

Provincial Flood Response

Flood Waste and Debris Management Plan

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Table of Contents

1.0	Introduction and Plan Purpose	3
2.0	Coordination and Activation of Debris Management Efforts	4
3.0	Phased Response	5
4.0	Identifying the Types of Flood Waste and Debris	5
5.0	Segregating and Quantifying Flood Waste and Debris.....	6
6.0	Management of Various Types of Wastes	7
6.1	Non-hazardous solid waste management	7
6.2	Used Sandbags and Gabion fill	7
6.3	Tiger Dams	8
6.4	Hazardous Waste.....	8
6.5	Industrial Hazardous Waste at Registered Facilities.....	9
6.6	Management of flood-related spill waste	10
6.7	Animal carcasses	10
7.0	Clean-up and Debris Removal Strategy.....	10
8.0	Temporary Debris Management Sites	11
9.0	Waste Management Options: Recycling to Disposal.....	12
10.0	Communications Plan	12
11.0	Appendices:.....	13
11.1	Templates and Tracking Sheets:	13
11.2	Additional Information and Fact Sheets:	13

1.0 Introduction and Plan Purpose

Flood events have the potential to generate large quantities of debris and waste, which in turn may negatively impact recovery and re-entry efforts. The [British Columbia Flood Response Plan](#)¹ outlines the role of various local, provincial and federal authorities and sets-out a general response direction to be followed. In terms of mandate with respect to debris management, the Ministry of Environment and Climate Change Strategy is directly tasked with:

- Providing direction and leadership regarding waste and flood debris management issues,
- Providing expertise on waste management and disaster debris issues resulting from flooding
- Providing technical services regarding environmental risks, their prevention and subsequent mitigation,
- Respond to spills and potential spills resulting from flooding
- Provide information on spill prevention for floods

This Plan is intended to provide an initial, generic framework to address flood-related debris management. It is written in view of the following legislative authorities, principles and/or assumptions:

- Developed within the operational framework of the BC Emergency Management System (BCEMS) and in accordance with the *Emergency Program Act* and associated regulation(s).
- Developed in accordance with the *Environmental Management Act* and associated regulations.
- In response to EMBC's responsibilities, as they appear in The British Columbia Flood Response Plan:
 - “coordinating provincial advanced planning to support flood readiness efforts when required
 - “liaise with local authorities, First Nations communities, and ministry representatives about potential consequences related to flooding
 - “provide support to local governments in the transition to recovery”.
- Debris management is implemented as per **existing local authority response plans**.
- The current document was developed under the assumption that local governments have planned for effective debris removal and are subsequently implementing those plans.

¹ The British Columbia Flood Response, 2013 at https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc_flood_response_plan-final.pdf, accessed May 20, 2018.

This document is intended to:

- Function as a generic starting point for those situations where effective debris management plans are not in place,
- Focus on hazardous and spill waste management and sandbag/gabion disposal.

This Plan is likely not sufficient to support all individual event response efforts. This plan is a good starting point, but each event response effort requires site and incident-specific plans. Should affected communities request leadership, guidance and/or technical expertise on flood waste and debris management, the Ministry of Environment and Climate Change Strategy staff, via EMBC, will provide additional details.

2.0 Coordination and Activation of Debris Management Efforts

Coordination between local, provincial, federal and international response agencies is described in the [BC All Hazard Plan](#)² and the BC Flood Response Plan referenced above. Waste management activities are generally carried out at the local government level. While this approach will not be changed, this document provides a larger area context for these activities, in order to ensure the safety and effectiveness of the response and re-entry efforts.

Many local governments have debris response plans. The [Joint Municipal Regional Disaster Debris Management Operational Plan](#)³ for Metro Vancouver region and members (Metro-Van Debris Plan) is a good example of such a plan. Where available, effective and appropriate, these plans should be consulted and implemented.

Note: reference to this material is provided for informational purposes only: review and comment on the appropriateness of these plans is outside the scope of the current document.

