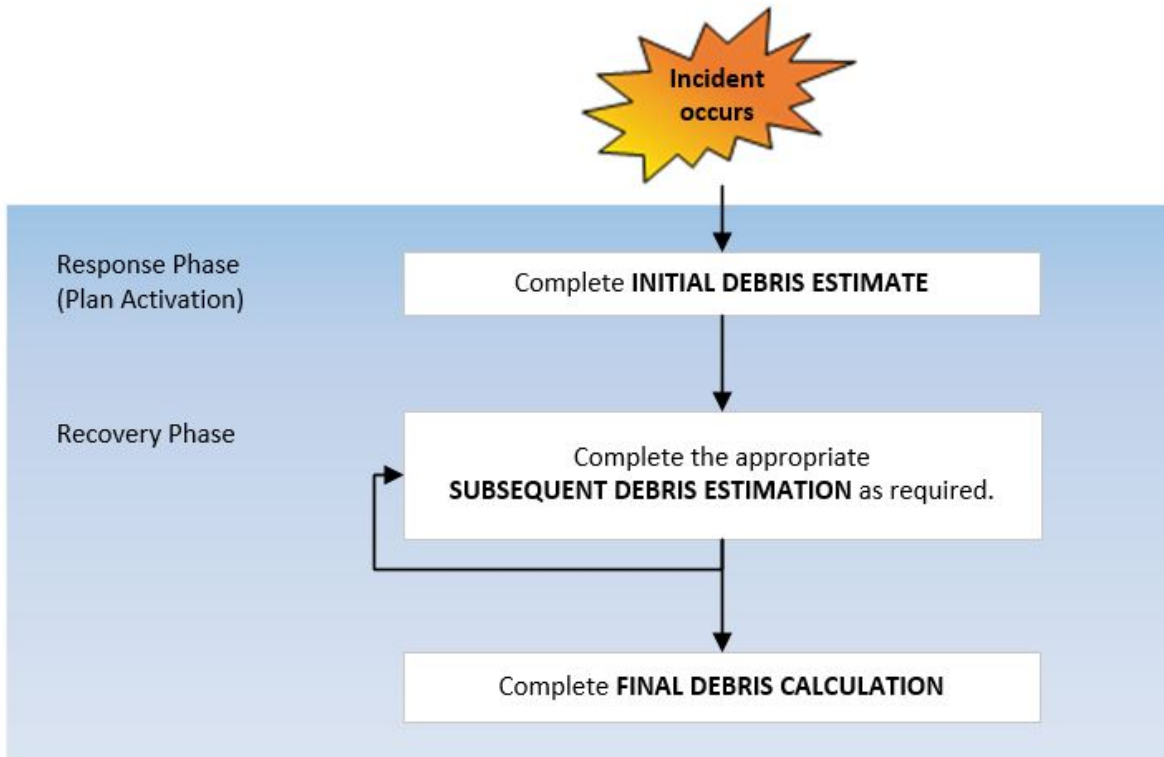


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Municipality	Wood & Masonry Debris (tons)	Steel & Concrete Debris (tons)	Disaster Debris - Total (tons)	Wood & Masonry (truckloads)	Steel & Concrete(truckloads)	Total Truckloads @25 tons/Truck
Tsawwassen	3,932.4	9,258.8	13,191.2	157	370	528
TOTALS	3,932.4	9,258.8	13,191.2	157	370	528

B. DEBRIS ESTIMATION TOOLS AND CALCULATIONS

The following debris estimation tools provide a consistent approach to calculating debris volumes and weight for Local Authorities across the Metro Vancouver region. To aid individuals tasked with completing the debris estimations at various stages of the response and recovery phases, the below diagram summarizes when each estimation type is to be completed.



Unless indicated otherwise, these debris estimation tools do not take into consideration “natural” debris, e.g. rock slides (rock rubble), landslides (earth), flooding (sediment and silt), earthquake liquefaction sediments, organic matter (all event types).

Joint Municipal Regional Disaster Debris Management Operational Plan

Initial Debris Estimate

An initial debris estimate is needed to determine the level of activation (refer to Figure 6 -- Activation Level. This can be determined by:

- Step 1: Identify the predominant building material type for each damaged building.
- Step 2: Determine the size (square metres) for each damaged building. Multiply by the number of stories for multi-story buildings to ensure to account for total square metres.
- Step 3: Using the below table, calculate the tonnes of debris for each building by multiplying its size (square metres) inclusive of height by the building material type multiplier.

Building Material Type	Tonnes per square metre
WOOD	0.325 m
STEEL	0.600 m
STEEL & CONCRETE	0.800 m
MASONRY	1.000 m
CONCRETE	1.250 m

Source: HAZUS methodology and methods

When completing the initial debris estimate, the following should be taken into consideration:

- the initial debris estimate does not account for vegetation;
- all buildings that are reported as damaged are assumed to be “completely” damaged in terms of the debris generated; and
- the above numbers estimate both structural and non-structural debris.

Example

Field personnel indicate there are 25 single family homes damaged in the impacted area of town. GIS information reveals that these homes are, on average, two (2) stories with a footprint of 140 m².

To estimate the tonnes of debris generated and need (and level) of RDDM activation:

1. The predominant building material type for these buildings is assumed to be wood.
2. The total size for all stories of all 25 buildings would be:
$$\# \text{ of buildings} \times \# \text{ of stories} \times \text{footprint}$$
$$25 \times 2 \times 140 \text{ m}^2 = 7,000 \text{ m}^2$$
3. As per the *Initial Debris Estimation Table*, buildings made primarily of wood generate approximately 0.325 tonnes per square metre.

$$7,000 \text{ m}^2 \times 0.325 \text{ tonnes/m}^2 = 2,275 \text{ tonnes}$$

4. As per Figure 6- Activation Level, 2, 275 tonnes is a sub-regional scale event.

Joint Municipal Regional Disaster Debris Management Operational Plan

Type	Descriptor	Formula	Example
Debris Piles	<p>Use this formula to estimate the volume of a pile of debris, i.e. not a building, with the exception of a Mobile Home.</p> <p>Use this formula to estimate the debris associated with Mobile Homes</p> <p>This formula is When performing this calculation, debris piles are to be treated as cubes, not cones.</p>	$V_{debris} = L \times W \times H$	<p>Assume a building under construction collapses in an earthquake and leaves a pile of debris. The pile of debris is approximately 15 m x 15 m, and approximately 4 m high.</p> <p>Using this formula, $L = 15 \text{ m}, W = 15 \text{ m}$ and $H = 4 \text{ m}$ $V_{debris} = 15 \text{ m} \times 15 \text{ m} \times 4 \text{ m}$</p> <p>Therefore, $V_{debris} = 900 \text{ m}^3$</p>
General Building	<p>Use this formula for any building other than a single-family residence.</p>	$V_{debris} = \frac{(L \times W \times H)}{3}$ <p>Note that $L \times W \times H$ is divided by 3 to account for air space within buildings, as determined by FEMA</p>	<p>An apartment building with a footprint of approximately 1500 square metres, and a height of approximately 22 metres is irreparably damaged in a disaster.</p> <p>The equation doesn't call for square metres, but it calls for length (L) x width (W) which is equivalent. Therefore, $L \times W = 1500 \text{ m}^2$, and the height = 22 m.</p> <p>Using the formula above:</p> $V_{debris} = \frac{1500 \text{ m}^2 \times 22 \text{ m}}{3}$ <p>Therefore, $V_{debris} = 11,000 \text{ m}^3$</p>

Joint Municipal Regional Disaster Debris Management Operational Plan

<p>Single Family Residence</p>	<p>Use this formula for single-family residence.</p>	$V_{debris} = 1.65 m \times L \times W \times (VCM + S - 1)$ <p>Length and width must be in metres</p> <p>1.65 m = a constant based on FEMA study data</p>	<p>Assume a 2 story single family homes with a first-floor area of 1000 ft² is destroyed in a disaster. The home was located in a neighbourhood with mature trees and a dense canopy cover.</p> <p>First, since all equations are in metric, convert square footage to square metres using the following conversion table.</p> <p>1 square foot = 0.0929 square metres, therefore 1000 square feet = 92.9 square metres</p> <p>Therefore, L X W = 92.9 m²</p> <p>We know that the number of stories is 2, and using the criteria for VCM, we can assume a vegetative cover multiplier of 1.5 for a neighbourhood with a dense tree canopy.</p> <p>Using these values,</p> $V_{debris} = 1.65 m \times 92.9 m^2 \times (1.5 + 2 - 1)$ <p>Therefore,</p> $V_{debris} = 383.2 m^3$ <p>To convert this to tonnes of debris, we could use the following density conversion: 1 m³ of debris = 0.6 tonnes, therefore the tonnage would be 383.2 X 0.6 = 229.9 tonnes.</p>
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Joint Municipal Regional Disaster Debris Management Operational Plan

<p>In Home Flood Debris</p>	<p>Use this calculation for buildings damaged (but not destroyed) by a flood. This accounts for property damage due to water absorption.</p>	<p>V_{debris} $= L \times W \times 0.0061 \text{ m}$</p> <p>Length and width must be in metres</p> <p>0.0061 m = a constant based on USACE study data</p>	<p>Assume a 180 m² single family home is damaged, but not destroyed, in a flood.</p> <p>The volume of debris can be determined by: $V_{debris} = L \times W \times 0.0061 \text{ m}$</p> <p>In this case, L x W = 180 m²</p> <p>Therefore: $V_{debris} = 180 \text{ m}^2 \times 0.0061 \text{ m}$ $V_{debris} = 1.098 \text{ m}^3$</p>
<p>Legend</p> <p>L= Length of building (in metres) W = Width of building (in metres) VCM = Vegetative Cover Multiplier H = Height of building (in metres) S = Number of stories in a building</p>			

Joint Municipal Regional Disaster Debris Management Operational Plan

Vegetative Cover Multiplier Table

The Vegetative Cover Multiplier only applies to single-family homes, and is based on US Federal Emergency Management Agency (FEMA) field experience.

Vegetative Cover	VCM Value
None/Minimal	1
Light - More ground is visible than trees from aerial view and canopy cover is sparse	1.1
Medium - Uniform pattern of open space and tree canopy cover	1.3
Heavy – Ground or houses cannot be seen from aerial view due to tree canopy cover	1.5

Conversion Table

The conversion table provides the means of converting the cubic metre figure obtained when completing the above formulas into other measures. This may be required when coordinating disaster debris management activities such as coordinating the disposal of debris with an out-of-area facility.