Debris management must be initiated in the pre-flood planning stage, even in the absence of flood-associated waste and debris. This process may involve ensuring a plan is available and up-

² The BC All Hazard Plan, 2012 at <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/embc-all-hazard-plan.pdf> accessed May 201, 2018

³ The Joint Municipal Regional Disaster Debris Management Operational Plan for Metro Vancouver region and member, 2017 at <http://www.metrovancouver.org/services/emergency-preparedness/Documents/2017JMRDDMPlan.pdf>, accessed May 20, 2018.

to-date, generating a plan, and/or reaching out for information and implementation resources to ensure prompt response in the emergency phase.

3.0 Phased Response

Debris management follows a phased response as it is directly impacted by emergency response goals. Generally, we identify four stages, as follows:

Phase I: Emergency phase

Phase II: Early Recovery phase

Phase III: Medium-term Recovery phase

Phase IV: Contingency Planning/Long-term Recovery phase

Each phase involves identifying, characterizing and quantifying the waste types and volumes, ensuring operational responsiveness, planning for current and anticipated operational, communication and logistical needs, and ensuring consultative processes are in place and functioning⁴.

4.0 Identifying the Types of Flood Waste and Debris

Generally and depending on the magnitude of the flood, the following types of waste streams/debris should be expected following a flood:

- Wastes associated with the operation of shelters and camps
- Household wastes (solid, liquid, recyclable, green, other)
- Household hazardous waste, cleaning products and electronic waste (e-waste)
- Mould and/or asbestos contaminated materials
- Industrial hazardous and non-hazardous waste and/or materials contaminated with these types of waste,
- Biomedical and/or hospital waste
- Animal carcasses due to mass mortality (mass carcass disposal requirements)
- Mud, gravel and displaced vegetation
- Construction and demolition waste as recovery begins

⁴ United Nations Office for the Coordination of Humanitarian Affairs Environmental Emergencies Section - Disaster Waste Management Guidelines at <https://www.unocha.org/sites/dms/Documents/DWM.pdf>, accessed May 20, 2018 and the Metro-Van Debris Plan as referenced in footnote 3.

- Used sandbags, sand and gabion fill
- Used response equipment such as sorbents, pads, etc.
- Wastes contaminated with hazardous substances due to a spill or release due to the flood
- Wastes contaminated with sewage

5.0 Segregating and Quantifying Flood Waste and Debris

Potential debris type and quantity must be estimated in order to identify transportation needs, routes and destinations. Once waste streams have been determined (e.g. construction and demolition, hazardous, biomedical, etc.), various tools exist to quantify the amount of waste that must be managed.

Debris segregation is recommended wherever possible and appropriate (see for example, the Metro-Van Debris Plan pp. 114-119). Depending on resources available, segregation at least as hazardous and non-hazardous waste streams is recommended. However, if possible and practical, the following categories may be considered and expanded:

- Reactive, explosive, flammable wastes
- Infectious and/or toxic wastes
- Other types of hazardous wastes
- Non-hazardous wastes, segregated as applicable (e.g. construction and demolition, green waste, scrap metal, utility related debris, etc.).

A preferred debris forecasting tool in the Metro-Van Debris Plan is the Hazards United States (HAZUS) methodology. As explained in the Metro-Van Debris Plan “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”³.

The **Hazus Canada** application is available to local governments at <http://hazuscanada.ca/hazus-canada-application-request>.

6.0 Management of Various Types of Wastes

6.1 Non-hazardous solid waste management

This type of waste includes construction and demolition waste, pavement, bricks, wood waste, etc. Local governments and local landfill operators have current plans for the operation of these facilities. Likewise, local Debris Management Plans, such as the Metro-Vancouver one referenced above have additional operational details. These plans should be consulted and if appropriate, should be implemented.

General operational principles include:

- Implementation of routine operational procedures to the extent possible
- Compliance with applicable regulation and existing best practice guidelines

6.2 Used Sandbags and Gabion fill

Depending on the size of the flood and the size of the response, a large quantity of sandbags may require subsequent waste management. Sandbag and gabion fill management and disposal should be part of the debris management plan for each local government and/or of the demobilization plans for the response. These plans should also be consultative and ensure the input of the community they serve.

Generic hazards associated with sand bags and gabion fill include:

- Potential contamination of the sand and/or gabion constituents with infectious or toxic substances.
- Introduction of large volumes of particulates and/or foreign objects into water systems.