1 square foot	0.0929 square metres
1 cubic metre	1.308 cubic yards
1 cubic metre construction and demolition debris (buildings and contents only)	0.6 tonnes
1 cubic metre mixed debris (buildings mixed with vegetation/other debris)	0.3 tonnes
1 cubic metre hardwood vegetation (e.g. deciduous trees)	0.3 tonnes
1 cubic meter softwood vegetation (e.g. conifers)	0.2 tonnes
1 tonne	1.102 tons (short tons)

Source: US FEMA Debris Guide

Final Debris Calculation

Final Debris Calculation will be required for reporting and financial purposes.

In the event of an earthquake or flood, the HAZUS methodology can be utilized to generate a more detailed estimate of debris. A detailed building inventory will need to be compiled and inputted into the advanced engineering building module. The building inventory will require type of building, as per the HAZUS definition, and the number of above ground stories in the building.

Building damage would need to be classified using the HAZUS categories of none, slight, moderate, extensive, or complete.

The HAZUS methodology of estimation will provide the number of tons of brick, wood and other material as well as concrete and steel material generated as a result of earthquake damage.

C. DEBRIS SEPARATION AND PROCESSING

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Aggregate Waste	Clean, uncontaminated brick, block, concrete and asphalt.	Physical	Sorting, crushing & granulating.	Recycle	
Animal Remains	Significant loss of livestock, pets, and/or natural wildlife.	Biological	Carcasses of small animals, wildlife, etc., will be directed to the SPCA for disposal in accordance with regulations. Agriculture Canada will stipulate requirements for disposal of large numbers of animal carcasses and farm animal debris.		
Asbestos Containing Waste	Commonly found in building debris: Insulation (blown, rolled, and wrapped). Resilient floor covering (tiles). Asbestos siding shingles. Asbestos Drywall/Gypsum Asbestos cement products. Asphalt roofing products	Chemical	Specialized handling which requires expertise/specialist.	Landfill	

Joint Municipal Regional Disaster Debris Management Operational Plan

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Construction and Demolition Debris (C&D) Non-Asbestos Containing Waste	Debris from buildings: Aggregate (concrete, brick, block), clean wood (free of adhesives, coatings and preservatives), roofing and siding materials, wallboard, metals, carpeting and flooring, insulation, glass, tile, window coverings, plastic pipe, heating and ventilating, and air conditioning systems and their components, light fixtures, furnishings and fixtures.	Physical, Chemical (see other specific debris types), Biological (see other specific debris types)	Sort	Recycle, Re-use, incineration or landfill	
Electronic Waste	Stereos, televisions, VCRs, DVD players, computers and peripheral accessories, telephones, and other devices.	Physical	Sort	Recycle or Re-use	
Green Waste/ Vegetative Debris	Trees, branches, shrubs, logs, brush.	Physical	Chipping & Mulching	Compost	

Joint Municipal Regional Disaster Debris Management Operational Plan

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Hazardous Waste	Petroleum-contaminated media, chlorofluorocarbons (CFCs), and all other substances as defined in the BC Hazardous Waste Regulation.	Chemical	Specialized handling which requires expertise/specialist. Identify: Sources of hazardous substances Potential risks Isolation measures Handling and disposal requirements	Incineration	2016 Emergency Response Guide Book http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm
Healthcare Risk Waste	Infectious agents, sharp objects, hazardous chemicals or pharmaceuticals, genotoxic or radioactive substances and anatomical waste.	Biological	Isolate The Health Region having jurisdiction will identify appropriate handling and disposal options.		
Household Hazardous Waste (HHW)	Automobile fluids, batteries, paints and stains, cleansers, photo chemicals, lawn-care chemicals, and pesticides.	Chemical	Isolate from other debris and stockpile for subsequent disposal in accordance with regulations.	Recycle	
Human Remains	Dead bodies, tissue, teeth and bones.	Biological	The Provincial Coroner's Office have a mass casualty plan and is responsible for handling and disposal of human remains (whether whole or parts of bodies).		

Joint Municipal Regional Disaster Debris Management Operational Plan

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Putrescent Municipal Solid Waste	Food spoilage and contaminated or damaged recyclables which requires immediate disposal.	Biological Local Environmental	Consolidate	Incineration or Landfill	
Scrap Metal	Ferrous metals such as structural steel and steel framing members and non-ferrous metals such as wiring/conduit, plumbing (pipes and fixtures) and HVAC materials (ductwork, motors).	Physical	Sorting & Crushing	Recycle	
Sensitive or Dangerous Debris	Weapons, ammunition, explosive materials and devices.	Physical	Isolate	Store – security	
Soil, Silt and Sediment (Uncontaminated ; Contaminated)	Residuals deposited by receding flood waters or earthquake liquefaction which may include historical sediment from nearby water bodies, soil from yards, road and construction debris, and other material.	Physical	Consolidate	Recycle	

Joint Municipal Regional Disaster Debris Management Operational Plan

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Stray and Abandoned Vehicles and Vessels	Cars, trucks, motorcycles, or recreational vehicles. Vessels left unattended for more than 24 hours on the waters not moored, anchored, or made fast to the shore; or a vessel left on the property of another for more than 24 hours without the consent of the property owner.	Theft	Isolate	Store – security	
Treated Wood	Commonly found in: decks, fences, gazebos, playground equipment, docks, landscape, agricultural uses and industrial applications, such as utility poles, railway ties and bridges.	Chemical	Isolate	Incineration or Landfill	http://www.woodpreservation.ca/index.php/en/residential-use/faq
Utility Related Debris	Power transformers, utility poles, cable, and other utility company material.	Chemical	Isolate The Utility (e.g. BC Hydro) with jurisdiction will identify disposal options.	Recycle or Re-use	

Joint Municipal Regional Disaster Debris Management Operational Plan

Debris Type	Description	Common Risks/Hazards	Handling Procedures	Processing Options	Additional Information
Valuables & Personal Possessions	Art, antiques, jewelry, money, safes, photographs, items having sentimental value.	Theft	Isolate	Store – security	
Waste Tires	All tires that have been separated from the vehicle to which they belonged.	Physical	Isolate & possibly shred	Recycle or Incineration	
White Goods	Appliances such as stoves, refrigerators, freezers, dishwashers, washers, dryers, water heaters, microwaves, air conditioners, other similar types of appliances.	Physical	Sort (Freon must be removed from cooling units of refrigerators, freezers and air conditioners.)	Recycle or Re-use	

D. EQUIPMENT CLASSIFICATION

Equipment Types	Description	Potential Attachments	Considerations
General Equipment			
Excavators	<p>Excavator equipment, using a thumb attachment, can be used to sort through rubble to pick out various materials to create separate piles of debris.</p> <p>They come in a variety of sizes depending on the size of the job and how much room there is for the machine: EX 120, EX 200, EX25, EX300, EX50, EX70.</p>	<p>Digging buckets.</p> <p>Clean out buckets.</p> <p>Herder bucket.</p> <p>Thumb attachment.</p> <p>Long Reach.</p> <p>Wrist-a-twist.</p>	<p>Tail swing (is a zero-clearance machine required?).</p> <p>Match the size of the excavator required to the size of the job as well as the space available for the machine to operate. <i>Note: a truck and trailer (i.e. tag trailer) is required to transport the equipment to job site/s.</i></p> <p>Rubber track, steel track and rubber wheel.</p>
Backhoes	<p>Backhoes can be used to load materials, can backfill as well as for digging and moving large amounts of materials. Backhoes can be driven to the site, vs. an excavator, which has to be moved to the site using low bed or tag trailer. With a thumb attachment, they could also be used to lift and sort through debris.</p> <p>They come in a variety of sizes and it is generally the size of the bucket (amount of material to be moved) that dictates the size of machine needed. Bucket size is in cubic yards.</p>	<p>Hoe pack (tampers).</p> <p>Augers.</p> <p>Breaker.</p> <p>Thumb Attachments.</p>	<p>Bucket size.</p>

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Equipment Types	Description	Potential Attachments	Considerations
Dump Trucks	<p>Dump trucks are used for moving large amount of materials. They will be filled by a backhoe or excavator operator with materials for transport. This can include soil, gravel, etc.</p> <p>Various dump trucks include:</p> <ul style="list-style-type: none"> Single axle dump trucks. Tandem axle dump trucks. Truck with pony attached. 	<p>Salt inserts.</p> <p>Tag trailer attachment (for moving and transporting equipment -- excavators, trees, etc.).</p> <p>Low bed trailer.</p> <p>Plow attachments.</p> <p>Sidewinder for shouldering and sandbagging.</p>	<p>Single axle truck has one axle at the rear and is a minimum of 13,608 kg.</p> <p>A tandem axle has two axles at the rear and is a minimum of 24,494 kg.</p> <p><i>Both must be capable of hauling payloads consistent with their respective GVW's and operate within legal load limits.</i></p> <p><i>A pony (pup) may also be attached to a tandem truck to move larger amounts of materials.</i></p>
Gradalls	<p>A gradall is a mobile piece of equipment that has a telescopic boom (as opposed to an articulated boom) which allows work in closer range of work area. They are used mainly for ditch cleaning, sidewalk work and dyke repair work.</p>		
Crane Trucks	<p>Crane trucks are used to a variety of materials, e.g. concrete blocks, pipe infrastructure, large trees, etc.</p>	<p>For the boom, you can get forks for lifting pallets (used like a forklift).</p>	<p>Size and reach of the load to be moved is the key consideration as this will dictate the weight capacity of the crane.</p>
Bulldozers	<p>Bulldozers can be used to push large amounts of soil or debris with an articulated blade.</p>		<p>The size of the load to be moved would dictate the size of the machine required.</p>

Joint Municipal Regional Disaster Debris Management Operational Plan

Equipment Types	Description	Potential Attachments	Considerations
Sweepers	Sweepers are used for cleaning roadways and debris from drains. Water is used to keep the dust down and there a vacuum to pick up debris that is being swept.		Size of the debris box/ hopper will indicate how quickly the unit will fill up requiring to be brought back somewhere for unloading.
Bobcats/ Skid Steer	This is a smaller, mobile machine that can do the functions of a small front-end loader. Used where there are small or hard to reach areas for multi-functions.	Backhoe attachment. Sweeper. Grinder. Breaker. Bucket. Snow blower. Sidewinder/auger bucket.	Terrain (cannot climb rubble). Size of the load to be moved.
Flushers	Flushers are mobile and can be used to spray water to minimize dust on roads or to flush the roads of debris.		Temperature (if cold, lines in the unit could freeze, water on road could freeze, creating unsafe condition/s).
Vactors	Vactors are mobile pieces of equipment that hydro-excavate around utilities. They can be used to suck water up from a hole or around plugged sewer lines or other infrastructure.		Temperature. Terrain.
Grader	Similar to a bulldozer for used to smooth access routes (generally used in road paving).	Front end loader attachment.	Size of job would dictate size of machine.

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Equipment Types	Description	Potential Attachments	Considerations
		Various blade sizes.	
Front End Loader	Loaders are also mobile and can move and load large amounts of debris.	Blade attachments (for use as a bulldozer).	Bucket size needed (cubic yards).
Forklift	Forklifts have front forks for picking up pallets that contain items/goods. They can be used to unload from panel vans.	Different length of forks.	Electric forklifts used inside. They come in a variety of fuel types which needs to be taken into consideration if they are to be used in an enclosed environment. Size and weight are also considerations to determine the size of the forklift required.
Rollers	Rollers could be used for compaction for temporary road repairs.		Weight of compaction required.
Dredger	A dredger is a barge-based piece of equipment used for taking debris out of river beds and around shorelines.		
Waste Collection Equipment			
Garbage Trucks	<p>Garbage trucks are used for the collection of refuse as well as organics with yard waste materials on a curbside application.</p> <p>Equipment can be either rear loaded with cart tippers or side loaded with cart tipper. Also, a fully automated option can be used with a fully automated helping hand collection arm.</p>	<p>Manual Collection: Rear load/side load.</p> <p>Semi Automated: Rear load/side load with cart tippers.</p> <p>Fully Automated: Side load with helping hand arm.</p>	Due to potential max payload, a tandem axle (2 axles at the rear) chassis will be required and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.

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Equipment Types	Description	Potential Attachments	Considerations
Recycling Trucks	<p>Recycling trucks are used for the collection of recycling materials including glass in a curbside/central location application. Each collection vehicle is segregated with a bulkhead wall to separate materials currently being collected at the curb (Mixed Paper / mixed plastic / glass under the current PPP stewardship plan).</p> <p>For the purposes of disaster relief, and the effort to get materials off the curb, the Local Authority would have to decide if they wished to collect all materials commingled - single stream.</p> <p>In this case a rear load collection vehicle semi automated with cart tipper / side load collection vehicle semi automated with cart tippers can be utilized.</p>	<p>Multi stream collection: manual side load multi compartment, semi automated side load (over the top).</p> <p>Single stream collection: semi automated rear load with cart tipper, semi automated side load with cart tipper, fully automated side load with helping hand arm.</p>	<p>Single axle truck has one axle at the rear and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.</p>
Front end Truck	<p>Front load collection trucks are used for the collection of front load containers. Most collection vehicle are single compartment.</p>	<p>Fully automated collection vehicle with front load fork capability.</p>	<p>Due to potential max payload, a tandem axle (2 axles at the rear) chassis will be required and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.</p>
Roll off Truck	<p>Roll off collection trucks are used for the collection of roll off containers.</p>	<p>Semi automated collection vehicle with hook or cable operation.</p>	<p>Due to potential max payload, a tandem axle (2 axles at the rear) chassis will be required and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.</p>

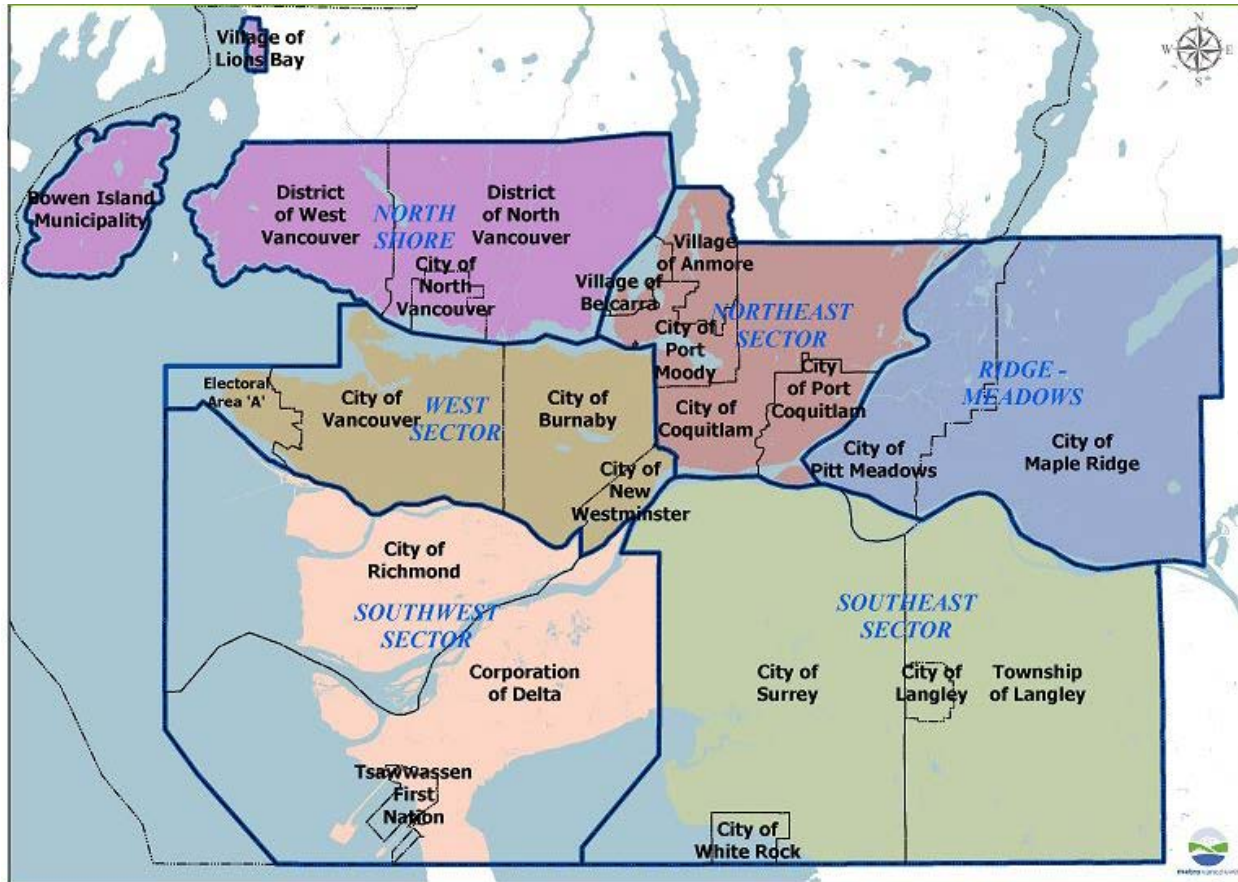
Joint Municipal Regional Disaster Debris Management Operational Plan

Equipment Types	Description	Potential Attachments	Considerations
Container Trucks			
Compactors	Compactor Equipment is used to contain materials in a closed top roll off bin. Typical use for compactors is for loose light materials such as cardboard or paper or refuse/organics materials. Compactor equipment require a power pack (electrical hook up and in most cases to be installed in a flat surface. Compactor bins are transported using a roll off truck.	Compactor bins can range from 10, 20, 30, 40 cubic yard closed top roll off bins.	
Roll Off Containers	Front load collection trucks are used for the collection of roll off containers. Most roll off containers are single compartment. This type of equipment is typically used for medium to large collection volumes with single stop/drop off points.	Sizes: 10, 20, 30, 40 cubic yard containers.	Open top. Closed top.
Front End Bins	Front load collection trucks are used for the collection of front load containers. Most collection vehicles are single compartment.	Fully automated collection vehicle with front load fork capability.	Due to potential max payload, a tandem axle (2 axles at the rear) chassis will be required and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.
Roll Off Truck	Roll Off collection trucks are used for the collection of roll off containers.	Semi automated collection vehicle with hook or cable operation.	Due to potential max payload, a tandem axle (2 axles at the rear) chassis will be required and must be capable of hauling payloads consistent with the respective GVW and operate within legal load limits.

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Equipment Types	Description	Potential Attachments	Considerations
Open Top Trailers	Similar to dump trucks and are used for moving large amount of materials. They will be filled by a backhoe/bobcat or excavator operator with materials for transport. This can include soil, gravel, etc.		
Chippers	To maximize on payload capacity and depending on the materials to be collected, it may be advisable to utilize chipping equipment especially if you are transporting large amounts of wood (trees/branches/construction/etc.) as these materials are bulky and will fill the collection container quicker with less volume.		<p>Mobile chippers (as in Parks equipment).</p> <p>Stationary chippers (e.g. large chippers used at composting sites).</p>

E. METRO VANCOUVER REGION SUB-REGIONS



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F. METRO VANCOUVER REGION FLOOD PLAIN MAPS

http://www.env.gov.bc.ca/wsd/public_safety/flood/fhm-2012/maps.html#emergmaps

G. SITE IDENTIFICATION AND SUITABILITY MATRIX

To support individuals in selecting the most suitable sites for use as Temporary Transfer Stations and Temporary Waste Handling Facilities, an automated spreadsheet has been developed which can be accessed from <http://www.metrovancouver.org/services/emergency-preparedness/Documents/SiteIdentificationandSuitabilityMatrix.xlsx>

HOW TO USE THIS FORM
A) For each criteria below, select a RATING SCORE from the drop down list provided in the RATING Column. Rating scores: 5 = excellent/yes; 3 = average/probable; 1 = poor /no; N/A = Not applicable
B) The Site Selection Template will automatically calculate the totals for the site identified.
C) Repeat this process for each potential site and then compare the totals for each site.
D) The site with the highest total meets the most criteria and should be considered the primary site for the area in question.