General guidelines for the management and disposal of used sandbags and gabion fill:

- The source and pre-flood contamination status of sand and gabion fill should be known.
- Appropriate personal protection equipment (PPE) should be worn and site-safety procedures should be reviewed and implemented.
- In accordance with the *Water Sustainability Act*, gabion fill and sand from sandbags (including uncontaminated sand) must not be placed directly into or adjacent to streams, lakes, ponds, rivers, creeks, springs, ravines, gulches, wetlands, or glaciers (whether they contain water or not).
- Sand from sandbags exposed to floodwater should not be used for children's sandboxes, playgrounds, public beaches or other areas with direct human contact.
- Sandbags and gabion fill that have been exposed to sewage, oils, hydrocarbons or other hazardous substances in amounts that can be seen or otherwise easily detected should be

considered contaminated and reported as a possible Dangerous Goods Incident to 1-800-663-3456.

- Sand and gabion fill that was uncontaminated before being used in sandbags and gabions and which has not been subsequently contaminated during the flood, may be considered for other uses, as per direction from local authorities and in accordance with applicable regulations.
- Damaged gabion baskets, as determined by a technical specialist, must be returned to the Province for assessment and subsequent disposal.
- Un-contaminated cloth and polypropylene bags should be recycled and/or disposed as per local instructions.
- If and when necessary, retain consulting services of a qualified professional for detailed sand and gabion fill classification.

6.3 Tiger Dams

Tiger dams can be an efficient mechanism of flood control. The following should be considered when managing used Tiger Dams during recovery operations:

- Fill with water that is not contaminated with sewage or hazardous substances.
- Drain in accordance with applicable regulation (e.g. *Water Sustainability Act*, *Environmental Management Act*, etc.).
- Cleaning operations should be established in accordance to vendor instruction and with direction from local authorities.
 - Soaps, antimicrobial solutions, and the resulting effluent, must be managed safely and in accordance with applicable regulations.
 - Dams that were exposed to hazardous materials in the flood waters (e.g. sewage, hazardous waste, etc.), will require specialized cleaning protocols.
- All organic material must be removed.
- Dry, clean dams can be rolled-up, stored and re-used.

6.4 Hazardous Waste

During post-flood clean-up activities, various types of hazardous⁵ wastes may be encountered. These include:

⁵ Hazardous Waste is defined in the BC Hazardous Waste Regulation (HWR). However, some of the contaminants in flood wastes may pose a hazard to human health but may not necessarily meet the criteria prescribed in the HWR. For simplicity, and in the absence of additional waste characterizations, all such waste is referred to in this plan as 'hazardous waste'.

- Mould contaminated wastes
- Asbestos contaminated materials
- Household paint, chemical paint-stripping solutions, some cleaners, waste oil and gas, medicines, pesticides, etc.
- Biomedical and/or health care and hospital (toxic and infections) waste
- Sewage-contaminated waste
- Materials contaminated with industrial hazardous waste as a result of a spill or release

These items may cause immediate and/or delayed effects. In addition to information presented by various authorities (Appendix 11.1 – Additional Information and Fact Sheets), this waste should be segregated from the rest of flood-related waste and managed separately.

Aside from health and safety guidelines specific to each type of waste, general best practice includes:

- Segregation of contaminated wastes (may use 6 mil bags, large garbage bags, delineated areas, etc.)⁶
- Storage in accordance with local, provincial and response effort directives
- Labeling and tracking
- Management in accordance with local directions if any
- Disposal at authorized facilities in accordance with local directives and/or applicable regulations

6.5 Industrial Hazardous Waste at Registered Facilities

Industrial hazardous waste is regulated under the *Environmental Management Act* and the *Hazardous Waste Regulation*. As such, facilities located in the projected hazard zone and managing hazardous waste would be expected to implement their contingency plans and continue operations as appropriate. (In one case, for example, in 2018, authorization holders located within many of the potentially affected areas of the Lower Fraser River, received a letter describing the flood risk and advising them to take precautionary actions).

General direction for industrial hazardous waste management facilities, including facilities collecting household hazardous waste includes:

- Implement the current facility contingency (and/or emergency response) plans.
- Reduce, eliminate or otherwise secure inventories in anticipation of site flooding.

⁶ Manage with caution: some types of hazardous wastes may react and pose further risks if allowed to mix or if stored in incompatible packaging.

- Retain the services of qualified professionals and other specialists for specific recommendations where necessary and appropriate.
- Take measures necessary to prevent loss and damage to human life and the environment.
- Remain in compliance with applicable regulations at all times during and post emergency phase.
- Follow local direction for further instructions.

6.6 Management of flood-related spill waste

Should a spill of a hazardous material occur as a consequence of the flood (e.g. from a hazardous waste management facility, a road or rail accident, pipeline incident or others), the Ministry of Environment and Climate Change Strategy's Environmental Emergency Response protocol will be implemented. Waste management is part of that protocol and further directions will follow.

6.7 Animal carcasses

Under direction in the British Columbia Flood Response Plan, management and disposal of mass animal carcasses is directed by the Ministry of Agriculture (AGRI). It is best practice to collaborate with AGRI staff to ensure a coordinated response.

7.0 Clean-up and Debris Removal Strategy

Debris removal and subsequent clean-up activities should be coordinated such that the removal plan enables the overall response goals. Generally, the following guidelines would be considered for establishing a priority order for debris removal:

- Lifelines – routes essential to life safety transportation, including evacuation routes
- Critical infrastructure – hospitals, police stations, EOCs, water sanitation and power transmission sites, telecommunications sites, etc.
- Major highways and arterial routes
- Major areas necessary for movement of goods and services
- Minor arterial routes
- Local routes

During the planning stages, response authorities may choose to use the following resources to geographically locate a debris removal strategy:

- Existing snow removal routes
- Existing disaster response and/or evacuation routes
- Pre-identified location of reception centers
- Pre-identified location of staging areas

- Pre-identified locations of temporary debris management areas (TDMAs)
- Review/update/implement pre-existing permit/approval processes, contracts, etc.
- Ensure access to and operator training to debris management plans, implementation guidelines, tracking and record keeping, etc.

Targeted details for clean-up and removal strategies would be listed in regional plans. Should a need for additional support be identified, APU direction would follow.

8.0 Temporary Debris Management Sites

Ideally, waste would be removed directly to final management facilities (e.g. landfills, recycling facilities, hazardous waste facilities, etc.). However, this activity may prove impractical in view of debris-impacted transportation routes and other physical and logistical flood-related demands. Consequently, Temporary Debris Management Sites (TDMSs) may be required. Although debris removal is a critical step in flood recovery efforts, it is important to only remove the waste out of the emergency area once an appropriate disposal strategy and disposal sites have been identified. TDMSs tend to be required when debris management at routine sites is not practical, and may be established at:

- Transfer stations and existing landfills
- Recycling facilities
- Public works yards
- Vacant lots, parking lots or right-of-way areas⁷
- Parks or other open spaces⁸

Depending on the planned extent of the TDMS, their establishment may be subject to a number of criteria as well as regulatory and logistical considerations. These include:

- Access/egress
- Security, including fencing and lighting
- All-season usability
- Proximity to schools and hospitals
- Environmental protection design needs
- Local/provincial regulatory requirements including approvals or permits

⁷ These sites should be part of larger plan such that removed waste is not placed in an area that restricts future re-entry efforts.

⁸ Use of parks for this purpose is determined in coordination with park and/or other authorities.

There are various templates and job aids available to help determine TDMSs. For example, the Metro-Van Debris Plan uses a Site Identification and Suitability Matrix, a Sample TDMS waste handling facility layout, a Sample TDMS Management Plan and various waste tracking forms³.

9.0 Waste Management Options: Recycling to Disposal

To the extent possible, practical, safe and legal, a waste hierarchy approach should be followed, as per typical waste management schemes:



The actual implementation of each of these steps depends on event-specific demands, local availability and safety considerations.

The ability to re-use/recycle and recover flood related waste is determined in part by:

- Safety of re-using potentially contaminated and/or flood-damaged materials
- Regulatory constraints of re-using and re-cycling hazardous wastes
- Feasibility of recycling and availability of re-cycling facilities

Specific details on the applicability of the waste prevention/minimization scheme are available from other local governments, regional plans or as instructed following a request for assistance from EMBC.