DATE COMPLETED

COMPLETED BY

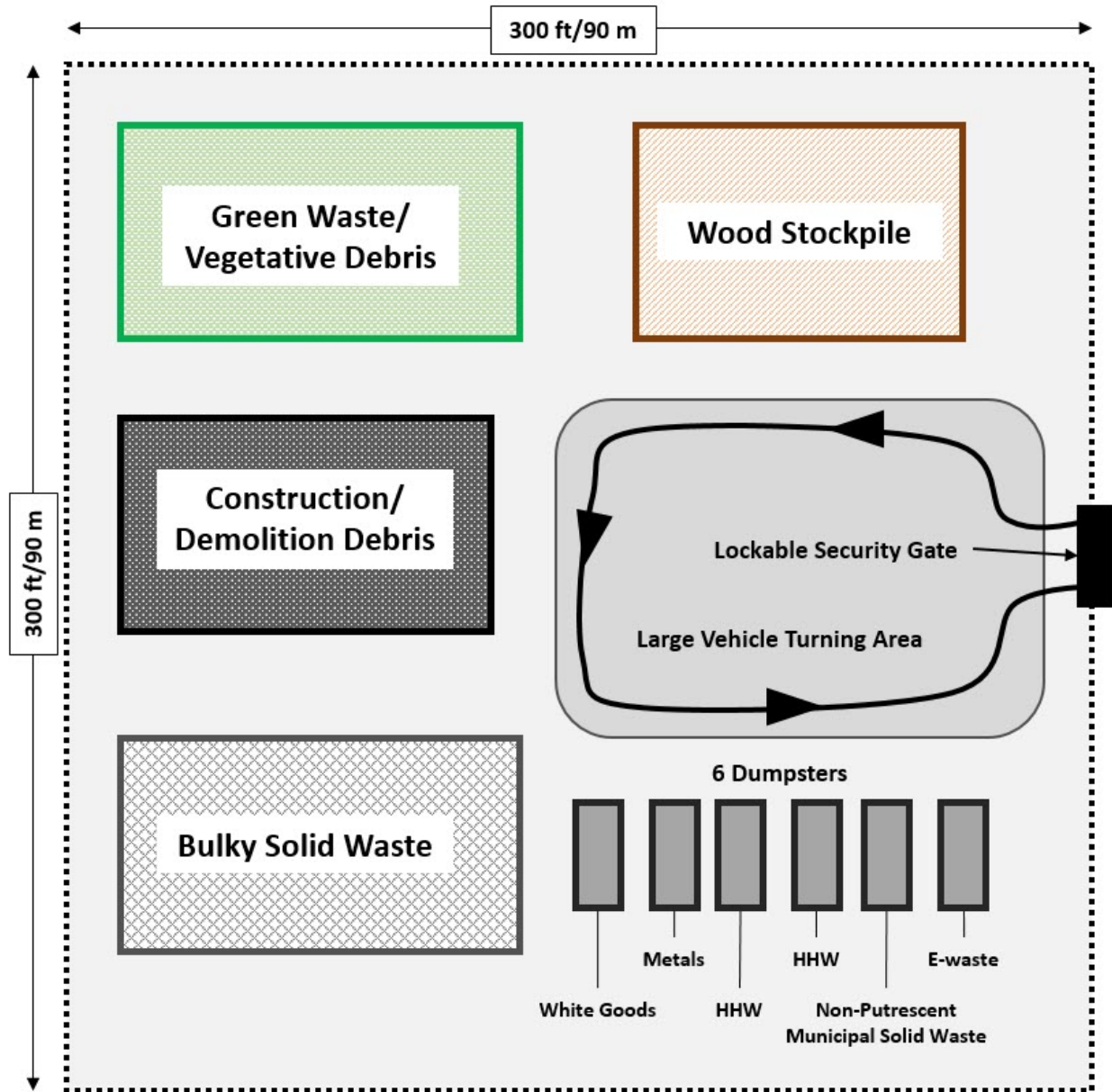
SITE #: NAME	SITE #: ADDRESS

CRITERIA	RATING	WEIGHTING	TOTAL (Rating x Weighting)	NOTES
Proximity to impacted area (debris)				
		Weighting	15	
1	Is the site located within close proximity to the (anticipated) debris?			
2	Is the site within close proximity to public and licensed recycle and disposal facilities (including closed landfills) which will be used for final disposal?			
3	Is there an established truck route/dangerous goods route which can be utilized between the site and (anticipated) debris?			
4	Can alternate routes be used if bridges, underpasses or impacted infrastructure (e.g. road damage, down powerlines) hinder access between the site and (anticipated) debris?			
Average		15%	0.15	
Size of site				
5	Is the site large enough, being ≥ 2 acres for temporary transfer stations and ≥ 5 for debris management sites, to accommodate the volume and weight of (anticipated) debris identified in the initial debris estimate for the area being serviced?			
6	Does the site have the capacity to management the (anticipated) volume and/or weight of debris?			
7	Is the site able to accommodate the types of debris identified in the debris estimation for the area being serviced?			
8	If being utilized as a collection site, can the site accommodate all storage, sorting and volume reduction requirements?			
9	If being utilized as a temporary transfer station, can the site accommodate all storage, sorting and volume reduction requirements?			
10	If being utilized as a debris management site, can the site accommodate all storage, sorting and volume reduction requirements?			
Average		15%	0.15	
Site management				
11	Based on land use and zoning, e.g. residential, commercial or industrial, can the chosen location be utilized immediately for debris management purposes?			
12	Can a logistically effective site layout be developed within physical constraints of existing infrastructure on the site?			
13	If there are implications caused by onsite infrastructure, can they be easily addressed, e.g. weight of debris on underground infrastructure?			
14	Is there access to infrastructure (e.g. water, power) to support the site operations?			
15	Are there appropriate surfaces at the site to address all debris types and management needs, e.g. non-porous areas such as a paved parking lot?			
16	Does the site have appropriate drainage?			
17	Are the gradients on the site adequate, being 0 - 5%?			
18	If utilizing a contaminated site, is it suitable to accommodate the (anticipated) debris?			
19	Does the site have existing security features such as fencing and lighting?			
Average		20%	0.2	

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Environmental considerations and sensitivity			
20	Is the site away from historical/ archeological sites?		
21	Is the site outside of environmentally sensitive areas, e.g. wetlands, streams, rivers, and potable water wells?		
22	Within the parameters of this site, can steps be taken to reduce any environmental impacts based on the array of debris types, e.g. use of paved parking lots, containers, tarps, etc.?		
23	If utilizing a park, can the environmental impacts considered be efficiently and promptly mitigated against?		
24	Have considerations been made to address wildlife, such as bears, that may be attracted to the site?		
25	Is the site outside of areas prone to liquefaction and flooding, e.g. 25 year (or less) flood plains?		
26	Can the site be protected from the elements, e.g. prevailing winds, etc.?		
27	Does the site have the ability to minimize the consequences of debris, e.g. visibility, odour, wildlife?		
Average		15%	0.15
Access			
28	Is the site accessible via road?		
29	Is the site accessible via water (marine)?		
30	Is the site accessible via rail?		
31	Are the primary access points to the site near disaster response routes?		
32	Are the primary access points to the site near truck routes/ dangerous goods routes to ensure easy access to and from the site?		
33	Are the roadways surrounding the site able to accommodate equipment transporting debris, e.g. the roads can accommodate the weight of vehicles' full carrying capacity; no obstructions such as overhead powerlines?		
34	Is there an acceptable gradient on the roadways leading to the site?		
35	Can effective traffic management plans be created to address an increased volume of traffic to, from and within the site?		
36	Is the site a reasonable distance away from schools and hospitals?		
37	Can the noise, dust and odours resulting from site operations be mitigated/ reduced?		
Average		20%	0.2
Ownership			
38	Is the site publicly owned?		
39	Is the site on crown land?		
40	Is the site privately owned?		
41	Can access to private land be granted easily, e.g. are contact details for the owner available?		
41	If private lands are being used, are they cost effective?		
42	Are the transportation routes providing access and egress to, from, and within the site publicly owned?		
43	If the transportation routes providing access and egress to, from, and within the site are privately owned, is the owner contactable and accommodating?		
44	If the critical infrastructure on or servicing the site is owned privately, is the owner contactable and accommodating?		
Average		15%	0.15
TOTAL		100%	1.0

H. SAMPLE TEMPORARY WASTE HANDLING FACILITIES LAYOUT



I. TEMPORARY WASTE HANDLING FACILITY MANAGEMENT PLAN (SAMPLE)

To effectively set-up and manage of the various temporary waste handling facility sites (neighbourhood drop-off points, collection centres, temporary transfer stations, and debris management sites), the below table identifies components which should be considered at each stage of operation.

SITE SET-UP

Site Name: _____

Site Location: _____

General

- Site layout prepared.
- Site hours of operation determined.
- Site hours of operation communicated/ posted.
- Debris tracking forms obtained.
- Debris tracking forms circulated.

Security

- Fencing materials sourced.
- Fencing installed around and within site (as per layout).
- Lighting materials sourced.
- Lighting installed around and within site (as per layout).
- Security services sourced and schedule established.

Communications

- Site operations communication methods determined.
- Site operations communication methods implemented.
- Public communication methods determined.
- Public communication methods implemented.

Resources

- Personnel sourced (utilize the EOC Logistics Section if assistance is required).
 - o Scheduling completed.
 - o Scheduling communicated/ posted.
 - o Training completed.

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- Equipment sourced (utilize the EOC Logistics Section if assistance is required).
- Equipment delivered to site.
- Contractors sourced (utilize the EOC Logistics Section if assistance is required).
- Contractors are scheduled.

Required Plans

- Occupational Health & Safety Plan
 - o Plan developed.
 - o Plan implemented.

- Traffic Management Plan
 - o Plan developed.
 - o Plan implemented.

- Wildlife Management Plan
 - o Plan developed.
 - o Plan implemented.

- Hazardous Materials Plan
 - o Plan developed.
 - o Plan implemented.

- Noise Management Plan
 - o Plan developed.
 - o Plan implemented.

- Dust Management Plan
 - o Plan developed.
 - o Plan implemented.

- Odour Management Plan
 - o Plan developed.
 - o Plan implemented.

SITE MANAGEMENT

Site Name: _____

Site Location: _____

General

- Determine if additional debris tracking forms are required and obtain if needed (utilize the EOC Logistics Section if assistance is required).
- Circulate additional debris tracking forms as needed.

Security

- Determine if additional security services are required and source as needed (utilize the EOC/ ROC Logistics Section if assistance is required).

Communications

- Site operations communication methods implemented and maintained.

Resources

- Determine if additional Personnel are required and source as needed (utilize the EOC/ ROC Logistics Section if assistance is required).
 - o Schedule updated.
 - o Revised schedule communicated/ posted.
 - o Training completed.
- Determine if additional equipment is required and source as needed (utilize the EOC/ ROC Logistics Section if assistance is required).
- Determine if additional contractors are required and source as needed (utilize the EOC/ ROC Logistics Section if assistance is required).
 - o Update contractors schedule and communicate/ post.