10.0 Communications Plan

Materials in this plan should be discussed and incorporated in the Province's communications plan. Communication samples and/or templates are available in Appendix 11.1

11.0 Appendices:

11.1 Templates and Tracking Sheets:

The following will be appended by June 2018:

- Waste needs assessment – Early Recovery Phase
- Debris Tracking Template
- Establishing Temporary Debris Management Sites
- Guidelines for closure of TDMS
- Public Communications Samples

11.2 Additional Information and Fact Sheets:

BC All Hazard Plan, 2012: at <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/embc-all-hazard-plan.pdf>

BC Flood Response Plan, 2013: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc_flood_response_plan-final.pdf

BC Water Well Disinfection using the Simple Chlorination Method:
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-wells/bc_gov_5402_water_well_disinfection_webbrochure.pdf

British Columbia Flood Response, 2013 at https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/provincial-emergency-planning/bc_flood_response_plan-final.pdf,

Cleaning Up After the Flood: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/flooding/flood_clean_up.pdf

Clean-up after a Flood at HealthLink BC: [at https://www.healthlinkbc.ca/healthlinkbc-files/clean-after-flood](https://www.healthlinkbc.ca/healthlinkbc-files/clean-after-flood) at <https://www.healthlinkbc.ca/healthlinkbc-files/clean-after-flood>

[Flood Safety Information at First Nations Health Authority at http://www.fnha.ca/about/news-and-events/news/flood-safety-information](http://www.fnha.ca/about/news-and-events/news/flood-safety-information)

Hidden Danger – Hazardous Materials in your Flood-Damaged Building, 2013, Alberta Government at <http://www.humanservices.alberta.ca/documents/factsheet-OHS-hazardous-materials-in-flood.pdf>

[Interior Health Emergency Information Floods/Landslides at https://www.interiorhealth.ca/YourEnvironment/Emergency/FloodsLandslides/Pages/Local-Governments-and-the-Public.aspx](https://www.interiorhealth.ca/YourEnvironment/Emergency/FloodsLandslides/Pages/Local-Governments-and-the-Public.aspx)

Joint Municipal Regional Disaster Debris Management Operational Plan for Metro Vancouver region and member, 2017: at <http://www.metrovancouver.org/services/emergency-preparedness/Documents/2017JMRDDMPlan.pdf>

Local Authorities and First Nations Recovery Toolkit was developed and can be found on the 2017 freshet and wildfire recovery webpage: <https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/local-government/local-authorities-and-first-nations-recovery-toolkit-march-2018.pdf>

Manitoba's Fact Sheet on securing hazardous materials containers before and after flooding: https://www.gov.mb.ca/asset_library/en/spring_outlook/securing_petroleum_storage_tanks.pdf

MOE Guideline to Managing Lead-containing Construction and Demolition Waste in BC: https://www2.gov.bc.ca/assets/gov/environment/waste-management/hazardous-waste/hazardous-waste/resources/guideline_managing_lead_containing_waste.pdf

MOE Land Remediation fact sheets: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/fact-sheets>

MOE Management of Waste Asbestos by Home Owners in BC: https://www2.gov.bc.ca/assets/gov/environment/waste-management/hazardous-waste/hazardous-waste/legsregs/protocols-criteria/management_waste_asbestos.pdf

MOECCS Environmental Emergency Fact Sheets: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/spills-environmental-emergencies/spill-preparedness-and-response-bc>

One Step at a Time: A Guide to Disaster Recovery: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/preparedbc/one_step_at_a_time_guide_to_disaster_recovery.pdf

Transport Canada's Emergency Response Guidebook (2016) intended for first responders arriving at a dangerous goods incident: <https://www.tc.gc.ca/eng/canutec/guide-menu-227.htm>

United Nations Office for the Coordination of Humanitarian Affairs Environmental Emergencies
Section - Disaster Waste Management Guidelines: at
<https://www.unocha.org/sites/dms/Documents/DWM.pdf>.

WorkSafeBC Safe Work Practices for Handling Asbestos:
<https://www.worksafebc.com/en/resources/health-safety/books-guides/safe-work-practices-for-handling-asbestos>