Required Plans

- Occupational Health & Safety Plan maintained/ adjusted as necessary.
- Traffic Management Plan maintained and adjusted as necessary.
- Wildlife Management Plan maintained/ adjusted as necessary.
- Hazardous Materials Plan maintained/ adjusted as necessary.
- Noise Management Plan maintained/ adjusted as necessary.
- Dust Management Plan maintained/ adjusted as necessary.
- Odour Management Plan maintained/ adjusted as necessary.

J. WASTE MANAGEMENT FACILITIES AND LANDFILL SITES IN THE METRO VANCOUVER REGION (2017)

Name	Accepting	Address/Phone	Materials	Tonnage
Vancouver Landfill	Yes	5400 72 St, Delta	NOT asbestos-containing drywall	100,000 annually (DLC site)
Ecowaste Landfill	Yes	15111 Williams Rd, Richmond		140,000 annually
Waste-to-Energy		5150 Riverbend Drive, Burnaby, BC		
Atlantic Waste Systems Landfill: Indian and Northern Affairs	No, it's full and closed ⁶	Maple Ridge, BC		
Cheam Landfill: First Nation	No, capacity is limited and it's closed ⁷	Rosedale, BC (East of Chilliwack)		
Shxha:y Landfill First Nations	Unknown (Fraser Valley Regional District management plan)	Chilliwack/Mission, BC	Demolition, Land-clearing and Construction (DLC)	30,000 annually
Skway Landfill – Tervita	Unknown (Fraser Valley Regional District management plan)			
Bailey Rd Landfill	Yes (Fraser Valley Regional District management plan)	5940 Matheson Rd Chilliwack, BC		21,000 annually
Chaumox Landfill	Yes (Fraser Valley Regional District management plan)	50390 Chaumox Road, Electoral Area A, North Bend, BC		500 annually

⁶ Source: Johanna van den Broeke, Metro Vancouver

⁷ Source: Johanna van den Broeke, Metro Vancouver

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Name	Accepting	Address/Phone	Materials	Tonnage
Mission Landfill	Yes (Fraser Valley Regional District management plan)	32000 Dewdney Trunk Rd, District of Mission, BC		12,000 annually
Valley Rd Landfill	Yes (Fraser Valley Regional District management plan)	33670 Valley Rd, Abbotsford, BC		
Wastech		1001 United Blvd., Coquitlam, BC	Accepts and handles wood waste	
Cloverdale Fuels		20408 - 102B Ave., Langley, BC	Accepts and handles wood waste	
Urban Wood Waste		110 69th Ave. E, Vancouver, BC	Accepts and processes both source separated wood waste and commingled loads. DLC	
Basran Fuels		1228 Pretty Ct., New Westminster, BC	Accepts demolition wood waste from transfer reload stations	
Cloverdale Disposal Ltd.	Yes	26116 31B Ave., Langley, BC	DLC	
AWS Transport Ltd.	Yes	11 Braid St., New Westminster, BC	DLC	
Urban Wood Waste Recyclers Ltd.	Yes	4 Spruce St., New Westminster, BC	DLC	
Bright Sky Disposal Ltd.	Yes	12863-116 Ave., Surrey, BC	DLC	
King Kubota Services Ltd.	Yes	140 Mountain Hwy, North Vancouver, BC	DLC	

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Name	Accepting	Address/Phone	Materials	Tonnage
726233 B.C. Ltd. (Waste-Away Disposal Service)	Yes	11560 Twigg Pl., Richmond, BC	DLC	
Smithers Enterprises Inc.	Yes	8501 Ontario St., Vancouver, BC	DLC, wood	
Eagle Disposal Inc.	Yes	11611 Twigg Pl., Richmond, BC	DLC, mattresses, carpet, furniture	
Revolution Infrastructure Inc.	Yes	460 East Kent Ave. S., Vancouver, BC	DLC, gypsum, furniture, white goods	
Great West Disposal Inc.	Yes	7800 Anvil Way (129A St.), Surrey, BC	DLC, yard waste, furniture	
River Road Area of Delta North and West of Burns Bog		5400 72 St., Delta, BC	DLC fill site	
South and East Perimeter of Burns Bog		Delta, BC	DLC fill site	
Big Bend Area (Byrne Road)		5113 Byrne Rd, Burnaby, BC	DLC fill site	
Flood Plain in Nicomekl and Serpentine River Valleys		Surrey and Langley, BC	DLC fill site	
Flood Plain of Pitt River (golf course contouring)		Pitt Meadows, BC	DLC fill site	
Flood Plain of Coquitlam River and Fraser River		Coquitlam, BC	DLC fill site	
Area East of the Vancouver Landfill		Delta, BC	Potential DLC fill site	
North Coquitlam (close to Pipeline Rd)		Coquitlam, BC	Potential DLC fill site	

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Name	Accepting	Address/Phone	Materials	Tonnage
Pinelands Peat site		Delta, BC	Soil overburden and non-structural fill loads	
Katzie First Nations land		Pitt Meadows, BC	Soil overburden and non-structural fill loads	
Acme fill site adjacent to EcoWaste Landfill		Richmond, BC	Fill site owned by Fraser River Port Authority	
Ottawa Street		Port Coquitlam, BC	Fill site operated by Excess West	
Bridgeview Properties near the Pattullo Bridge		Surrey, BC	Fill site	

Closed Landfills

Name	Accepting	Address/Phone	Materials	Tonnage
Stride Avenue Landfill		6292 Stride Ave., Burnaby, BC		
Jackman Landfill		272 St. and 8 Ave., Aldergrove, BC		
Cottonwood Landfill		11589 Cottonwood Dr., Maple Ridge, BC		
Premier St Landfill		1101 Premier St., North Vancouver, BC		
Barnet Hwy (Semple Landfill)		South of Barnet Highway at Reed Point Way		
Coquitlam Landfill		Braid St., Coquitlam, BC		
Iona Island WWTP		1000 Ferguson Road, Iona Island, BC		

Joint Municipal Regional Disaster Debris Management Operational Plan

Name	Accepting	Address/Phone	Materials	Tonnage
Elgin Landfill		34th Ave. and 140th to 144th St.		
Loutet Park Landfill		1440 Rufus Ave., North Vancouver, BC		
Lions Bay Landfill		Approx. one mile north of Lions Bay, near Brunswick Beach, Village of Lions Bay, BC		
Bonson Landfill		11546 Bonson Rd., Pitt Meadows, BC		
Bear Creek Landfill		King George and 88th		
Johnston Road Landfill		152 St. and 112nd Ave.		
24th Ave Landfill		24th Ave. between 140th and 144th		
Kerr Road Landfill (Everette Crowley Park)		East of Kerr Rd., North of Marine Dr.		
China Creek Ravine Landfill		East Broadway and Clarke Dr., China Creek Park South		
Third Street Landfill (Hugo Ray Park)		3rd St. at Keith Rd.		

Joint Municipal Regional Disaster Debris Management Operational Plan

Transfer Stations

Name	Accepting	Address/Phone	Materials	Tonnage
Coquitlam Transfer Station	Yes	1200 United Blvd., Coquitlam, BC	Metal, plastic, tires, wood, yard waste	
North Shore Transfer Station	Yes	30 Riverside Dr. West, North Vancouver, BC		
Maple Ridge Transfer Station	Yes	10092-236 St., Maple Ridge, BC		
Surrey Transfer Station	Yes	9770 192nd St., Surrey, BC		
Vancouver Transfer Station	Yes	377 West Kent Ave., North Vancouver, BC		
Langley Transfer Station	Yes	1070-272 St., Aldergrove, BC		

Recycling and Composting Facilities

Name	Accepting	Address/Phone	Materials	Tonnage
B.A. Blacktop		201-111 Forester St., North Vancouver, BC	Concrete and asphalt	
Columbia Bitulithic		13340 Mitchell Rd., Richmond, BC	Concrete and asphalt	
Richvan Recycling		15300 River Rd., Richmond, BC	Concrete and asphalt	
733166 B.C. Ltd. (Western Material Recovery)	Yes	11610 Twigg Pl., Richmond, BC,	Gypsum	
New West Gypsum Recycling	Yes	38 Vulcan St., New Westminster, BC,	Gypsum	
Emterra Environmental	Yes	132 Riverside Dr., North Vancouver	glass, metal, plastic, mixed recyclables	

Joint Municipal Regional Disaster Debris Management Operational Plan

Name	Accepting	Address/Phone	Materials	Tonnage
Emterra Environmental	Yes	955 W. Kent N. Ave., Vancouver	glass, metal, plastic, mixed recyclables	
Emterra Environmental	Yes	6362-148 th St., Surrey, BC	glass, metal, plastic, mixed recyclables	
Cascades Recovery Inc.	Yes	12345-104 Ave., Surrey, BC	Glass, metal, plastic, segregated recyclables	
Augustine Trucking Ltd.	Yes	1708 Perkins St., Port Coquitlam, BC	Yard waste	
Happy Stan's Recycling Services Ltd.	Yes	1603 Langan Ave., Port Coquitlam, BC	Glass, metal, plastic, white goods, wood (pallets/furniture), carpet/underlay, electronics	
Urban Impact Recycling Ltd.	Yes	15360 Knox Way, Richmond, BC	Plastic, mixed recyclables	
Augustine Soil & Mulch Ltd.	Yes	17949 Kennedy Rd., Pitt Meadows	Yard waste, clean wood, land clearing waste	
Meadows Landscape Supply Ltd.	Yes	17799 Ferry Slip Rd., Pitt Meadows	Yard waste, land clearing waste, clean wood	
Recyc-Mattress Inc.	Yes	Unit 212-27353 58 th Cres., Langley	Mattresses, boxsprings	
Lafarge Canada Inc.	Yes	7611 #9 Rd., Richmond, BC	Clean wood, plastics, asphalt shingles	
Canadian Mattress Recycling Inc.	Yes	1210 Cliveden Ave., Delta, BC	Mattresses, boxsprings, furniture, white goods	
Urban Impact Recycling Ltd.	Yes	5 Capilano Way, New Westminster	Mixed residential recyclables	

Joint Municipal Regional Disaster Debris Management Operational Plan

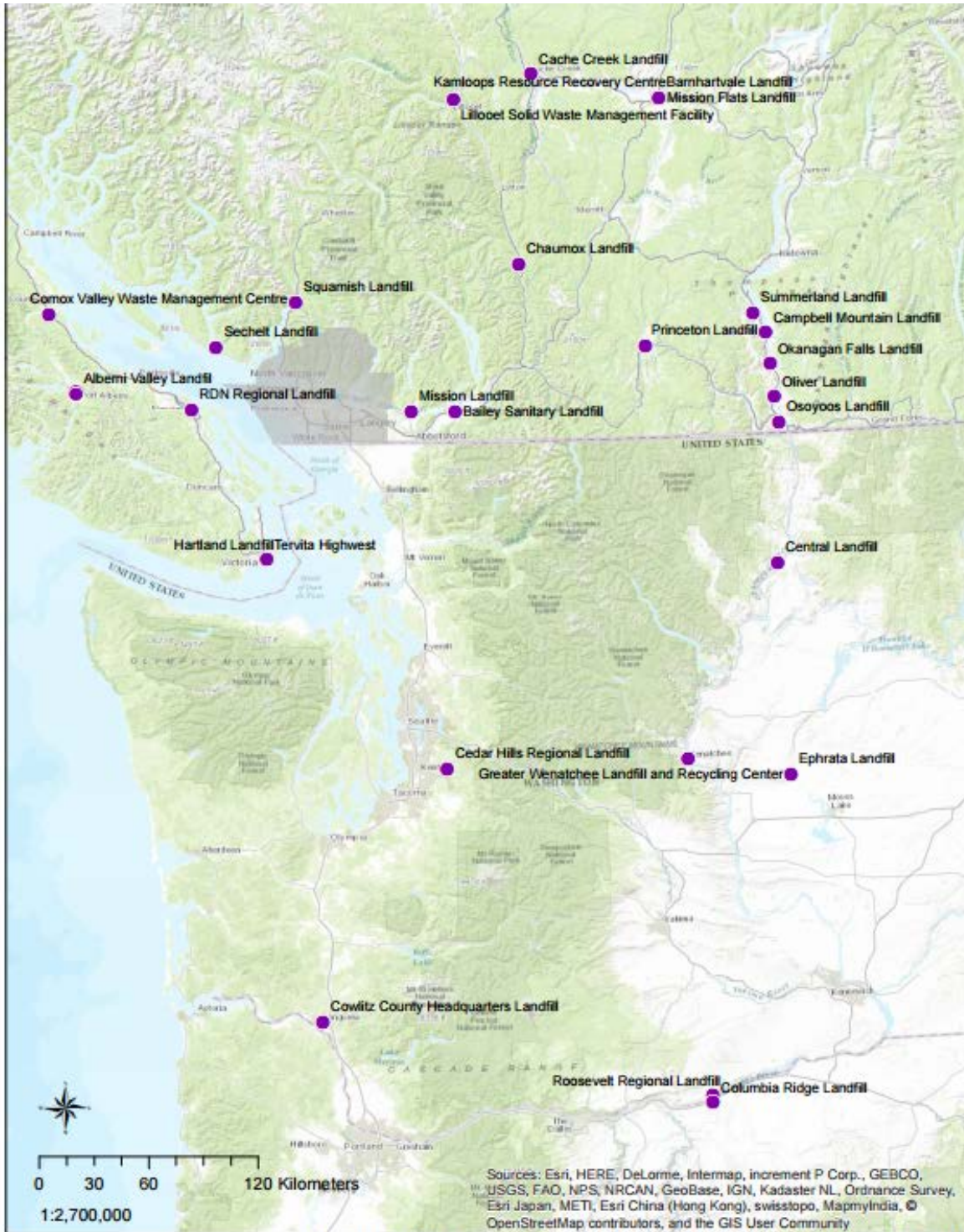
Name	Accepting	Address/Phone	Materials	Tonnage
GRE Manufacturing Cdn. Inc.	Yes	10064 River Rd., Delta, BC	Glass	
Stonewolf Ventures Ltd.	Yes	11571 Twigg Pl., Richmond, BC	Wood, metal, mattresses, electronics, plastic	
IMR Drywall Recycling	Yes	10619 Timberland Rd., Surrey	Gypsum	
Recycling Alternative	Yes	449 Industrial Ave., Vancouver	Wood, carpet, mixed recyclables	
Fraser Richmond Soil & Fibre Ltd.	Yes	7028 York Rd., Richmond, BC	Yard waste, clean wood, land clearing waste	
Enviro-Smart Organics Ltd.	Yes	4295 72 nd St., Delta, BC	Yard waste, clean wood	
Glenval Organics Ltd.	Yes	25330 88 th Ave., Langley, BC	Yard waste, clean wood	
UBC	Yes	6055 Nurseries Road, Vancouver, BC	DLC, glass, metals, plastic, rubbish	
Revolution Infrastructure Inc.	Yes	19500-56 th Ave., Surrey, BC	Plastic, glass, metal, mixed recyclables	
Revolution Infrastructure Inc.	Yes	460 East Kent Ave. S, Vancouver, BC	Plastic, glass, metal, mixed recyclables, clean wood	
Pacific Carpet Recycling	Yes	130-2351 No.6 Rd, Richmond	Carpet	

Joint Municipal Regional Disaster Debris Management Operational Plan

Hazardous Materials

Name	Temporary/ Permanent	Address/Phone	Materials	Tonnage
Quantum Murray		3600 Viking Way #100, Richmond, BC	Asbestos- containing drywall, contaminated soil	
Phoenix private transfer sites			Asbestos- containing drywall	
Quantum Environmental at EcoWaste Landfill	Permanent	Richmond	Contaminated soil	
Quantum Environmental	Permanent	9376 River Rd., Delta, BC	Contaminated soil	

K. WASTE MANAGEMENT FACILITIES AND LANDFILL SITES OUTSIDE OF THE METRO VANCOUVER REGION (2016)



G:\Projects\SW08\MXDs\Landfills_OutofRegion_16Aug2016.mxd TN August 16, 2016

L. PUBLIC COMMUNICATIONS SAMPLES

Audience: EOC Information Officer

Response Phases Communications

Phase: Debris Clearing

Concern:

Due the disaster event there is a high volume of debris on the roadways, which is restricting access to <name of critical facility, e.g. Hospital, Fire Hall No. 1> and impacting the ability of Emergency Services Personnel to provide critical services to the public.

Action:

Impacted governmental bodies are to activate their disaster debris management plans and to commence clearing of primary roadways and transportation routes leading to critical services and infrastructure, which will assist the Emergency Services Personnel in providing critical services to the impacted community/ies.

Associated Communications Sample:

Disaster Debris Restricting Access – Avoid Impact Areas

City, BC, Date: Debris stemming from the <disaster description> is blocking roadways and other emergency access points. Public Works crews are working to clear areas as quickly as possible to support emergency responders, who are focused on assisting affected citizens as quickly as possible.

Please use alternate routes to stay away from the following areas until further notice: <list affected areas or refer to a website for list if extensive number of locations>. Updates on the status of road clearing and access to these areas will be available at www._____, on Twitter following #<hashtag> or by calling <emergency information line # or customer information #>.

Phase: Garbage and Recycling Collection Temporarily Delayed

Concern:

Regular garbage collection cannot be provided in the impacted areas due to limited/ restricted access, which is raising health concerns within the community caused by a delay in collection of regular household waste and the debris resulting from the disaster.

Joint Municipal Regional Disaster Debris Management Operational Plan

Action:

Advise members of the public to continue placing household waste in their normal bins until access can be provided and service can resume. Temporary waste handling facilities will need to be set up to provide an alternate location for debris and waste to be collected until regular waste collection resumes.

Note: if members of the public are unable to transport debris to a neighbourhood drop off point or collection centres, <Local Authority> will need to organize contractors to haul debris from the roadside to temporary transfer stations or debris management sites.

Associated Communications Samples

Garbage and Recycling Collection Temporarily Delayed

City, BC, Date: Due to limited access to areas affected by the <disaster description> and the need to focus on debris removal to clear emergency routes, regular garbage and recycling collection will be temporarily delayed. Residents are asked to continue using their garbage and recycling carts, as well as additional bags and bins as needed, until collection can resume. There will be no charge for extra collection.

Residents are assured that if collection cannot safely be resumed within a <xxx week time>, alternative options for waste disposal will be implemented, including possible use of drop-off locations.

Drop Off and Alternate Collection Options Now in Place

City, BC, Date: To help support areas with accumulated garbage and recycling, a number of temporary drop-off points and collection areas have been set up. Dropping off your household waste offers a quick and simple option to address collection delays. For a list of locations where residents can drop off their household waste, visit www._____.

Residents who are not able to transport their household waste are asked to call _____ . Please note that there may be a delay in when contractors will be able to collect the waste due to the continued focus on clearing debris that poses safety hazards or blocks emergency routes.

Recovery Phase Communications

Temporary Waste Handling Facilities

Concern:

Due the disaster event there is an influx of debris in the impacted area, and the usual disposal sites have limited or no capacity to accept the increased volume of debris.

Action:

Governmental bodies are to determine debris management strategies and set up temporary waste handling facilities to assist with the clearing, collection and removal of debris. This may include one, or all, of the following depending on the volume and types of debris as well as the community/ies needs: neighbourhood drop-off points, collection centres, temporary transfer stations, or debris management sites.

Associated Communications Sample

Temporary Waste Handling Facilities Now in Place

<Local Authority> are asking people to take their garbage to their neighbourhood drop-off points and place them in the bins provided. Please remember to put your garbage in the right bins! They are clearly marked to accept <types of debris>. Your drop-off points will be open <from-to>.

Tweets:

“Reminder: The <name of facility> landfill is providing free disposal of residential waste brought by personal vehicles until <date>. #<Local Authority>”

“<Local Authority> reminds residents of options for residential debris removal <link to article>. #<Local Authority>”

White Good Collection

Concern:

White goods, e.g. fridges and freezers, contain an array of hazardous materials and cannot be transported by members of the public to disposal facilities.

Action:

Governmental bodies need to determine a collection program for white goods inclusive of a communication plan containing information on health and safety concerns, e.g. they are

Joint Municipal Regional Disaster Debris Management Operational Plan

difficult to move and contain hazardous materials such as Freon and organic materials, which is to be shared with the public.

Note: a collection program may be available through insurers and should be used/ promoted if available.

Associated Communications Sample

Fridge and Freezer Collection

<Local Authority> are asking people to place their fridges and freezers for disposal on the curbside on <date(s) and time(s)> so they can be collected. Please remember to make sure they are secured to avoid attracting rodents and bears!

Tweets:

“Reminder: Place fridges and freezers for disposal on the curbside for collection on <date>. #<Local Authority>”

“<Local Authority> reminds residents to place fridges and freezers for disposal on the curbside for collection on <time, date>. #<Local Authority>”

M. DEBRIS TRACKING TEMPLATE

All debris will need to be tracked and documented. By doing so, the Local Authority is able to accurately monitor, assess and analysis the debris volume and types to process and reduce or mitigate risks, and aid in financial reimbursement processes. Debris tracking template forms are available at <http://www.metrovancouver.org/services/emergency-preparedness/Documents/DebrisTrackingTemplateForms.docx>.

DEFINITIONS

Contractor	This is the name of the company providing services, inclusive of organizations providing mutual aid.
Contract PO number.	The PO number specified on the Contractor's contract
Location of work	Geographic area, e.g. Name of municipality
Truck No.	The truck placard number (issued to a truck when the truck certification has been completed).
Truck weight	Physical weight of empty truck.
Load size	Weight of debris material (excludes Truck weight) in tonnes.

FORM A: DEBRIS TRACKING LOAD TICKET

Overview

The below is a sample page from what would be a carbon copy booklet. These booklets would be provided to the contractors, and truck resources provide through mutual aid, once they have successfully completed the truck certification process. The completed forms provide information required to complete Form B: Debris Tracking Daily Operational Report (by Truck). All completed Debris Tracking Load Tickets should be submitted to the DDM Operational Team Leader at the end of each day.

Purpose

- To provide contractors/ mutual aid organizations and their personnel with a standardized template to track disaster debris transported on a daily basis.
- To assist the DDM Operational Team with the management of disaster debris, inclusive of supporting the Finance Section in verifying and processing related costs incurred.

Note: All white copies should be provided to the DDM Operational Team Lead along with Forms B and C so that they can be cross referenced and verified.

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Local Authority Name DEBRIS TRACKING LOAD TICKET		Ticket No. 000001
Section 1		
Prime Contractor or Contract No.:		Date (yyyy/mm/dd):
Subcontractor (Hauler):		Departure Time (24-hour clock):
Driver (full name – print legibly):		Licence Plate No.:
Measured Truck Bed Capacity (cu. yds.):		
Debris Loading Site Location: (Address or Cross Streets)		
Debris Type: <input type="checkbox"/> Green Waste/ Vegetation <input type="checkbox"/> Construction & Demolition <input type="checkbox"/> Whites Goods <input type="checkbox"/> HHW <input type="checkbox"/> Mixed (combined debris types) <input type="checkbox"/> Other: _____		
Loading Site Monitor: Print Name: _____ Signature: _____		
Remarks:		
Section 2		
Debris Unloading Site Location:		
Debris Quantity (cu. m.) or Actual Weight (tonnes):		Arrival Time (24-hour clock):
Unloading Site Monitor: Print Name: _____ Signature: _____		
Remarks:		
Copies to: White: Load Site Monitor Green: Unloading Site Monitor Blue, Canary, Pink, Gold: Onsite Contractor’s Representative or Driver		

FORM B: DEBRIS TRACKING DAILY OPERATIONAL REPORT (BY TRUCK)

Overview

The below is a sample page from what would be a carbon copy booklet (or require photocopying once complete). The form would be given to the contractors and organizations providing mutual aid once they have successfully completed the truck certification process. The form is to be populated based on all the Form A: Debris Tracking Load Tickets completed for a given truck and should be completed by each truck driver at the end of each shift. A copy of the completed Form B is to be given to DDM Operational Team Leader before 1000 hours on the following day (originals are to remain with the Contractor/ Mutual Aid Organization).

Purpose

- To provide contractors/ mutual aid organizations and their personnel with a standardized template to track disaster debris transported on a daily basis.
- To assist the DDM Team with the management of disaster debris, inclusive of supporting the Finance Section in verifying and processing related costs incurred.

Note: A copy of each completed Form B should be provided to the DDM Operational Team Lead along with Forms A and C so that they can be cross referenced and verified.

Joint Municipal Regional Disaster Debris Management Operational Plan

FORM B DEBRIS TRACKING DAILY OPERATIONAL REPORT (BY TRUCK)				
Truck no: _____		Vehicle plate no: _____		
Contractor	Contract no.	Prepared on (yyyy/mm/dd)		
Location of work	No. of landfill trips	Tonnage totals	No. of local collection site trips	Tonnage totals
DAILY TOTAL				

Copies to: Original (White): EOC - DDM Operational Team Lead Blue: Driver Green: Contractor

FORM C: DEBRIS TRACKING DAILY OPERATIONAL REPORT (BY CONTRACTOR)

Overview

The below is a sample page from what would be a carbon copy booklet (or require photocopying once complete). The form would be given to the contractors, and organizations providing mutual aid, once they have successfully completed the truck certification process. This form is to be populated based on all the Form A: Debris Tracking Load Tickets and Form B: Daily Operational Reports (by Truck) submitted for a given contractor/ mutual aid organization at the end of each day. A copy of the completed Form C is to be given to DDM Operational Team Leader before 1300 hours on the following day (originals are to remain with the Contractor/ Mutual Aid Organization).

Purpose

- To provide contractors/ mutual aid organizations with a standardized template to track disaster debris transported on a daily basis.
- To assist the DDM Team with the management of disaster debris, inclusive of supporting the Finance Section in verifying and processing related costs incurred.

Note: A copy of each completed Form C should be provided to the DDM Operational Team Lead along with Forms A and B so that they can be cross referenced and verified

Joint Municipal Regional Disaster Debris Management Operational Plan

FORM C								
DEBRIS TRACKING DAILY OPERATIONAL REPORT (BY CONTRACTOR)								
Contractor: _____								
Contract no.					Prepared on (yyyy/mm/dd)			
Date of load ticket (yyyy/mm/dd)	Load ticket no.	Site ticket no.	Time		Truck no.	Truck weight (tonnes)	Load size (tonnes)	Comments
			Loading	Unloading				
DAILY TOTAL								

Copies to: Original (White): EOC - DDM Operational Team Lead Green: Contractor

N. PUBLIC WORKS MUTUAL AID AGREEMENT (2000)



CITY OF RICHMOND

REPORT TO COUNCIL

TO: Richmond City Council
FROM: Chuck Gale, P. Eng.
General Manager, Engineering & Public Works
RE: Public Works Mutual Aid Agreement

DATE: February 8, 2000
FILE: 0040-00

STAFF RECOMMENDATION

THAT the Mayor and Clerk be authorized to enter into a Mutual Aid Agreement, in the form attached to this report, with other participating Lower Mainland Municipalities.

A handwritten signature in cursive script, appearing to read 'C. Gale'.

Chuck Gale, P. Eng.
General Manager, Engineering & Public Works

STAFF REPORT

ORIGIN

In September of 1999, the Regional Engineers Advisory Committee, (REAC), received a recommendation from the Lower Mainland Operations Managers, regarding the establishment of a Public Works Mutual Aid Agreement. After consideration, REAC passed a resolution in support of the resolution as follows:

THAT REAC enter into the development of a Mutual Aid Agreement for Public Works Assistance,

AND THAT C. Gale co-ordinate the agreement for REAC members to take forward to their member Councils.

A copy of the proposed Mutual Aid agreement is attached as Appendix "A".

COMMENTARY

In the event that an individual municipality's public works resources are overwhelmed in an emergency response, this proposed agreement sets out a protocol, whereby any of the signatories to the agreement may call upon the resources of other municipalities. Some of the more significant elements of the agreement are:

- Local resources, including contractors, should be expended before seeking Mutual Aid.
- Payment for emergency services under the mutual aid agreement will be on a cost recovery basis, and will not include mark-ups for overhead or profit.
- Most specialized equipment will be provided with an operator, to ensure adequate familiarity and certification to operate.
- Resources will only be made available if they are not required by their primary jurisdiction.

Provision is made within the agreement, to settle any disputes arising from the use of this agreement, through arbitration.

There are no financial implications to a municipality for entering into this agreement. Financial obligations can only arise in the event a request is made for assistance.

SUMMARY

Staff support consideration of the recommended agreement as a means of ensuring cost effective support for emergency operations in times of need.

February 8, 2000

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Appendix A

WHEREAS the Parties desire to enter into an Agreement whereby Public Works resources can be deployed to assist any Party during an emergency.

NOW THEREFORE THIS AGREEMENT WITNESSES THAT, in consideration of the mutual covenants and agreements herein contained and subject to the terms and conditions hereinafter set out, the Parties agree as follows:

1. In this Agreement, unless the context otherwise requires,
 - a) "emergency" means any present or imminent calamity or sudden or violent disturbance that in the opinion of the City Engineer cannot be brought under control by the use of the available local resources and that requires prompt co-ordination of action or special regulation of persons or property to protect the health, safety or welfare of people, or to limit property damage;
 - b) "emergency resources" means all persons, services, equipment and materials held by, or directly available to, the Public Works Services of a Party;
 - c) "City Engineer" means, for each Party, the senior municipal employee responsible for the Public Works Services of that Party or his delegate.
2. The procedure to be followed in requesting and rendering aid under this Agreement shall be governed by the following principles, namely:
 - a) A City Engineer will attempt to fully utilize the emergency resources of his bordering Parties before requesting emergency resources from more distance Parties except where special equipment is not available from the bordering Parties.
 - b) Where a City Engineer determines that an emergency exists, he shall request emergency resources from the appropriate Party.
 - c) A City Engineer who receives a request for emergency resources from another Party may determine the extent of and duration for which the emergency resource are available and thereupon such emergency resources, if any are available, shall be dispatched and utilized to control the emergency; but nothing in this Agreement shall be construed to require a City Engineer to dispatch emergency resources.
 - d) The Person in Charge of emergency resources sent to assist in an emergency shall remain in charge of those resources and control and direct those resources in co-operation with the requesting City Engineer.
3. The Parties agree to consult on a regular basis through their City Engineer on the best ways to achieve the optimum deployment of emergency resources to control emergencies.
4. When a Party provides emergency resources:

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Joint Municipal Regional Disaster Debris Management Operational Plan

February 8, 2000

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- a) the Party providing emergency resources may, within sixty days after so doing, render to the Party that requested emergency resources a correct account of the cost of the service.
 - b) the Party that requested emergency resources shall pay the account within thirty days after receiving it.
 - c) Payment for emergency services would be on a cost recovery basis without overhead or profit.
5. Any Party may terminate its rights and responsibilities under this Agreement by giving to the City Clerk of the other Parties, thirty days notice in writing of its intention to do so.
 6. This Agreement is not intended to interfere with or supersede any existing written agreements between the parties.
 7. Subject to paragraph 8, each party to this Agreement covenants and agrees that it will not initiate legal action or third party proceedings against any other party to this Agreement, based on provision or failure to provide emergency resources. In any action arising from the provision or failure to provide emergency resources, the municipality where the incident requiring emergency resources occurred, shall (a) defend the action on behalf of itself and any other parties to this Agreement who are defendants in the action, and (b) indemnify and save harmless the other parties for liabilities which may result.
 8. Any claims as between the Parties to this Agreement arising out of gross or willful negligence in the provision or failure to provide emergency resources or any dispute arising respecting a Party's rights or obligations shall be referred to and finally resolved by arbitration under the rules of the British Columbia International Commercial Arbitration Centre and shall be administered in accordance with its "Procedures for Cases under the BCIAC Rules". Provided the arbitrator in this procedure is satisfied that the dispute arises from gross or willful negligence, the arbitrator has jurisdiction to provide relief against the indemnity in paragraph 7 and may allocate responsibility among the Parties in whatever manner the arbitrator deems appropriate.

For the purpose of Sections 7 and 8, "Party" includes any employee, contractor or volunteer of the Party.

9. Notices or other communications under this Agreement shall be sufficiently given if delivered to a City Engineer personally or left at the City Engineer's office or mailed to the following:

(List of Participating Agencies will be entered here as resolutions are received from Municipal Councils.)

IN WITNESS WHEREOF the Parties hereto have caused to be affixed their seals attested by the signatures of their respective officers duly authorized for such purpose.

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Joint Municipal Regional Disaster Debris Management Operational Plan

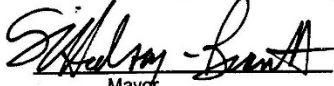
February 8, 2000


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The Corporate Seal of the Corporation of

CITY OF RICHMOND

Authorized signing Officers


Mayor
GREG HALSEY-BRANDT


City Clerk
J. RICHARD MCKENNA

The Corporate Seal of the Corporation of

CITY OF WHITE ROCK

Authorized signing Officers

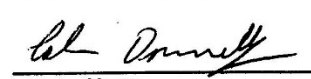

Mayor
HARDY K. STAUB
MAYOR



Clerk
DIANE A. MIDDLER
CITY CLERK

The Corporate Seal of the Corporation of

CITY OF NEW WESTMINSTER

Authorized signing Officers


Mayor
CALVIN DONNELLY
ACTING MAYOR


Clerk
SUSAN BROWN
CITY CLERK

135090 / 0040-00

Joint Municipal Regional Disaster Debris Management Operational Plan

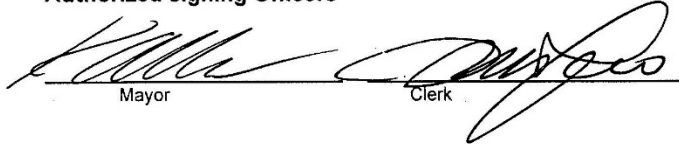
February 8, 2000

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The Corporate Seal of the Corporation of

THE TOWNSHIP OF LANGLEY

Authorized signing Officers

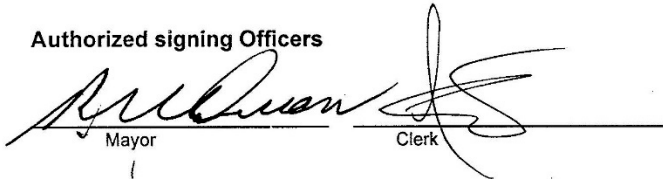


Mayor Clerk

The Corporate Seal of the Corporation of

CITY OF VANCOUVER

Authorized signing Officers

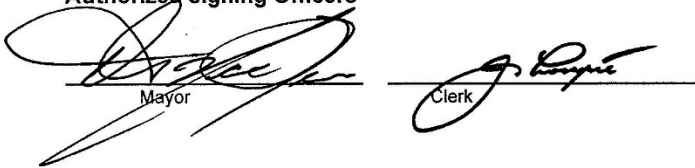


Mayor Clerk

The Corporate Seal of the Corporation of

DISTRICT OF PITT MEADOWS

Authorized signing Officers



Mayor Clerk

135090 / 0040-00

Joint Municipal Regional Disaster Debris Management Operational Plan

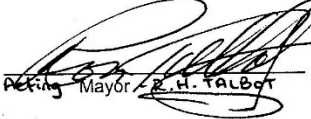
February 8, 2000


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The Corporate Seal of the Corporation of

City of Port Coquitlam

Authorized signing Officers

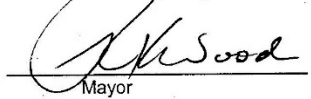

Acting Mayor **R.H. TALBOT**



Clerk **SUSAN RAUH, CMC, CITY CLERK**

The Corporate Seal of the Corporation of

THE DISTRICT OF WEST VANCOUVER

Authorized signing Officers

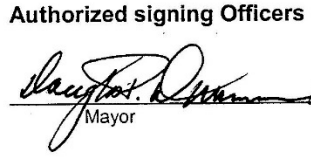

Mayor

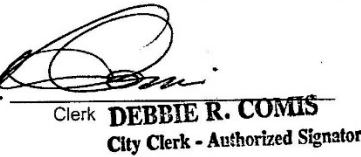

Clerk

The Corporate Seal of the Corporation of

THE CITY OF BURNABY

Authorized signing Officers


Mayor


Clerk **DEBBIE R. COMIS**
City Clerk - Authorized Signatory

135090 / 0040-00

Joint Municipal Regional Disaster Debris Management Operational Plan

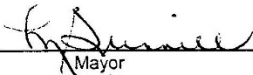
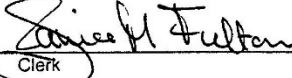
February 8, 2000

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The Corporate Seal of the Corporation of

CITY OF LANGLEY


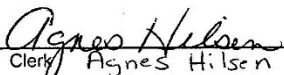
Authorized signing Officers

 
Mayor Clerk

The Corporate Seal of the Corporation of

DISTRICT OF NORTH VANCOUVER

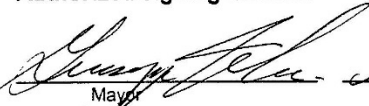

Authorized signing Officers

 
Mayor Don Bell Clerk Agnes Hilson

The Corporate Seal of the Corporation of

City of Port Moody

Authorized signing Officers

 
Mayor Clerk

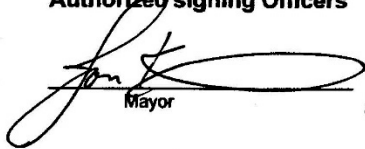
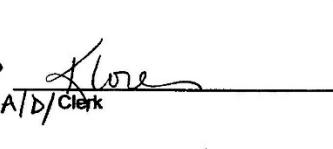
135090 / 0040-00

Public Works Mutual Aid Agreement
Lower Mainland Municipalities

The Corporate Seal of the Corporation of

The City of Coquitlam


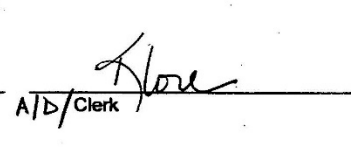
Authorized signing Officers

 Mayor  A/D Clerk

The Corporate Seal of the Corporation of

the City of Coquitlam

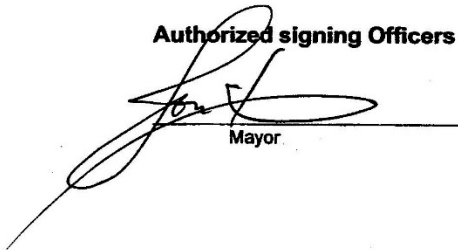
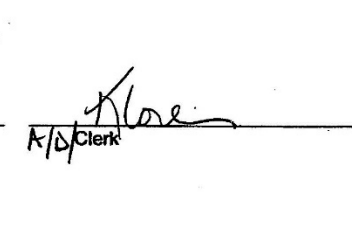
Authorized signing Officers

 Mayor  A/D Clerk

The Corporate Seal of the Corporation of

the City of Coquitlam

Authorized signing Officers

 Mayor  A/D Clerk

Joint Municipal Regional Disaster Debris Management Operational Plan

February 8, 2000

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The Corporate Seal of the Corporation of

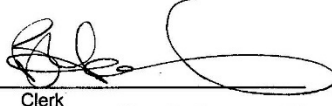
CITY OF NORTH VANCOUVER

Authorized signing Officers



Mayor

Barbara A. Sharp - Mayor



Clerk

Bruce Hawkshaw - Clerk

The Corporate Seal of the Corporation of

DISTRICT OF MAPLE RIDGE

Authorized signing Officers



Mayor

KATHLEEN J. MORSE
MAYOR

Clerk

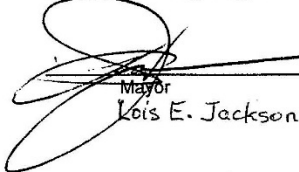


TERENCE E. FRYER
MUNICIPAL CLERK

The Corporate Seal of the Corporation of

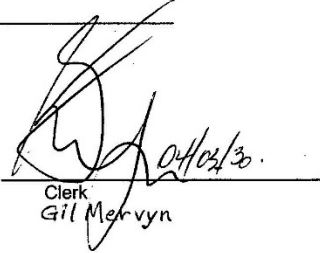
Delta

Authorized signing Officers



Mayor

Lois E. Jackson



Clerk

Gil Mervyn

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Joint Municipal Regional Disaster Debris Management Operational Plan

February 8, 2000

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The Corporate Seal of the Corporation of

City of Surrey

Authorized signing Officers

D. Williams Shirley Jones *June 18, 2004*
Mayor Clerk

The Corporate Seal of the Corporation of

Authorized signing Officers

_____ _____
Mayor Clerk

The Corporate Seal of the Corporation of

Authorized signing Officers

_____ _____
Mayor Clerk

135090 / 0040-00